PEOPLE OF THE HIMALAYAS

ECOLOGY, CULTURE, DEVELOPMENT AND CHANGE

K. C. MAHANTA

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K. C. MAHANTA
Department of Anthropology
Dibrugarh University,
Dibrugarh, Assam

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PREFACE

Ever since the dawn of civilization in India, the socio-cultural history of the land is replete with references to the Himalayas. History is eloquent that hordes of diverse ethno-linguistic communities crossed over the Himalayan ranges into the sub-continent turning it into a veritable motley land of multiple socio-ethnic characters. It is from or through the Himalayas that came the pre-Aryan and the Aryan races now inhabiting India, as well as the successive waves of the Baktrians, Skythians and the Islamic invaders who conquered India in historical times. Socio-cultural norms and ways of life having their origin in or beyond the Himalayas have influenced the people's life patterns especially the religious system of this land from the earliest times to the present day. Since time immemorial the Himalayas have been serving as the refuge of those who seek spiritual blessings and solace of life. The Indian ancient scriptures including the two epics, the Ramayana and the Mahabharata, deal with episodes with mythical stories having bearing with the great mountains.

It is thus evident that the political and religious history of this vast land can well be assessed from an adequate conception of physiography, ethnography and history of the Himalayan-Tibetan as well as the Bhutan - Assam Himalayan tracts.

The study of Himalayan region as a whole or in part both from physiographic and ethno-historical perspectives has so far received scant attention of social scientists as also of geographers. Both geographical and ethnographic studies have been baffled on account of remote location, difficult terrains and extreme ruggedness of the region.

The Himalayas are a conspicuous landmark of India. Yet systematic scientific knowledge of the conditions of the habitat, economy and society remains inadequate and vague. There have been few attempts at making a systematic scientific study and research of the physio-ethnography of the vast sprawling areas extending from Kashmir to Assam.

Different theories have been advanced in regard to the systematic geography of the Himalayan-Tibetan region. Captain Herbert who conducted the minerological survey of the Himalayan country between the Kali and the Sutlej in 1818 was the first who attempted to give a general account of its physical characteristics. He describes the country north of India as a large central space strongly marked by the feature that it was little intersected by rivers whilst from its sides flowed the streams that united to form the greatest rivers in the world. Later General R. Strachy, in his paper on the Physical geography of the Province of Kumaon and Garwal, read before the Royal Geographical Society in 1851, pointed out distinctly for the first time that the Himalaya was in truth the broad mountaneous slope of the great Tibetan tableland descending to the plains of Northern India. The snow-clad mountain chain lying between Tibet and the plains of India is generally referred to as Himachala or Himalaya by the people of India. However, the popular definition of the Himalaya is one extending from the gorge of the Indus on the west to that of the Brahmaputra on the east and from the Upper courses of the main branches of those rivers on the north to the plains of India on the south.

The Himalayas (the word 'Himalaya' meaning 'abode of the snow' in Sanskrit), the highest range of mountains in the world, form the northern boundary of the Indian sub-continent. They are for over 2700 km through Kashmir, northern India (including Sikkim), Nepal, Bhutan and Southern Tibet. The Himalayan range abounds with 14 peaks over 8000 m and hundreds over 7000 m. These peaks constitute what is generally called the Himalayan Range, forming a great long arc between the Indus river in the west and the Brahmaputra river in the east. The Greater Himalayas have an average elevation of over 6000 m; they contain some of the highest peaks in the world, including Mount Everest. The lesser Himalayas rise to between 2000 to 4500 m, and the Outer Himalayas in the south rise to between 600 and 1500m.

The Himalayas are the sources of several of the most important rivers of the Indian sub-continent, including the Gangas, Jamuna, Indus and Chenab. Several rivers having their sources in Tibet flow between the souring walls of the Himalayas into the great plains of India. Deep valleys are cut through the Himalayas. Most Nepal rivers, namely, the Arun in the east, the Trisuli and the Kali in the central and the Karnali in the west cut across the main range of the Himalayas, and have formed deep valleys, that have long served as trade routes between Tibet and India. Accounts written by Himalayan travellers frequently tell of Tibetan traders leading donkeys and sheep laden with salt down these deep valley routes and of Nepalese merchants going northward along the same paths with loads of rice to trade on the other side of the mountains. It is these deep valley routes through the Himalayas along which percolated various socio-cultural norms and practices including religious faiths amongst the peoples of the Himalayas.

There are great variations in the climate, vegetation and wild life in the Himalayas. The lower slopes of the Outer Himalayas are covered with tropical rain forests. Most areas in the northern side of the Himalayas are dry, and the land is barren.

Transportation in the mountains is difficult. There are few passes between the steeply-sided valleys and these are generally suitable only for pack animals. Agriculture is confined to the valley floors and terraced hill sides. The area is sparsely populated, mainly with the people of Mongoloid stock.

For convenience, the 2700 km long true Himalayas from the south-eastern extreme of the Karakoram, can be subdivided as follows:

1. Punjab Himalayas
2. Garhwal Himalayas
3. Nepal Himalayas
4. Sikkim Himalayas
5. Bhutan and Assam Himalayas.

The Garwal Himalayas are separated from the Punjab Himalayas by the Sutlej river, a tributary of the Indus. The Garhwal Himalayan mountains are considered the loveliest of all the mountains in Central Asia. The Garhwal mountains end at the Kali river. The range from there eastward is the Nepal Himalayas, that are followed by the Sikkim Himalayas. To the east of the Sikkim mountains lie the Bhutan Himalayas, and to the east of them the Assam Himalayas. At the far eastern end of the Assam Himalayas stands Namcha Barwa, the last peak in the 2700 km stretch of the Himalayas. In the Assam Himalayan region there are dense jungle areas between the villages and the mountains. Also it rains a great deal in the region. Further till nearly three decades back, plague, malaria and small pox were rampant.

Of the aforesaid subdivisions of the true Himalayas, the Assam Himalayas have a distinctive import and significance on account of these mountains being physiographically related to the relatively thickly populated vast region of North-east India. The region consisting of 255,036 sq km in area is inhabited by nearly 3 million tribesmen belonging to more than 100 distinct tribes and sub-tribes. The hilly rugged expanse lying between 22 north and 29.5 north latitudes and 89.70 east and 97.30 east longitudes consists of seven geo-political units, namely, the States of Assam, Manipur, Mizoram, Nagaland, Meghalaya, Tripura and Arunachal Pradesh. The whole of North-east India consists of parts of five river basins. By far the largest one, the Brahmaputra basin, covers entire Arunachal Pradesh and greater parts of Assam and Meghalaya. In the north-eastern end of this region a large number of tributaries from the north, east and south-east join the Dihang, the Dibong and the Lohit which together form the great Brahmaputra. Besides these, the Brahamaputra receives a total of 42 tributaries all along its course. Some of the tributaries meandering all over the basin have created numerous swamps. Some of the swamps are perennial inland water bodies, locally called *beel* in Assam. They are in fact veritable reservoirs of storm-waters abounding with certain varieties of mud-dwelling fish and edible aquatic herbs.

Another major basin is the Barak-Surma-Meghna basin that covers the northern and westen margins of Manipur, southern part of Assam and northern parts of Mizoram and Tripura and southern parts of Meghalaya. Here in this region is located the wettest part of world, namely, the Cherrapunji-Mowsynram region.

The third basin, the Tizu basin, covers the south-eastern part of Nagaland and the northern part of Manipur. It contributes to the Chindwin river of Mayanmar across the Patkai and Surma tract. It covers an area of about 6000 sq km.

The fourth river basin is created by the Manipur river with a catchment area of about 16,000 sq km in North-east India. Three tributaries come down from the surrounding hills of Manipur basin and join the Loktak lake.

The fifth basin of the river Kaladan covers an area of about 9000 sq km towards the southern part of the districts of Lunglei and Chimtuipur of the State of Mizoram. The Kaladan having captured several tributaries falls into the Bay of Bengal near Akyab.

The river system of North-east India is such that the entire drainage area does not form an integrated basin system. The region contains four important plains, namely the Brahmaputra plain (56480 sq km), the Barak plain (6962 sq km), the Manipur basin (1840 sq km) and the Tripura plain (3500 sq km). These are all very flat areas.

Having taken cognizance of the Himalayan physiographic features, attention is now diverted to featuring and assessing of certain key factors of people's life-ecology, culture, development and change, as these are reflected in the life-patterns of the peoples living all along the 2700 km along mountain ranges. Myriads of distinct disparate ethno-linguistic communities have had their abodes since perhaps prehistoric times. Over the millennia the Himalayan habitations had their ever sustaining subsistence level of livelihood from the environment that obtained there without ever being depleted or least metamorphosed till quite recent times. With the advent of the steady urbanization and westernization on a substantial scale around since early twentieth century in India, the age-old sustainability began to wane, and by the on-set of the fifties of this century, the pristine Himalayan environment eroded considerably. And the deteriorating process has since become a continuing one that proceeds uninterruptedly and unabatedly. Environmental deterioration is not exclusive to the Himalayas only. It has become a world-wide phenomenon affecting every part of the world portending a bleak future for the humanity as a whole. What are the factors and circumstances that have since been eroding the environmental stability, the essence of human existence? It will be impertinent to blame the recent unprecedented spurt of science and technology that have revolutionised man's material acquisitions and put forth before him an infinite vista of needs and aspirations for material growth. In pursuance of man's limitless efforts at acquisition of material needs, his persistent endeavours have come to be aggregated over the years in the form of industrialization, urbanization, westernization and globalization. In the present day world these west-inspired phenomena have their global ramifications. Environmental metamorphoses in the Himalayas are the direct outcome of the global process of the aforesaid west-inspired phenomena that aim at rapid instant development with little heed to portents of disasters in the forthcoming generations.

This volume contains a collection of forty two papers contributed by a cross-section of leading social, physical and environmental scientists and researchers having first-hand involvement with the study of the Himalayan region. The work deals broadly with the subject : *People of the Himalayas : Ecology, Culture, Development and Change*. The papers have accordingly treated of the Himalayan ecology and other cognate phenomena that have had their relevance in the wake of the modern day development spurts indicated above.

The first three papers primarily deal with conceptual aspects of human ecology and environment. Ghosh, Kandar and Bhattacharyya highlight in their paper the ecological perspective of man as one evolved through ages as a biocultural product. Baiping in a slightly altered tone also speaks of environmental evolution - landscapes dynamics due to human impact. Jest banks upon the idea of sustainability in the harsh Himalayan environments in the present day context of the dynamics of human behaviours in the region.

The second set of five papers dwells upon geo-environmental problems primarily arising out of the spurt for development. Das opines that with the progress of industrial growth through extraction of crude oil and natural gas etc., magnitude and ramification of pollution are also increasing. Mahanta harps on another far-reaching problem obtaining rapidly presently owing to lack of the notion of sustainability on the part of the development-planners.

Kotoky, Baruah, Baruah and Sarma, in a study of the water and sediment discharge data of the Jhanji river basin, find through physicochemical analyses that except iron, the various trace metal contents in water and sediment factions are within the tolerable limit. Iturrizaga observes that high mountain settlements besides being affected by sudden outburst of glacier dammed lakes, are not infrequently subjected to processes of mass movements of rockfall and mudflow events as a source of danger. Goswami refers to the persistent environmental problem of highland soil erosion in Arunachal Pradesh owing to practice of shifting cultivation occasionally aggravated by natural disasters like the Great Assam Earthquake of 1950.

The third set comprising four papers deals with biodiversity and eco-development. Sarma and Nath apprehend extinction of valuable plant species of North-eastern region owing to general lack of people's awareness and stress the instant need of conservation of biodiversity through spread of education among mass people. Husain speaks of biophysical resource management at high altitude hostile environment through judicious practice of husbandry of land and animal and transhumance. Barua and Barua in their karyotype analysis in five locally grown cultivars of chilli (*Capsicum annuum* L.) observe that variations in the number of chromosome etc. in the karyotypes of the cultivars play an important role in ecotype formation and also in evolution. Bordoloi in his comparative account of vegetation survey visualizes replacement of indigenous tree species with *Eucelyptus citriodor* and its consequent effect on local environment.

The fourth set of papers is concerned with ecohistorical perspective, dwelling upon Himalayan highland dwellers' way of life since dim historical times. Joshi and Baruah and Kalita in their individual papers have stressed that over the years the people's mode of life have been shaped by ecological factors. Nath also dwelling on historical events speaks of the Koches of Assam in early times as being called Kambojas, who denoted Tibet or its poeple. Nath asserts that the Koches who established a kingdom in Assam were none but the Tibetan migrants, a Himalayan community. Gist refers to a Himalayan community in the Suru area of Ladakh as having tendency to treat present day as historical accounts from the past.

The fifth set of papers deals basically with material culture - people's life ways and material components. The set contains sixteen papers of which as many as thirteen relate to North-east India, highlighting primarily mode of highland cultivation especially jhumming. In this regard, it is worth noting that while Roy and Ali speak of shifting cultivation, with a fallow period cycle of 2 to 3 years, as an unsustainable practice, Borang on the other hand finds that the Minyong-Padam group of Abor tribes' practice of jhumming for a cycle of 10 to 16 years are both ecologically and economically viable. Also on the other hand Phukan highlights the Apatanis' maintenance of ecological balance of their highland habitat by intensive terrace cultivation. Some of the remaining papers in this category by far treat of the modes and practices of material componets abounding in the people's immediate habitat. These have been brought into focus in the joint works of Banerjee and Banerjee, Sharma and Mahanta, Barua and Das, Bossya and Kalita, Coomar and Raha, Datta and Handique and also in the individual works of Singh, Dhar, Cameron and Das. Bhasin, working on Sikkimi people's health in a broad sense as meaning quality of life, finds health as a dynamic equilibrium stemming from the socio-economic pursuits in the Himalayan terrain. In another study of health status of the people of Ladakh, Bhasin and Bhasin discuss the multiple material enviornment constraints and the resultant conception of health among the Ladakhis.

The last set of nine papers is on change and effect. Multiple changes have come about over the past one and half a century on account of urbanization and industrialization creeping into the highland Himalayan regions. The highland dwellers across the Himalayas have by and large come under the vortex of phenomenal changes wrought over the ages. Spectacular changes have been brought into focus in the works of this set. It is pertinent to see that west-oriented industrialization and urbanization have verily had their effects on the indigenous norms and patterns of life in the far-flung, remote, not easily accessible regions in the Himalayas. Dube and Singh noted that the collapse of the Indo-Tibetan trade following Sino-Indian war of 1962, population dwindled as a result of out-migration from sedentary habitations. Bhasin in a study of transhuman population has noted considerable shortcomings in basic education and adult literacy especially among womenfolk on account of the cultural diversity of the people. Khongadier notes variations in anthropometric traits owing to varying environmental conditions. Noting the existence of intra-village variation in anthropometric traits between income-groups of the same village, he opines that selection pressure varies with varying environmental conditions not excluding socio-economic aspect. Sonowal finds that the changing political set-up, rapid urbanization, exposure to non-tribal cultures, etc. have directly influenced the age-old traditional life ways, causing youth dormitory to disappear from tribal society. Negi and Gadgil note that recent introduction of roads and motorized transport and opening of job opportunities etc. have caused considerable neglect of the age-old practice of rearing large livestock herds by the traditional joint families of the Kinnuar. The authors opine that use of live-stock manure in place of chemical fertilizers can well ensure the preservation of the rich genetic wealth of live-stock of the Himalayas. Barua, Sarma, Bordoloi, Singh and Ghosh discuss in their paper the post - harvest deterioration of Mandarin, Assam lemon and Rough lemon as a result of fungal attack. The authors suggest chemical or biological management technology to save the spoilage of the citrus wealth. Haines studying the Karakoram mountain habitats notes a wide - ranging experience and understanding and representation of the mountains in the infrastructural development under erstwhile colonial administration and the new forms of labour practices and the new state apparatuses for the present day road transport operations. The author opines that the new practices and institutions have reshaped the manner in which lowlanders and highlanders experience the mountain environment. Sengupta and Gogoi have analysed the effects of a few socio-cultural determinants that cause differential rates of fertility and mortality. Finally, Gowloog, in a diachronic study of the Lepchas over a period of 50 years from 1937 to 1987-90, notes that in the last fifty years, the dependence of the villages on their habitats has decreased considerably, giving rise to a life-style, having fascination for non-bio-degradable goods and loss of eco-piety in the delinking process.

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Khagen Chandra Mahanta
Department of Anthropology
Dibrugarh University, Dibrugarh 786 004, Assam, India

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LIST OF CONTRIBUTORS

Zhang Baiping, Ph.D., Institute of Geography, CAS, P.O. Box 9719, Beijing 100 101, P.R. China.

Shubhra Banerjee, M.Sc., Department of Silviculture and Agroforestry, University of Horticulture and Forestry, Nauni 173 230 (Solan), Himachal Pradesh, India.

U.K. Banerjee, M.Sc., Ph.D., IFS, Department of Silviculture & Agroforestry, University of Horticulture and Forestry, Nauni, Solan 173 230, Himachal Pradesh, India.

Indira Barua, M.Sc., Ph.D., Professor, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

N.K. Barua, M.Sc., Regional Research Laboratory, Jorhat 785 006, Assam, India.

Alaknanada Baruah, M.Sc., Ph.D., Lecturer, B.H. College, Dibrugarh 786 001, Assam, India.

J. Baruah, M.Sc., Research Scholar, Regional Research Laboratory, Jorhat 785 006, Assam, India.

Paran Baruah, M.Sc., Ph.D., Scientist, Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India.

S.L. Baruaha, M.A., Ph.D., Professor, Department of History, Dibrugarh University, Dibrugarh 786 004, India.

M.K. Bhasin, M.Sc., Ph.D., Professor, Department of Anthropology, University of Delhi, Delhi 110007, India.

Veena Bhasin, M.Sc., Ph.D., Research Scientist 'C' U.G.C. (Professor Grade), Department of Anthropology, University of Delhi, Delhi 110 007, India.

Subhra Bhattacharyya, M.Sc., Senior Fellow, Anthropological Survey of India, Calcutta 700 019, India.

C.L. Boissya, M.Sc. (Gau.), Ph.D. (London), FNASc. (London), FNRS, FISPP, Professor of Plant Physiology & Botany, Gauhati University, Guwahati 781 014, Assam, India.

Asham Borang, M.Sc., Scientist-SD, State Forest Research Institute, Van Vihar, P.B. No. 159, Itanagar 791 111, Arunachal Pradesh, India.

Ajit Kumar Bordoloi, Scientist, Regional Research Laboratory, Jorhat 785 006, Assam, India.

P.K. Borua, M.Sc., Ph.D., Reader in Life Sciences, Department of Life Sciences, Dibrugarh University, Post Box No. 15, Dibrugarh 786 004, Assam, India.

Mary M. Cameron, Ph.D., Anthropology Program, Department of Sociology, Anthropology and Social Work, 7030 Haley Centre, Aburn University, Alabama 36849-5209, USA.

Palas Chandra Coomar, M.Sc., C/o Manis Kumar Raha, M.Sc., Ph.D., 10/3, Jamir Lane, Calcutta 700 019, India.

Bornali Das, Research Scholar, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

Girindra Nath Das, M.Sc., District Research Officer, Karbi Anglong, Diphu 782 460, India.

Niloy Kumar Das, M.Sc., Ph.D., Retired Professor of Botany, Bepin Bhawan, Jasomonta Road, Panbazar, Guwahati 781 001, Assam, India.

N.N. Dass, M.Sc., Ph.D. (London), D.I.C., Professor, Department of Chemistry, Dibrugarh University, Dibrugarh 786 004, Assam, India.

A. Datta, M.Sc., Ph.D., Lecturer, Moran College, Moran 785 669, Assam, India.

Bibhash Dhar, M.Sc., Ph.D., Anthropologist, Anthropological Survey of India, North East Regional Centre, Shillong 793 001, Meghalaya, India.

D.K.Dube,M.Sc., 347 E, Brahmaputra, Jawaharlal Nehru University, New Delhi 110 067, India.

Madhav Gadgil, Professor, Biodiversity Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur, P.O. Bangalore 560 064, India.

Anil C. Ghosh, Ph.D., Director, Regional Research Laboratory, Jorhat 785 006, Assam, India.

Asok K. Ghosh, M.Sc., PRS, Ph.D., D.Sc., Professor, Department of Anthropology, University of Calcutta, 35, Ballygunge Circular Road, Calcutta 700 019, India.

Arundhati Gogoi, M.Sc., Research Scholar, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

S.C. Goswami, M.Sc., Ph.D., Professor, Department of Applied Geology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

Rip Roshina Gowloog, M.Sc., Ph.D., Assistant Anthropologist, Anthropological Survey of India, North East Regional Centre, Shillong 793 003, Meghalaya, India.

Nicola Grist, 13 Wingmore Road, London SE24 OAS, UK. 0044-171-326-1828.
email : anp01nhg@gold.ac.uk.

Charles S. Haines, M.A., Research Scholar, Department of Anthropology, 1180 Observatory Drive, Madison, Wisconsin 53706, USA.

R. Handique, M.Sc., Ph.D., Professor, Department of Life Sciences, Dibrugarh University, Dibrugarh 786 004, Assam, India.

Zahid Husain, M.Sc., Ph.D., Research Associate (Human Ecology), Anthropological Survey of India, North East Regional Centre, Shillong 793 001, Meghalaya, India.

A.N.M. Irshad Ali, M.Sc., Ph.D., Professor, Department of Anthropology, Gauhati University, Guwahati 781 014, Assam, India.

Lasafam Iturrizaga, C/O Geographie/Hochgebirgsgeomorphologie, Geographisches Institut-Goldsschmidtstrasse -D-37077 Goettingen, Germany.

Corneille Jest, Ph.D., Directeur de Recherche CNRS, 1 Place Aristide riand 92195 Meudon Cedex - France.

Maheshwar P. Joshi, M.A., Ph.D., D. Litt., Sri Mallika Kunja, Malla Joshi Khola, Almora 263 601, Uttar Pradesh, India.

Bharat Ch. Kalita, M.A., Ph.D., Reader and CGO-I, National Defence Academy, Poona, India.

D. Kalita, M.Sc., Lecturer, T.H.B. College, Jamugurihut 784 180, Assam, India.

Arun Kandar, M.Sc., Researcher, Department of Anthropology, Calcutta University, Calcutta 700 019, India.

R. Khongsdier, M.Sc., Anthropologist (P), Anthropological Survey of India, North East Regional Centre, Shillong 793 001, Meghalaya, India.

P. Kotoky, M.Sc., Scientist, Regional Research Laboratory, Jorhat 785 006, Assam, India.

J. Mahanta, M.D., Director, Regional Medical Research Centre, N.E. Region (ICMR), Post Box No. 105, Dibrugarh 786001, Assam, India.

K.C. Mahanta, M.Sc., Ph.D., Professor, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

D. Nath, M.A., Ph.D., Reader, Department of History, Dibrugarh University, Dibrugarh 786 004, Assam, India.

S.C. Nath, M.Sc., Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India.

Hans Raj Negi, Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, Karnataka, India.

Jogada Phukan, M.A., Ph.D., Lecturer, North Lakhimpur College, Lakhimpur 987 001, Assam, India.

Manis Kumar Raha, M.Sc., Ph.D., 10/3, Jamir Lane, Calcutta 700 019, West Bengal, India.

Babul Roy, M.Sc., Senior Research Fellow (UGC), Department of Anthropology, Gauhati University, Guwahati 781 014, Assam, India.

J.N. Sarma, M.Sc., Ph.D., Reader, Department of Applied Geology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

P.C. Sarma, M.Sc., Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India.

T.C. Sarma, M.Sc., Ph.D., Assistant Director, Regional Research Laboratory, Jorhat 785 006, Assam, India.

Sarthak Sengupta, M.Sc., Ph.D., Reader, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India.

S.K. Sharma, M.Sc., Ph.D., Research Officer, Regional Medical Research Centre, North East Region (ICMR), Post Box No. 105, Dibrugarh 786 001, Assam, India.

Harjit Singh, Professor, Centre for the Study of Regional Development School of Social Science, Jawaharlal Nehru University, New Delhi 110 067, India.

K. Saratchandra Singh, M.Sc., Ph.D., Professor, Department of Anthropology, Manipur University, Canchipur, Imphal 795 003, Manipur, India.

R.S. Singh, M.Sc., Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India.

Chandra Jyoti Sonowal, M.Sc., Ph.D., Lecturer, Unit for Child and Youth Research, TATA Institute of Social Sciences, Post Box No. 8313, Sion-Trombay Road, Deonar, Bombay 400 088, Maharashtra, India.

I. ECOLOGY AND ENVIRONMENT CONCEPTS

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Human Ecology and Developmental Changes in The Himalayas During The Pleistocene Epoch : An Integrated Overview

Asok K. Ghosh, Arun Kandar and Subhra Bhattacharyya

FRAMING OUT THE CONTEXT

Despite its initiation more than a century ago, in somewhat nascent state made by Ernst Haeckel (Krebs, 1985), in recent times ecology has turned to be a fullfledged discipline. In the beginning attempts were made in drawing equation between natural phenomena and plants. Later, projection was made for inclusion of animals. For all practical purposes, the prime focus was laid on the system related to adjustment and adaptation - so that the mechanism of proper balance may be understood. In course of time, manifold involvement came into being from various disciplines as life science, and physical science, even from geo-science. With a view to testing the rationality, mathematics and statistics also came into vogue. Thereby a number of models have been formulated, and gradually the significance started gaining ground for confirmation. Attempts have also been made to define ecology in sequential manner with inputs of continuous development. Elton (1927) proposed a definition which is both simple and broad. He defined ecology as "scientific natural history". In a way this concept includes everything and at the same time it conveys nothing, leading to a "uncomfortably vague" state of affair. In a restrictive sense, according to Andrewartha (1961), his definition states "ecology is the scientific study of the distribution and abundance of organisms". He fails to indicate the interactional relationship. The scope of definition further continued and in due course Odum (1963) presented his view point pertaining "structure and function of nature". Margalef (1963, 1968), a proponent of ecological studies, has made continuous attempts to define ecology putting forward ecology as "the study of a system at a level in which individuals or whole organisms may be considered elements of interaction, either among themselves, or with a loosely organized environmental matrix. Systems of this level are named ecosystems and ecology is the biology of eco systems". This exercise with multiple facets with wide spectrum in defining ecology is still continued, embracing various perspectives. However, in the level of concept it is understood but it is perhaps difficult to achieve a final and full proof definition.

The above episodes do not mean that progressive development of ecology has been ceased. Rather, with coordination of different disciplines, ecology has turned to be multidisciplinary in form and interdisciplinary in nature. In course of accelerated traverse, the coverage of ecology has largely been accentuated. Nowadays, it has made furtherance in dealing with macro and micro characters. Stress has also been put forward in diverse conditions, as terrestrial, arboreal and aquatic situations. At the same time other works indicate that ecological shifts are found to occur from one vegetation pattern to the other.

HUMAN INTERACTIONS

At the outset, human elements in ecological studies were not properly taken care of. In due course, it was felt that ecology concerned with man is somewhat different. Moreso, human interactions in the perspective of ecology are giving rise to dieverse conditions and deflected results. Unlike all other animals, man is provided with a number of special attributes. In the overall scheme of evolution, man is placed on the highest scaler position. Naturally his biological make up surpasses all his precursors. Above all, the crucial and major identity of man is discernable in capability of culture, the sequential operation-cum-production manifestation. As a result, ecology of man or in other words human ecology is discretely different from all other facets of ecology. Simultaneously, man along with his culture plays a conspicuous role on other ecological systems - thereby the final product, *i.e.* the result, deviates mostly from the expected values.

During early times, human intervention, in the dimensions of biology and culture, was least. Such minimal human interference and the interactions thereof may be accounted for with the aid of a number of factors. Immediately after the emergence of man, the population size was within the lowest limit. At the same time, his biological endowments did not start acting in optimum level. In addition, his cultural pool was in an incipient state. In accordance with all the above noted forms and features, his way of life was close to other animals in bio-spatial proximity. No abrupt change was made and for a long period of time developmental change came into being in a very slow rate but with uninterrupted continuity. This does not mean that biological evolution and cultural development were completely inactive. But the activation on both the aspects was feeble, however, it was gradual and with consistency. To explain this circumstance indication may be made in terms of less encounters, and simultaneously survival mechanism was devoid of much challenge.

The forenoted situation did not exist for long. Fitness for sustenance came into existence with a number of shifts towards favourable directions. These comprise increase in population size of early hominids, with which interpersonal along with interband rivalry cropped up mainly to overcome uncongenial condition. It came into existence due to scarcity of available natural food resources. Biological evolution in microforms brought out the macro dimensions through the process of accumulation of micro evolutionary products. In the long run, distribution of hominids turned wide, resulting in isolation, causing inbreeding. The total result also witnessed varied forms of adaptation in different geo-environmental locales. This had also affected the milieu of culture. The major programme of culture constitutes diverse needs in dissimilar contexts, management of cultural traits on the basis of prevalent needs, availability of raw materials for fabricating tools, dependence and utilization of food resources. Coping with the need and availability of suitable raw materials, technology of fabrication of tools was manouvered. Instead of this being static, dynamic forces also triggered the total system.

Such alterations in all dimensions, in holistic form, led to emergence of new sub-species and even species. In addition, there are other features, as isolation, which may be considered responsible for speciation. Geographical isolation was concomitant with local environment, resource materials and so also behavioural pattern. In these sectors the role of physiology and genetics can seldom be excluded. It is known that behaviour is controlled and monitored by gene(s). In this context the contribution of gene should not be underestimated, especially with regard to fitness. In the sense of genetics "fitness is a measure of the relative change in the frequency of an allele owing to selection" (Valentine and Campbell, 1975).

The mutual cooperation between hominid, at the earliest stage, and nature brought out a nascent form of ecological equilibrium, without affecting each other because of least or relatively lesser interference of many on nature. This stability did not continue for long. With biological evolution needs were conceived with higher magnitude and greater details, thereby culture underwent through ramification and development, both in spatial and temporal contexts respectively. The total process and its effect complicated the ecological equation and slowly the imbalance set in.

HUMAN ECOLOGY CONTRARY TO CULTURAL ECOLOGY

Human beings constitute a componential part of organic world. Naturally man contributes a significant role in ecology. Both role and relationship of man in ecology act in dual form. For the distinctiveness of human biology, his interaction with nature is different from all other plants and animals. There are inputs of nature on man and so also of man on nature. In return there are respective outputs and feedbacks. The prime consideration in the interaction between man and holistic nature yielded one-way effect. Human interference on nature in the level of unit is not very wide. Rather, it is somewhat sporadic and there is seldom any way for rectification on part of nature. In the same arena, nature in total form but with individual factor is putting pressure on man. The results which are uncongenial can not always be prevented. In the meantime, almost simultaneously, the biological changes start operating. This has resulted in setting the adaptive mechanics. Examples may be set forth from skin colour, accumulation of fat (Newman, 1955), regulation in metabolic activities and other physiological operations.

Mention may also be made that biological changes for adaptation are never induced, not spontaneous in the strictest sense of the term. Contrary to the same, the course of development of culture underwent through shifts either in response to some need or as incessant process.

In comprehensive but brief manner human ecology may be expressed as the position of man within the environment in which he lives, and the overall relationship between man and environment (Quinn, 1950), primarily natural. There are different views on human ecology, as an inclusive synthesis (Bowes, 1935), identical with human geography (Barrows, 1923; White and Renner, 1936), an application of biological principles (Adams, 1935; Alle, 1938), a study of sub-social relations among men (McKenzie, 1934; Park, 1936; Quinn, 1939). In view of the above proposals, it is worthwhile to mention that human ecology is never constant. It changes in the dimensions of space and time. Again, in the modus operandi of relationship, as stated earlier, there are different forms of interactions. Being exposed to nature, unlike other animals, man receives the pressure of natural environment from various sources and diverse points. In case of other animals, there is greater survival fitness within their respective specific environment. This is well illustrated from the geo-environmental distribution of different species of animals. There are a good number of animals which are highly environment specific. Larger the area of distribution, more diversification of environment and this indicates the greater adaptability of some animal species.

With regard to man, he is an exception from the above rules. Adaptation in biological sense is perhaps the least. Despite this his geographical distribution is perhaps the widest. This was not the case to begin with. To start with the emergence of man, the locales were too few, probably varying between the minimum 1 and maximum 4. During the same time the earliest human species used to live in isolation in different geo-environmental settings. Naturally, the prevailing ecological conditions were dissimilar. It is not unlikely that not the individual biological attributes, but in their totality, the biological makeup was different from one another, instead of being homogenous. This is indicative of the biological distinction of man in micro level.

CULTURAL ECOLOGY - A CONCEPT OF INEQUITY

In course of time the term "cultural ecology" was proposed "to develop the concept of ecology in relation to human being as an heuristic device for understanding the effect of environment upon culture" (Steward, 1955 : 30). Prior to the formulation of this concept another proximal term "social ecology" was coined (Alihan, 1938). Some authors are of the opinion that "human ecology" and "social ecology" are synonymous to each other. Perhaps for the proposal of a new term "cultural ecology", Julian H. Steward made a mess specially with the exclusion of biology of man from *his* culture. Many a time he has endeavoured not only to separate the "biology" and "culture" of man but also arrived at a conclusion that there is no interrelationship between the two. To point out some of his comments, a few excerpts have been included here :

> "... the apperance of *Homo sapiens* is probably more the result of cultural causes than of physical causes". "... the problem of explaining human's cultural behaviour is of a different order than that of explaining his biological evolution. Cultural patterns are not genetically derived ..." "... human beings do not react to the web of life solely through their genetically-derived organic equipment. Culture, rather than genetic potential for adaptation, accommodation, and survival explain the nature of human societies" (Steward, 1955).

Study of spatial distributions and even with coterminus studies of communities and regions (Mukherjee, 1928) brought out a new dimension in the perspective of ecology.

In dealing with "the concept and method of cultural ecology", Steward has made a number of remarks pointing to inadequacy. He endeavours to identify the works of Hollingshead (1940), Adams (1935, 1940), Bates (1953) and many others who have taken into acount both biology and culture. His prime stand point is on the clearcut distinction and non-correlation between biology and culture of man, unlike the above noted scholars. Perhaps feeling scared, he has drawn his support from Hawley (1950). It appears to be a matter of great compassion that Steward had no interest to look into the biological aspects of man and its linkage with culture. During formulation of his concept on cultural ecology, works on behaviour and biology were conspicuously available. In recent times with the advancement of biological sciences, including ethology and biocultural aspects in anthropology, the intimate relationship between biology and culture of man can never be refuted.

In dealing with human ecology, cultural ecology can be well taken as one of the components but under any circumstance this can not be treated as a-bio.ogical. After all culture is laid within the stable foundation of human biology. At the same time, the biology of man in the intrinsic level of genes controls both the preception of need and conceptual response in the form of culture. In the same ambit culture may be expressed as the phenotypical behaviour of specific gene pool. Generally all human beings, as of modern times, are provided with a greater similarity in the genetic makeup and so also the cultural outfits. Variations of cultural forms are not altogether absent from one community or group to another. Such differences may be accounted for in terms of diverseness in environmental conditions and distinctions in resource materials.

With confidence, mostly generated from the works already carried out it is marked that in the domain of ecology, human ecology is an area in which the interactional relationships are to be studied between man and his total environment within a restricted locale. To encounter with the environmental exposures human behaviour plays a significant role. The basic constituent of the same is laid in the genes, depending on genetic endowment. The genes responsible for behaviour and behavioural complex are transcribed in the form of behavioural manifestation. In such a context, resources as part of the environment also play a significant role both as inputs and feedbacks. This complex interactions give rise to behaviour of manifestations known as "culture".

ECOLOGY OF EARLY HOMINIDS

From the surfeit of information and data it is observed that with one species, as *habilis* or *erectus* the course of cultural development is restricted and the rate of change is also very slow. At the same time differences are met with among a number of sub-species, as *erectus*, *pekinensis* etc. living in distantly placed geographical locations, keeping appreciable isolation. During the next stage of speciation, giving rise to *sapiens*, relatively faster change took place in different componential traits of culture. Here the rate was compratively faster. With the emergence of subspecies *sapiens* of *Homo sapiens* the cultural matrix underwent through changes in quick succession. It is obvious that the genome complexes of different species and sub-species are not constant, rather the shift is linked with the phylo-taxonomy, placed in chronological frame. In a way it may be said that speciation or sub-speciation is a biological process. Similarly culture change following progressive development may be viewed as the end product of the bio-behavioural phenomenon, and the system thereof.

In the context of the above noted comprehensive full-length background in a brief manner, an inferential projection has been made with early hominids, keeping it restricted within the spatial dimension of the Himalayas with its coverage within India and Pakistan. At this juncture the main issue of discussion is pointed to geographical area, chronological periodization, environmental episodes and succession of culture.

The history of the Himalayas goes back to Eocene period, prior to this the mountain range was covered by the sea. This is confirmed with the occurrence of marine fossils. Slowly but with continuity the Himalayas started rising and ultimately attained the enormous height of about 9000 metres. The elevation is still continued at a slower rate (Wadia, 1961). At the sametime, erosional activities took place by fluvial actions During this vast time span this mountain range passed through different climatic conditions, thereby the environment was almost ever-changing. For the present purpose the boundary line of chronology may be fixed to 25 m.y. B.P. This particular period is known as Miocene in terms of geological division. On the basis of fossil evidences it is confirmed that from the Miocene to Pliocene, with a coverage of about 23 million years, the area was inhabitated by hominoids, specially varied species of *Dryopithecus*, *Sivapithecus*, *Gigantopithecus*, *Ramapithecus* etc. (Pilgrim, 1927a; 1927b; Prasad, 1964, 1969; Pilbeam, 1969) . It is to be pointed out that in some of such works attention has been paid to the revision of nomenclature (Simons and Pilbeam, 1965) and ecological consideration (Prasad, 1971).

There are various approaches in dealing with ecology and land-use pattern as one of the crucial parameters. The early hominoids in the Himalayas used to live within an elevation between 300 and 1200 m. Within the same range there were two eco-niches for *Dryopithecus* and *Ramapithecus* genera (Brown, 1924; Lewis, 1934; Gregory et al., 1938; Simons, 1972). One of the present authors pointed out "the area below the elevation line of 300 m is completely devoid of any hominoid fossil finds ... due to very low land area, with considerable damp and wet whether" (Sen and Ghosh, 1982 : 44). It is suggested that the area with elevation between 600m and 1200m was favourable for habitation of the early hominoids with abundant food supply. In exceptional cases either for scarcity of food or deterioration of climate they might have come down temporarily below 600 m. Tatersall (1969a,b) made attempts to reconstruct the (palaeo) ecology of north Indian *Ramapithecus*.

The Tertiary ecology in the Himalayas might have played a significant role in speciation. According to the approved scheme "a species is a number of related populations the members of which compete more with their own kind than with members of other species" (Colinvaux, 1986 : 152). In this connection it may be assumed at this stage that there was mutual association among the early hominoids in this region which further gave rise to commensalism (Kendeigh, 1980). However, the above information indicates the ecology of the hominoids in this region pointing to both co-existence and adaptation.

Afterwards there was a wide gap of about two million years. During this period, mostly of Pleistocene epoch there were a number of climatic fluctuations in a cyclic manner in the form of glacial and interglacial stages (Ericson and Wollin, 1968; Flint, 1971). During this epoch certain issues are indicative of change, as climate which also brought about differentiation on ecology and culture. The latter displayed the interactive responses of man with environment for the purpose of survival. Unfortunately so far no early hominid fossil finds of this epoch have been recovered from this region. Despite this, cultural ecology may be considered as the behavioural attributes in response to the environmental change. It is needless to mention that culture is provided with a close bearing on biology. However, the Himalayas are provided with glaciated and periglaciated regions, hominoid fossil sites and in the further lower reaches there are many palaeolithic sites (Fig. 1.1).

ENVIRONMENTAL EPISODES

During the Pleistocene epoch the total landmass of South Asia was under the impact of climatic change in two sets. One set comprises the northern area broadly situated above 30° N.L. while the east west extension is between 60° and 100° E.L. This area was practically covered by glacial and interglacial activities with two subregions glaciated and periglaciated areas. The most part below 30° N.L. constitutes the second set which is termed as aglaciated area.

The present disquisition is limited to the first set. On the basis of geomorphological features and terrace sequences along the river valleys there is indication that the area was under the influence of cyclic climatic changes. From the U-shaped valleys, glacial lakes, moraines and such other features, the activities of glacial and interglacial periods are confirmed. During the glacial period the valleys in the mountains were covered with snow capped ice of huge thickness. Naturally, the water level in the sea went down. The volume in the rivers was appreciably less which resulted in aggradation In the succeeding interglacial period huge quantities of cold water, melted from the glacier went down through the rivers. Both for the higher volume and greater velocity of the water in the rivers, degradation took place. These cyclic and repeated climatic interferences gave rise to terrace formations. Top terraces are older and bottom terraces are later. The interconnection between the climatic conditions and geomorphological features of the rivers with terrace formation turned helpful for estimating a relative chronology.

CULTURE - THE PROPULSIVE MEASURE FOR ADAPTATION

It has already been pointed out that ecology is the resultant product of environment and other

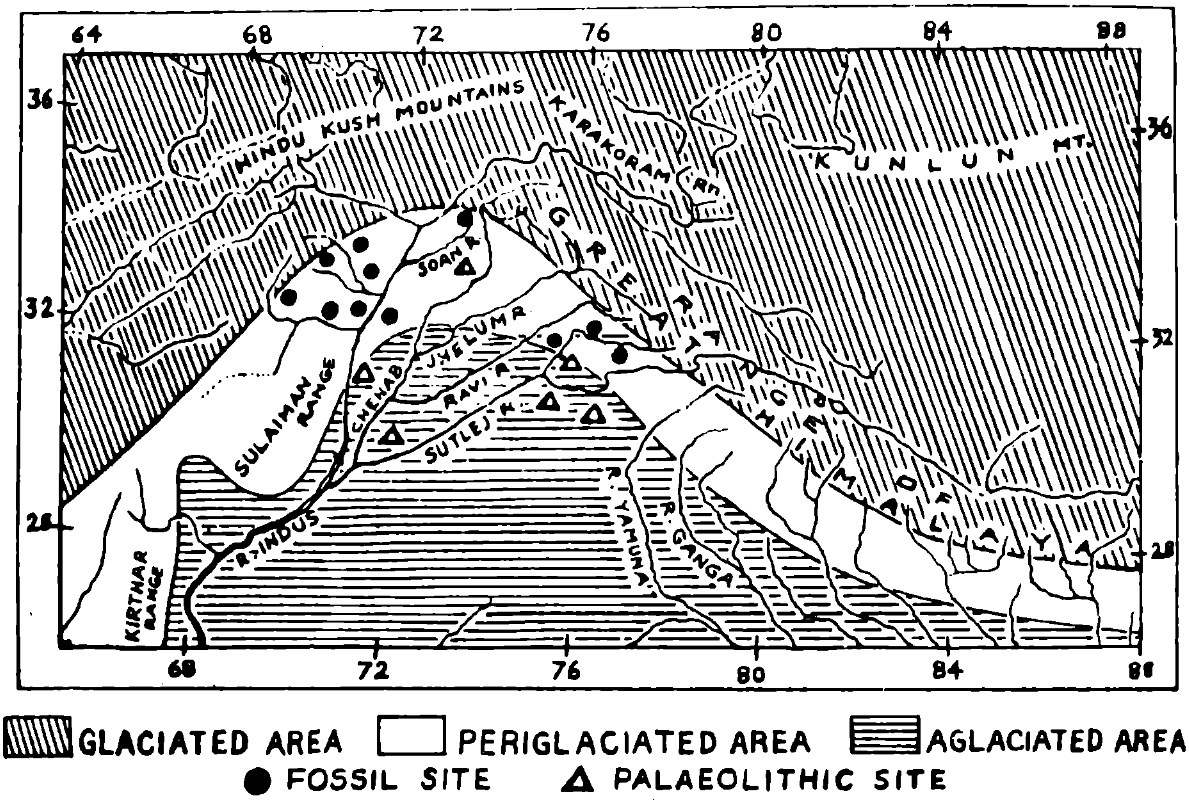

Fig. 1.1. Map of the region under consideration with indication of glaciated, periglaciated and aglaciated areas, showing the fossil hominoid and palaeolithic sites

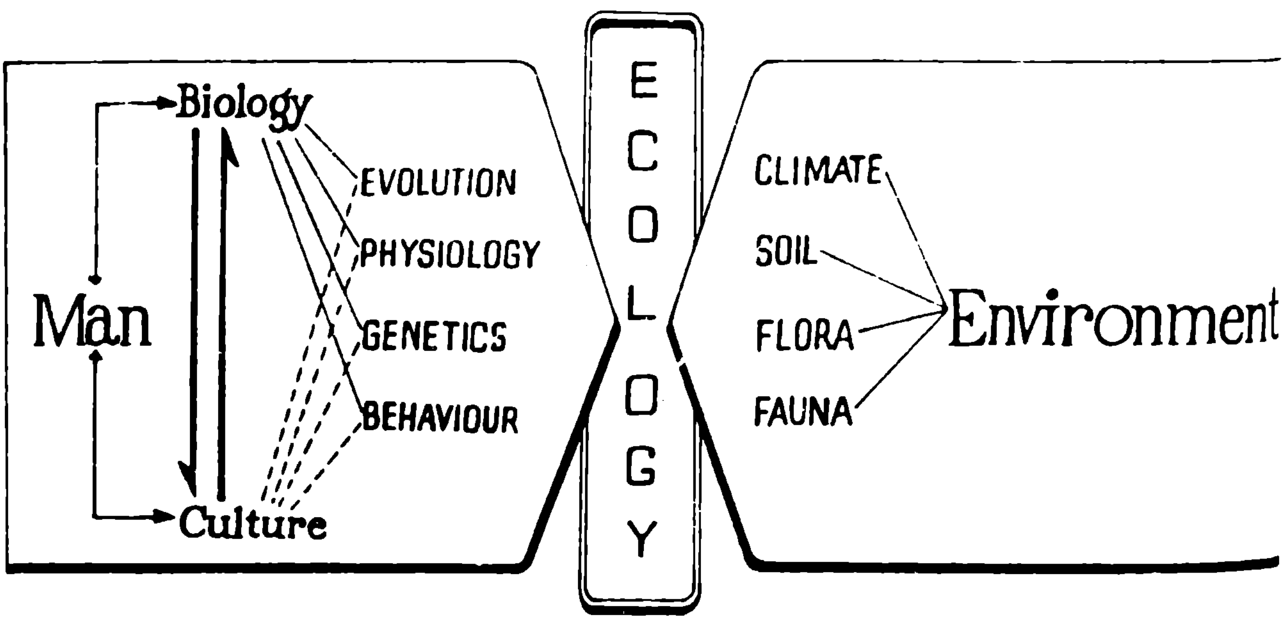

Fig. 1.2. Diagramatic imagery of ecology in the system of interaction between environment with its constituents and man - both of biological and cultural sets, including componential units

organisms. In the context of human ecology, the primary issue under consideration does not change much. The environment retains in holistic manner and man turns as the main focus, replacing organisms. In case of environment the major componential parts are climate, soil, flora and fauna. With regard to these constituents, close-knit interrelationship is present among one another. In connection with man, irrespective of time and space, there are two basic units, *viz.* biology and culture. Human biology as an entity has a number of units. These are evolution, physiology, genetics and behaviour. On the other, there is a broad interconnection between biology and culture of man. And in intricate form. culture is linked with above noted units of biology. Afterall, culture may aptly be considered as the expression of behaviour (Fig. 1.2).

There are five terraces in addition to the highest initial plain, formed of boulder conglomerate, along the river valleys in the periglaciated tract. From almost all the terraces assemblage of palaeolithic tools have been found (Sen, 1955; Lal, 1956; Pruffer, 1956; Paterson and Drummond, 1962; Graziosi, 1964; Johnson, 1972; Mohapatra, 1974). Besides the environmental episodes and terrace sequence, the tool assemblages also turned to be the indicator of cultural chronology. In the sequence of culture there are five major stages of the Soan lithic culture complex. These are : proto-Soan, early-Soan, middle Soan, late Soan and advanced Soan as proposed by Ghosh and Ray (in Ray and Ghosh, 1981). This chrono-cultural scheme of the Soan lithic culture complex is a modified version of the original scheme of De Terra and Paterson (1939). Afterwards, a number of changes were suggested.

In all the classifications, it has been confirmed that in total culture complex, one stage is different from other stages with regard to tool typology and the fabrication technology applied for the preparation of tools. Again one set of tools of a stage differs from other in metric variables and attributes related to morphology and raw materials used. It is necessary to explain why such changeover took place. One explanation refers to the fact that techno-typology of tools is a behavioural manifestation which might have developed spontaneously, keeping in view of overall betterment and greater efficacy in function. Tools were made with the application of proper technology to cope with the prevailing need through manipulative functions. For widespread climatic change through time there were shifts of the holistic environment. The basic need was procurement of food, and the environmental changes must have made impacts on the micro needs. Tools used for big game hunting are seldom of any use for hunting small games. Otherwise proper adjustment can scarcly be met with.

In view of this circumstance, there are indications that alteration in any aspect of ecology gives rise to change in other sectors or components. In the above illustration the initial change that took place was brought about in the aspect of climate. This in turn made impact on the flora and fauna, resulting in replacement with new species. Accordingly, with a view to coping with the basic need of sustenance, transferance came into vogue in the area of behaviour. The behavioural network comprises a number of stages as perception and conception related to need, planning for making efficient tools, programming for fabrication technology, selection of suitable nature and form of raw materials. Finally, the total action implies the net product of ecology through the interaction between environment and human behaviour.

It has already been noted earlier that the tools of different cultural stages are different in dimension, morphology, typology and technology. The latter includes both fabrication and manipulation procedures. In this perspective the function of the tool, the basic necessity can not be excluded. In typological nomenclature the tools constitute choppers (unifacial), chopping tools (bifacial), scrapers of different sub-types, awls, points etc. The above nomens are suggestive of functional implications. Specially due to lack of relevant data, this format appears to be presumption - may or may not be logically valid and as a result the uncertainity is difficult to overcome. This problem may be taken into account in the theoretical perspective in which there are different stages. There are certain factors which are conceivable. These include collection of tools which are genuinely man-made instead of natural products. All the tools are provided with marks of workmanship made by the hominids. Each tool type is different from one another but a broad spectrum

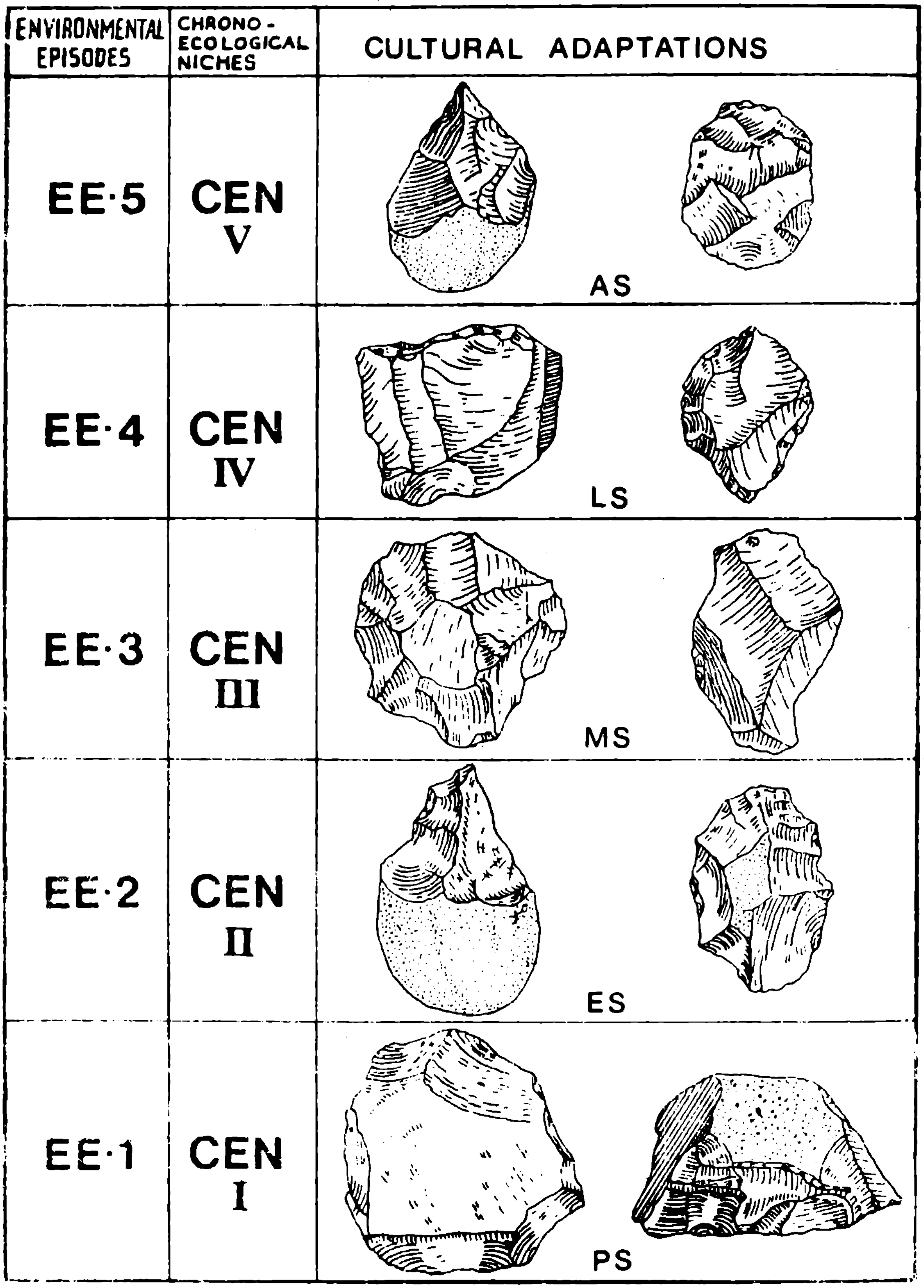

Fig. 1.3. Cultural adaptation during the Pleistocene epoch in the Himalayan region, representing the stages of the Soan industrial complex *vis-a-vis* logically assessed environmental episodes and chrono-cultural niches

lumping can be arranged with the help of morphological attributes and metric variables. Thereby instead of a tool type with its specific identity, the same criteria may be lumped together into a number of groups in which members of the tools population of distinct type has variants. As a result, tools per se are more in numbers but the types are significantly less.

The divisible five stages of the Soan Palaeolithic culture are placed in chronological ordering which indicates the time perspective on the basis of terrace sequence. The terraces are not only of different period but at the same time, their formations were made during different chrono-climatic episodes. Climate as one of the basic units of environment also related to other units, as soil, flora, fauna etc. On hominids, environmental impacts, in the form of forces and pressures were certainly made. In terms of responses, the biology with its different areas, made encounterance. Except the behaviour, set in culture traits, other information can not be culled. As a matter of fact, there are distinctions in the environmental makeup during the formation of the terraces. At the same time, the culture, *i.e.* the behavioural manifestations are found to be dissimilar. Naturally, the logical correlation may be made between environmental change and cultural alterations, giving rise to diverse ecological niches at the same place but at different point of time (Fig. 1.3). It is worthwhile to mention that the form of material, *i.e.* core and flake continued through time but marked distinctions are observed with technology, tool type and obviously functions. In the sequential context, different stages of the Soan culture may be fixed. Even without accurate identification of environmental phases, the ecological periodization may be formulated in logistic theoritical framework.

This exercise may further be continued. Any type is made for a specific function or a number of functions. The determinant factors of functions may be correlated with the type. In the long run, in the level of abstruction, a type has its own function which is different from other types. Through such rational equation the assemblage pattern of tool types in different chronological stages may be well ascertained. This scale of cultural chronology may be equated with relative geo-chronology, as terrace sequence and further interrelationship with the climatic change. The total exercise has already given rise to a model in understanding human ecology during the Pleistocene epoch in the Himalayas. Both the relationship and interaction between environment with a number of known factors, and early hominids with regard to their bio-behavioural activities can be accounted for, of course within a specific limit. The present undertaking may not be an endeavour first of its kind, but the problem selected and the treatment made are provided with new dimensions. Work in furtherance in other areas will bring out a new horizon of human ecology, more so of early hominids.

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KEYWORDS AND ABSTRACT

KEY WORDS Environment. Biological Characters. Cultural Attributes. The Himalayas. Chronology. Human Ecology.

ABSTRACT Human ecology has emerged as a distinct discipline, through a number of shifts, both with materials and concepts. In the same arena both biology and culture of man in integrated form interact with holistic environment with a view to arriving at an equilibrium. Thus through time, adjustment and adaptation of man have turned possible. Ecological perspective of man may be understood from the onset of early hominids. In the present case the area under consideration is the Himalayas. The data reveal macro developmental changes in the sector of culture which are also useful to reconstruct the biological evolution in micro level. After all, ecology related to early hominids appears to be with a favourable equation which brought out the existence of man through his bio-cultural progress. It is to be pointed out that cultural ecology does not make much sense when it is devoid of biological considerations. For all practical purposes, biology and culture of man are connected to each other and any bio-cultural product is the result of both the units.

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Authors' Address : **Asok K. Ghosh, Arun Kandar and Subhra Bhattacharyya**, Department of Anthropology, Calcutta University, Calcutta 700 019, West Bengal, India

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Landscape Dynamics and Sustainable Development in The Northwestern Tibetan Plateau

Zhang Baiping

Towering on an average above 4,000 m and totaling about 2,500,000 km^2, the Tibetan Plateau is well known for its loftiness, immenseness, youthfulness and uniqueness. For a long time, it has been attracting thousands of explorers, scientists and tourists to come to it for work and travel. The environment and development of the whole plateau and its surrounding mountains have become one of the main concerns of the modern world.

Since the 1950's and especially 1973, the Chinese Academy of Sciences has organized many times of integrated investigation in the plateau and the surrounding mountains, *e.g.*, in the Xizang Autonomous Region from 1973-1980; in the Hengduan Mountains from 1981-1986; in the Karakorum and Kunlun mountains from 1987-1992; and in the Qinghai Hoh Xil region from 1989-1991. The field of research includes geology, glaciology, geomorphology, environmental changes since the late Cenozoic Era, altitudinal belts and three-dimensional structure, flora and fauna, etc. Many books and papers have been published, but most of them are in Chinese. As a result, only a very small part of these work is known to the outside world.

The northwestern Tibetan Plateau refers to the West Kunlun, northern Karakorum, East Pamir, and the northwestern Qiangtang Plateau (Fig. 2.1). It is one of the least studied regions in the world. Since 1987, the author has participated in the integrated scientific investigation and research in these mountains and plateaus.

GENERAL FEATURES OF THE PHYSICAL ENVIRONMENT

The northwestern Tibetan Plateau, like the Himalayas, began its intensive uplift at the end of the Pliocene and/or the Early Pleistocene (Zhang Qingsont et al., 1989). Analysis of plant fossils (*Salix heterochoma, Pterocarya stenoptera, Rhus sp., Sorbus sp.*, and others), found at 4,600 m north of the Arqqikol Lake in the middle Kunlun, shows that the Kunlun has been uplifted by 3,000 m since the early Pleistocene (Pan Yusheng, 1992). According to a comparative survey of benchmark elevations between 1960-1989 along the Xinjiang-Tibet highway from Yecheng to Shiquanhe, the mean uplift rate is as high as 4.2 mm a year (Sun Honglie et al., 1990), and even as high as 6-9 mm/yr. on the northern flank of the Kunlun. With the uplift of the entire Tibetan Plateau and bordering mountain ranges in the Pleistocene, the climate became increasingly arid. To the north, in the Tarim Basin, the Taklimakan Desert came into being. During this process, loess was blown from the desert upwards onto the northern flank of the Kunlun, and was deposited at altitudes below 4,000 m, generally to depths of 10-50m. The existence of this loess is of great geoecological significance, because it provides favorable soil conditions for the development of montane forest, montane steppe, and alpine meadow.

Because of the extreme inland location (continentality) in Eurasia, the surrounding high mountains and plateaus which prevent the penetration of oceanic air masses, and especially the dynamic and thermic effects of the immense, very high Tibetan Plateau, the climate of the study region is generally extremely arid; there is some variation of humidity according to altitude and location. On the northern piedmont plains of the Kunlun, mean annual precipitation is usually as low as 30-60 mm; on the low and middle mountain slopes it amounts to 100-300 mm, or even more; but in the large river valleys in the interior of the Kunlun and between the Karakorum and Kunlun, and on the northwestern Qiangtang Plateau south of the Kunlun, despite their high altitudes, mean annual rainfall is very low (*e.g.*, 72 mm at Taxkorgan, 3,091 m; 36.6 mm at Kangxiwar, 3,986 m; 23.8 mm at Tianshuihai, 4,860 m; and about 30 mm at the Kongka Pass, 5,278 m). However, precipitation increases conspicuously above the snowline, to about 500-600 mm in the West Kunlun (Su Zhen et al., 1989)

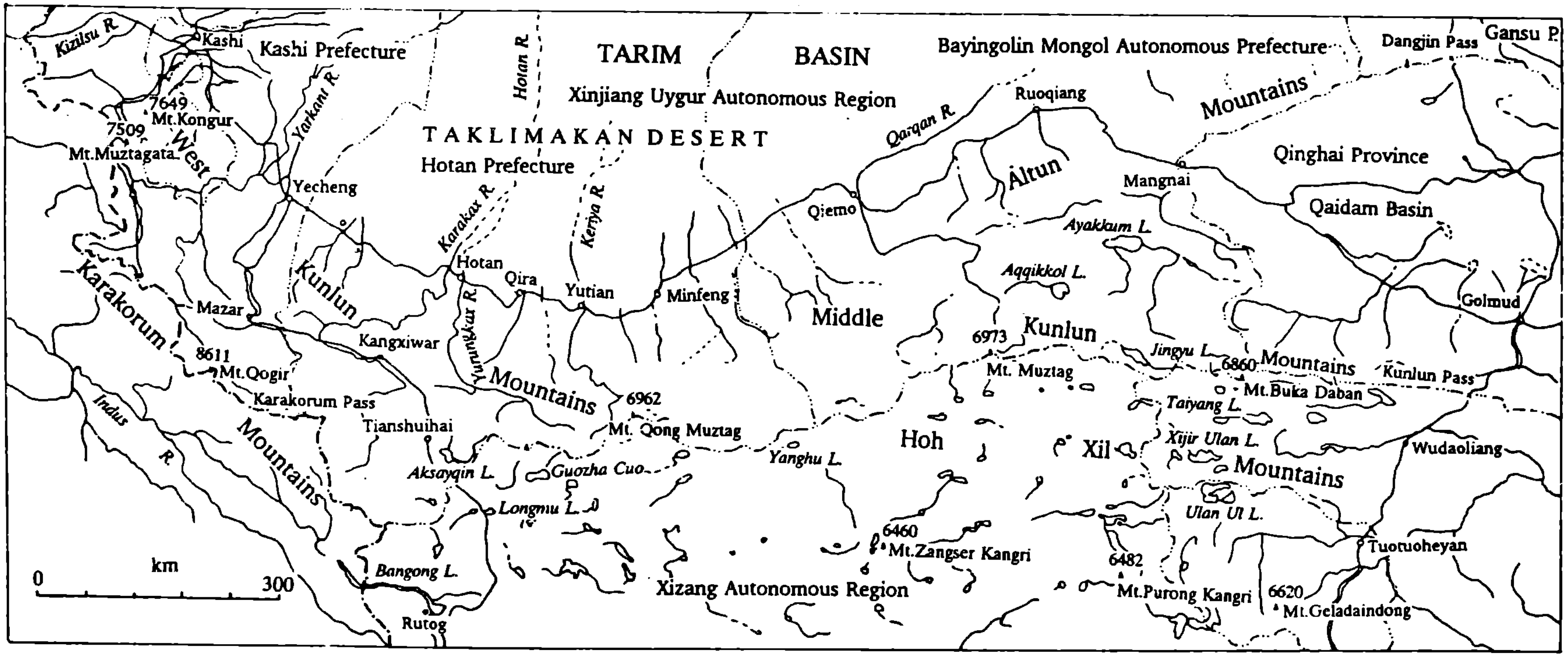

Fig. 2.1. Sketch map of the northwestern Tibetan Plateau and the southwestern Tarim Basin

and to 800-2000 mm in the Karakorum (Lanzhou Institute of Glaciology and Cryopedology, 1980). This high-level precipitation provides the solid accumulation for present-day glaciers on the extremely high mountains. In short, the Kunlun and the northern Karakorum are generally arid, the middle slopes of the northern Kunlun are slightly humid, and the mountains above the snowline receive considerable solid precipitation.

The distributions of glaciers and rivers are closely related. All rivers are internal and flow into the Tarim Basin. The large area occupied by glaciers replenish the large rivers which, in turn, give rise to large oases on the piedmont plains downstream. For example, the Gez and Kizilsu rivers are associated with glaciers in the Kungay Mountains and give rise to the Kashgar alluvial plain; the northern Karakorum glaciers supply the Yarkant River which, in turn, has produced the extensive Yarkant alluvial plains; eatern West Kunlun glaciers nourish the Yurungkax and Karakax rivers and they are responsible for the Hotan oases.

Because of the harsh climate, the biodiversity in the northwestern Tibetan Plateau is rather limited: there are only 245 genera and about 700 species of vascular plants (Wu Sugong et al., 1990), 21 species of large wild mammals, some 150 species of birds, and 13 species fish (Feng Zuojian, 1990).

The phytogeographical elements comprise mainly Iran-Turanean, Tibetan Plateau, and Central Asiatic elements, with some Temperate-Asian and North-Temperate elements. The Iran-Turanean elements contains typical paleo-Mediterranean species or Mediterranean-West Asia-Central Asian species (*e.g.*, *Ceratoides latens and Peganum harmala*) and eurytropic Iran-Turanean species (*e.g.*, *Kalidium schrenkianum and Ephedra intermedia*). The Central Asiatic element is represented by *Sympegma regelii*, *Nitraria sphaerocarpa*, *Ajania fruiticulose*, and *Artemisia parvula*. All the above mentioned are the main components of the montane desert vegetation. Other Central Asiatic elements make up montane and alpine steppe (*e.g.*, *Stipa glareosa*, *S. gobica*, *S. breviflora, and Festuca olgae*), montane forest (*Sabine centrasiatica*, *Sabine pseudosabine var turkestonica* which are endemic to West Kunlun), alpine meadow (*e.g.*, *Kobresia pamiroalaica* and *Carex stenocarpa*). The Tibetan plateau element includes *Stipa Purpurea*, *S. subsessiliflora* var. *basiplumosa*, and *Carex moorcroftii* that constitute alpine steppe; *Ceratoides compacta* and *Ajania tibetica*, which are the main components of alpine desert; and *Thylacospermum caespitosum*, *Arenaria bryophylla*, and *Myricaria prostrata*, that appear in alpine cushion vegetation.In terms of geographical distribution of these elements, the northern flank of the Kunlun is mainly associated with the Central Asiatic element; the West Karakorum and western part of the West Kunlun and eastern Pamir are influenced by Iran-Turanean elements; the Middle Kunlun, eastern Karakorum, and northern Qiangtang Plateau contain primarily Tibetan elements, together with some Central Asiatic elements.

The existence of montane coniferous forest is a very unusual geoecological phenomenon in such arid mountains as the Kunlun. But they do not constitute an altitudinal belt; instead, they are confined to three localities west of the Shangzu River of Pishan Country on northern flank of the West Kunlun, at altitudes of 2,800-3,600 m. Their total area is only about 20,000 h. Geoecologically, they are associated with (1) the relatively moist middle mountain slopes, (2) favorable ground surface material - the loess, and (3) special shady environment. The largest patch of the three is located in the Oytag area mentioned above.

Zoogeographically, the westernmost part of the study region has Central Asian elements (*Panthera unica*, *Gazalla subgutturosa*, *Capa ibex*, *Ovis ammon*, *Pseudois nayaur*, *Marmota caudata*, etc.); progressively eastwards, Tibetan elements become dominant, especially in the open, broad inland lake basins where there are large herds of Tibetan wild ass (*Asinus kiang*), wild yak (*Peophagus mutus*), and Tibetan antelope (*Pantholops hodgsoni*), all of which are endemic to the Tibetan Plateau.

The environment and agriculture are all vertically zoned in the study region (Zhang Baiping, 1991b and 1995). The mountains and the low-lying piedmont plains are closely interrelated in many aspects of resources, economy, ecology, and development. Regional sustainable development relies on the coordination of high/low interaction (Zhang Baiping, 1995).

ENVIRONMENTAL EVOLUTION IN THE QUATERNARY PERIOD

In terms of regional average elevation, the northwestern Tibetan Plateau is the highest of all parts of the whole plateau, with an elevation of about 6000 m above mean sea level or about 5000 m higher than the low-lying Tarim Basin on the north. But in the end of Pliocene or in the early Pleistocene, it was still one part of the ancient Tibetan planation surface at an elevation of about 1000-1500 m. With the continuing press of the Eurasian plate and the Indian sub-continent, the northwestern Tibetan Plateau, together with the Himalayas, began to be intensively uplifted in the end of Pliocene and/or in the beginning of Early Pleistocene. Since then, the total uplift of this part of the plateau amounts to about 3100-3600 m. This uplift induced various events in its different stages.

During the early Pleistocene, the intensive uplift of the whole plateau had just begun and the plateau had not been high enough to develop glaciers; the only possible area with glaciation was the Mt. Xixiabangma (8012 m above mean sea level nowadays) in the south of the plateau. On the other hand, the increased plateau gradually induced the development of southwestern and southeastern monsoons, which gave rise to more moist climate on the whole plateau.

Up to the middle Pleistocene, the study region had been greatly uplifted and glaciers began to develop on a large scale, mainly including piedmont glaciers and trellis valley glaciers of maritime type. Investigations have shown that the middle-Pleistocene moraines stretch down to an elevation of 4,000-4,600 m along the Karakax and Yurungkax river valleys in the southern flank of West Kunlun from the Kekart Pass to Dahongliutan. West of Mt. Kongur and Mt. Muztagata, moraines of the same kind can be found at an elevation of 3,600-4,200m in the Tahman Basin and the Gez river valley. In the southern flank of the Kungay mountains such moraines appear at 3,200 m in the Muji Basin and in the northern flank even down to 2,000 m in the Oytag river valley.

The late Pleistocene is such a period when great changes took place in many aspects. The northwestern and the whole Tibetan Plateau had approached the present altitude, and the moist southwest monsoon was blocked away from penetrating into the northwestern part of the plateau. As a consequence, the climate was channeled into its development toward aridness; the middle-Pleistocene maritime glaciers turned into continental ones; glaciated area expanded but glaciers were shortened; from west to east was there obvious areal differentiation in the scale of glaciation. On the other hand, simply north of the study areas, the Taklimakan Desert gradually came into being, and the fine materials were blown up onto the northern flank of the Kunlun and deposited there as loess. And also related with the uplift of the plateau and the change of the climate, lakes began to shrink and drop.

In the Holocene, the climate kept becoming more arid with some fluctuation. Glaciers shrank further; the dropping large lakes were disintegrated into small lakes, *e.g.*, the present Aksay, Tianshuihai and Kushui lakes were a unified great lake from 4,9000-36,000 years BP, which was about 1,030 km^2 or more than six times their total area nowadays; the Longmu Cō (lake) has dropped by 72 m since 11,000 years BP; some oceanic lakes were cut off from the large rivers and turned into inland lakes, *e.g.*, the Banggong and Shipangur lakes were cut off from a branch of the Indus River about 45,000 years BP; the vegetation was channeled into a succession of semidesert-steppedesert. According to analysis of pollen-spore combinations, the climate underwent three stages of evolution in the Holocene: toward humidness in the early Holocene, relatively mild in the middle Holocene, and toward aridness in the late Holocene.

Related with environmental changes are some vegetation or plant communities which have undergone severe changes. Shrubs of *Pentaphylloides frusticosa* can be found near or in alpine meadow. As is known, this plant usually grows near the treeline and is the relics of montane forests which had existed but disappeared. It indicates the existence of ancient montane forests in some now non-forest locales in the Kunlun Mountains. A species of cushion plant of *Myricaria prostrata*, dark-green-colored and patches-shaped (80-100 cm in diameter), is generally seen on the high flood land of the study areas. Many patches of this cushion plant are badly developed with more than half of the branches and leaves withered, and an extremely xerophytical cushion plant – *Ceratoides compacta* – has intruded into the *Myricaria prostrata* communities. This clearly reflects the environmental changes from arid to extremely arid.

HUMAN ACTIVITIES AND LANDSCAPE DYNAMICS

Just as environmental evolution is mainly a natural process, so landscape changes are chiefly related with human activities in the last centuries or decades. In the present study the author would like to concentrate on landscape changes in the last 40 years in the northwestern Tibetan Plateau.

The most obvious of all types of landscape changes has taken place in the areas with montane coniferous forests. Even in the contour maps (1:50,000) of 1970-71 many small patches of natural forests can be found in the northern flank of West Kunlun; however, most of them had disappeared when we carried out field investigation in 1987. In some locales what has been left are only few coniferous shrubs of *Sabina pseudosabina* var. *turkistanica* or even completely no signs of ancient forests. Merely in some extremely remote and inaccessible areas the patches of forests have been left, but also reduced both in area and in coverage. This sort of change has nothing to do with natural process but is completely the result of human activities. The most direct cause is the rapidly growing population and its rapidly increasing demand for firewood. Owing to the rapid change of the forests, their actual area is not easy to be known. But the detailed changes of forest in the northwestern Tibetan Plateau in the last 40 years must be very interesting and deserve our in-depth study. With different stages of satellite data and available aerial photographs of 1969-70 and 1:50,000 contour maps, we are able to acquire detailed information of forest changes in the last 30 years in the northwestern Tibetan Plateau, mainly in the northwestern Kunlun Mountains.

In the early 1970s, large patches of *Myricaria elegans* were distributed on the banks of Banggong Lake and in the Marzar-Dahongliutan Valley between the Kunlun and the Karakorum; but in the 1980s, few could be seen. There is no doubt that this results from human reckless gathering of this plant for firewood or other use.

In the study region, there are large areas of pastureland of various types. According to grazing time, two types can be identified: winter-spring pastureland (mainly includes montane desert-steppe and montane desert) and summer-autumn pastureland (mainly includes montane steppe, alpine steppe and alpine meadow). The problem is that severe overgrazing has been occurring in the winter-spring pastureland while undergrazing in most of the summer-autumn pastureland. The reason is that the winter-spring pastureland is low productive, *e.g.*, 900-1,500 kg fresh grass per ha. in montane desert zone and 2,250-3,750 kg fresh grass per ha. in montane desert-steppe zone. As a result, land degradation has occurred in winter-spring pastureland, especially in montane desert-steppe zone: grass productivity is decreased, grass quality is lowered, and some areas are overgrown with rank grass and poisonous weeds.

The opening of the Sino-Pakistan highway and the Xinjiang-Xizang (Tibet) highway has brought about great changes in many aspects to the areas along them, one of which is landscape changes. An example is the Karakol Lake which is located at the foot of Mt. Kongur and Mt. Muztagata and is very close to the Sino-Pakistan highway. It was a beautiful and peaceful lake; but since the middle 1980s, large tents and new buildings have been successively established on its bank for the development of tourism. Its peace has been broken and its purely natural properties have been "polluted", by tourists. The opening of the Xinjiang-Xizang (Tibet) highway made some inaccessible montane forests and many patches of *Myricaria elegans* accessible and, therefore, destroyed.

SUSTAINABLE DEVELOPMENT IN THE NORTHWESTERN TIBETAN PLATEAU

In many aspects, this part of the plateau is more closely related with its northern low-lying Tarim Basin than with other parts of the plateau. Administratively, it is mainly part of the Xinjiang Uygur Autonomous Region or part of the Kashi, Hotan and Kizilsu Kirgiz (Khalkhas) Autonomous prefectures; ecologically, landscape changes in the mountains result mainly from the activities of the inhabitants in the southwestern Tarim Basin, and existence of oases in the Tarim Basin depends wholly on the water from the mountains. As a matter of fact, the northwestern Tibetan Plateau and the southwestern Tarim Basin combine together into a closely interacting highland/lowland system and, therefore, an inseparable "sustainable development region". It is also interesting that many small administrative units, namely counties, contain part of the northwestern Tibetan Plateau and part of the Tarim Basin and, therefore, are also highland/lowland systems. As a consequence, regional sustainable development must be based on the rational coordination of the relationship of highland (the northwestern Tibetan Plateau) and lowland (the southwestern Tarim Basin).

Pastureland is widespread in the northwestern Tibetan Plateau; but the majority of the usable are distributed in the northern slopes of the Kunlun. They are the most significant resource in the study region and their rational utilization is central to sustainable development of the northwestern Tibetan Plateau. Over a long period, a traditional grazing system, namely, grazing alternately on winter-spring grassland and on summer-autumn grassland, has been pursued. As mentioned above, overgrazing and land degradation have been occurring on the winter-spring grassland due to low productivity and a long period of seasonal grazing (about 195 days); while the summer-autumn grassland is insufficiently used. This situation is being displaced by a transitional grazing system: the grassland is divided into three parts which are grazed in winter, spring, and summer-autumn respectively. This shortens the period of grazing on the desert-steppe (spring grassland) from 195 to 90 days, and thereby, restores to some extent its natural productivity and prevents further overgrazing; but it also imposes the problem that winter grassland sustains an even strong pressure from livestock. This can be offset partly by dry grass storage in summer and autumn. But the summer-autumn grassland still can not be fully used. With the development of managed grassland and soil-fertilizing crops, such as alfalfa, in the oases downstream, a completely new grazing system should be pursued. Such a system identifies three types of seasonally used pastureland (winter, spring-autumn, and summer), of which the spring-autumn pastureland is grazed twice (spring and autumn) in a year. This systems can prevent not only overuse and underuse of pastureland, but can also increase the yields of animal husbandry and bring montane steppe and desert ecosystems into an integral economic system (Cui and Wang, 1990). However, as have been shown, this can be attained only through cooperation with oases downstream, where necessary amount of artificial forage for winter and spring use can be produced. In other words, cooperation between the northwestern Tibetan Plateau and the southwestern Tarim Basin is a requisite for their sustainable development.

To achieve full use of summer-autumn pastureland, one of the effective steps is to promote the development of seasonal livestock raising, namely, to breed one-year sheep which are scheduled to be born in spring and killed in late autumn. This practice would also prevent overuse of the present winter-spring pastureland. In addition, some summer-autumn pastures are difficult to use because of extreme inaccessibility; it is therefore necessary to construct small roads and simple bridges. It is also necessary to control and reduce the population of marmots to protect grassland from damage. The present winter-spring pastureland faces degradation, shortage of water for herdsmen and the livestock, and other problems. The solution here is the construction of small-scale water-conservancy works, enclosure of some grasslands to enhance productivity, the practice of rotation grazing to eliminate overgrazing, and active promotion of grassland irrigation.

Owing to harsh environment conditions, the northwestern Tibetan Plateau has very limited habits for the growth of natural forests. They are ecologically very fragile, grow very slowly, and once destroyed, are very difficult to restore. These forests and surrounding alpine meadow, montane steppe and even glaciers constitute a cool and comfortable summer site for tourism, set against the general aridity of the northwestern Tibetan Plateau and the sandy desert in the Tarim Basin. It is safe to argue that, with the development of the economy and an increase in the living standards of the local people, the montane forests are bound to become a summer resort in the near future. Some planning and measures should be undertaken in advance. It will be too late to restore such forests after they have been severely damaged. A nature reserve is suggested for the Oytag area, so that the largest patch of such forest in the northwestern Tibetan Plateau can be well protected and sustainably used (Zhang Baiping, 1995).

In recent years, some nature reserves have been established in the study region, including the Altun Nature Reserve, the Taxkorgan Nature Reserve and the Northern Qiangtang Plateau Nature Reserve. They play an active role in the protection of rare wild animals and their environment and in promoting regional sustainable development. However, more strict management should be implemented to reduce reckless hunting.

KEY WORDS AND ABSTRACT

KEY WORDS Northwestern Tibetan Plateau. Tarim Basin. Landscape Dynamics. Sustainable Development.

ABSTRACT The northwestern Tibetan Plateau is one of the least studied regions in the world. Based on the author's field work over the years and the research results of the colleagues, this paper deals with physico-geographical features, environmental evolution, landscape dynamics and sustainable development in the northwestern Tibetan Plateau. In the Quaternary Period, the northwestern Tibetan Plateau underwent glaciation and desiccation; the Holocene Epoch saw an environment-change trend toward further aridness. Great changes have taken place in landscape (montane forest, shrub-land, grassland, etc.) due to human impact. Regional sustainable development must be based on rational coordination of the study region and the southwestern Tarim Basin in grassland utilization, forest protection and nature conservation.

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Author's Address : **Zhang Baiping**, Institute of Geography, CAS, P.O. Box 9719, Beijing 100 101, P.R. China
E-mail : Zhang bp@dls.iog.ac.cn

Contribution to The Knowledge of The Himalaya in Ecological and Social Sciences by The French Scholars

Corneille Jest

When, in the period of 1955-1960, a small group of researchers in social sciences decided to study the Himalayan region in their respective disciplines, geomorphology, geography, history, social anthropology, this region was little known to the western world (and certainly also to the nationals...).

The Himalayan range was a fascinating field for research, a unique site where one could in less than 100 kilometers as the crow files, reach from the Gangetic plain the highest summits of the World. In the South-North transect covering various ecological zones from tropical to alpine, populations of diverse origin and culture have settled over the last centuries. The orography made the Himalaya a unique conservatory of environments which attracted foreign scholars who could easily choose a type of environment or a specific social structure attractive to their strategy of research.

The CNRS (French National Centre for Scientific Research) organized a series of missions in the Himalayan region from 1959 onwards. Over the years researchers extended their studies in different countries of the Himalayan belt, Nepal, India, Pakistan, Bhutan and China (Tibetan Autonomous Region, Sechuan and Yunnan).

We will briefly present the activities in Nepal and the major results.

This paper gives us the opportunity to recapitulate the past actions and to bring elements for a broader debate on the use of ecological and social sciences today in developing countries.

THE METHODOLOGY

Two major principles underlined our work, from the inception of the programme: the knowledge of the vernacular languages and the need for a good documentation.

The team initiated the teaching of Nepali and Tibetan at the Ecole des Langues Orientales Vivantes, University of Paris, the objective being to train the researchers in local languages and cultures.

A documentation centre, "Centre d'etudes Himalayennes", was established with the aim to collect all publications, including the grey literature, maps and more recently audio-visual references, in western and national languages.

FIELD RESEARCHES AND RESULTS

In earth and life sciences the first move was to aquire a basic knowledge on the geology, geomorphology, fauna and flora of the region.

In the Sixties in social sciences, most of the studies were carried on in populations living at high altitudes and speaking Tibeto-Burman languages, the final result being village or regional monographs. Long stays in the field permitted to get an intimate knowledge of the way of life, the social structures and the beliefs of the specific communities.

In 1980 a multi-disciplinary project was implemented to study the watershed of the Salanku Khola, in central Nepal. The focal point of the study was the slope and the village of Salme.

In 1985 the same type of multi-disciplinary research was organized, with a change of scale. The team approached Nepalese institutions and proposed a research programme without success. At last the "Small Farmers Development Project" showed interest and suggested a series of districts where the SFDP programme was about to be launched and where a state of knowledge would be useful before the inception of the project. The choice fell on the districts of Gulmi and Argha Khanci, in the Lumbini zone of central Nepal.

In the two districts increasing population pressure on a limited land base had aggravated the degradation processes, leading to a low productivity and a misutilization of the existing forest lands. The previous studies undertaken by our team in the Himalayan region had already developed a concern about questions involving the dynamics of human behaviours in harsh environments.

These questions were related to the inter-relationships of limited natural resources, the processes going on in these environments, the way of life and culture of the ethnic groups in the area, the economic process, the response of the inhabitants to pressures which induce change.

Based on the geological and geomorphological survey, a base line study was done with the participation of the line agencies of the Government of Nepal at the district level.

The investigations associated geomorphologists, geographers, ecologists, historians, agronomists, economists and anthropologists working with national counterparts and local "Men of progress".

The final aim was to provide to the developers basic information and prepare the ground for an integrated rural development programme.

However, the development project did not take into account the results of the observations made during the period of fundamental research. In fact solutions were imposed by the developers without taking into account the knowledge of the local people, who had answers to the issues but no financial support. This point should be a matter of broad discussion in a conference and should initiate reactions among the readers of this paper.

An effort was made to associate national institutions and scholars to the research programmes. We must confess that we were not successful, as such a need for a dialogue was not felt by the national institutions. However, we were able to identify scholars who contributed to the success of some of our endeavours.

There was and still is a problem of communication as the results are published in French (still a cultural language) despite the efforts which are being made to publish in English.

CONGRESS AND SEMINARS

The team has been involved in the organization and participation of a series of congresses and seminars, among the most important:

- *Himalaya: Geologie et Ecologie*, Paris CNRS 1976
- *Environmental and human population problems at high altitude (Himalaya-Andes)* Paris October 1980 CNRS/National Science Foundation USA.
- *Symposium on Qinghai-Xizang Plateau: Geological and Ecological Studies of Qinghai-Xizang Plateau.* Beijing 1980. (published in 1981).
- *Franco-nepalese seminar on the Ecology an Anthropology of Nepal.* Kathmandu November 1983.
- *Nepal Past and Present, Colloque d'Arc et Senans* June 1990 (CNRS-Deutsche Vorschungs Programm, published in 1991).
- *The Anthropology of Nepal. From Tradition to Modernity.* Franco-nepalese seminar, Kathmandu March 1992 (published 1993).

COOPERATION WITH NATIONAL AND INTERNATIONAL INSTITUTIONS

The team was able to establish institutional links with the following research centres:

Nepal : Tribhuvan University, Centre for Nepalesè and Asian Studies.
Department of Archaeology, HMG Nepal.
Royal Nepal Academy
Department of medicinal plants HMG Nepal (ecology, botany, pharmacology).

Training of national scholars (Ph.D. obtained in a French university).

At the international level. with:

UNESCO: participation in the Man and Biosphere programme, advising the Project 6 "Impact of human activities in the mountain ecosystems"

Organization of the workshop on the Ecology of the Himalaya-Karakorum region, Kathmandu 1975.

UNESCO/Division of cultural heritage: participation in the preparation of the "Master plan for the conservtion of the cultural heritage of the Kathmandu valley" 1975. As a follow-up financial support and advice for the restoration of the religious complex of the city of Panaoti.

Survey of the historical and religious monuments of Northern Nepal.

Ongoing programmes and future perspectives : At present, with the accumulation of knowledge and the "aging" of the research and the new orientations given, the new topics of research chosen are related to sociological aspects such as the notion of State, the decision making process at village, regional and national level, the role of women in politics, education, the external religious influences in the local societies.

MAJOR PUBLICATIONS

The results of the research have been published in the following series:

Cahiers Nepalais, CNRS, Paris: geology, geomorphology, ecology, anthropology, medecine (Editor C. Jest)

Cahiers Nepalais-Documents CNRS, Paris: a series of 12 Ecological maps of Nepal, scale of 1:250000. (editors J.F. Dobremez and C. Jest)

Monde Indien et Himalayen, CNRS edition (Series, coordinator G. Toffin).

Special issues of *Objects et Mondes*, Paris, Musee de l'Homme 1965, 1969 , 1974.

The team is presently in charge of the editorship of the European Bulletin for Himalayan Research (a CNRS-Sudasien Institut, University Heidelberg).

CONCLUSIVE REMARKS

Major issues are coming up in developing countries, which make the researcher, *volens-nolens*, directly involved in the process of development and as such an agent of change.

In the field, the researcher, a "foreigner", is seen by the local inhabitant as an agent of development, he raises expectations, hopes (hope for more money, a job, a better life, the possibility to leave the country...)

Therefore the researcher has to adjust himself/herself rapidly to changing structures, work in a team, expand his/her knowledge, identify national scholars and become a catalyst.

The information network is one of the most important tools in this adapted type of research. This does not mean that fundamental, sectorial research should not continue; it is an indispensable part of research and remains a major contribution to the preservation of the cultural heritage of a country.

Information on the documentation is available at:
Centre d'Etudes Himalayennes
CNRS
I Place A. Briand 92195 MEUDON CEDEX, France.

KEY WORDS AND ABSTRACT

KEY WORDS Himalaya. Nepal. Ecology. Anthropology. Socio-economy. Development.

ABSTRACT This report presents the major activities of the French research team working in the Himalayan range and some of the results. The present themes of study are closely linked with development issues.

Author's Address : **Corneille Jest**, Centre d'Etudes Himalayennes, CNRS, I Place A Briand 92195, Meudon Cedex, France

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Oil Based Industries in Assam and Pollution Problems

N.N. Dass

INTRODUCTION : HISTORY OF FIND

The North Eastern region comprising Assam, Meghalaya, Arunachal Pradesh, Manipur, Nagaland and Tripura is very rich in natural resources. Assam is one of the leading states for production of petroleum, coal, tea and forest product. Here stress will be made on Assam crude oil and natural gas (NG) only.

Crude oil or petroleum as it is often called is the backbone of growth and development of a country. At present, India is spending crores of rupees to foot the bill of petroleum. In 1991 bill for import of petroleum was Rs. 6400 crores and there is galloping increase in every year (Oil News 1991). By the turn of the century India may require 80 million tonnes of crude oil per annum (Black Gold 1990).

In India, the search for oil began over a century ago, with the discovery of Digboi field in Assam in 1867. Mr. Goodenough of Mckillop Stweart and company acquired petroleum mining rights in Upper Assam in 1866. Mr. Goodenough started drilling in the dense jungles of Upper Assam near Joypur and stuck oil in the third well. So oil was discovered in Assam, just after seven years after Col. Drake drilled the world's first well in USA. In 1882 the Assam Railways and Trading Company acquired petroleum rights over 30 square miles around Makum. The experts after returning from the forest on an elephant ride, one day noticed oil on the feet of the elephant. So they investigated and found an oil seepage spot. "Dig, boy, dig" urged Mr. Lake, the explorer and Digboi oil field came into existence. The first oil well at Digboi and in fact first in Asia was spudded in September 1889 and the producing well with a depth of 662 feet was completed by 1890. In 1899, Assam Oil Company (AOC) was promoted and a small reifnery was established by 1901. In 1981, AOC came to be known as Assam Oil Division (AOD) of Indian Oil Corporation (Gohain, 1990). The Digboi Refinery Modernisation Project is now underway. This project envisages a new Crude Distillation Unit. A Gas Based Power Plant with Waste Heat Boilers and augmented off-side facilities (Batori, 1990). Apart from modernisation three other projects and Catalytic Reforming Unit for producing low-lead Motor Spirit (Rs 64 crores). Wax-Finishing (Rs 17 crores) and VRSD Unit (Rs 13 crores) for producing quality bitumen. The on going project of AOD and IOC at Digboi will cost Rs 592.80 crores (Sentinel, Jan. 6, '95). Much water flowed through the Brahmaputra and two more refineries were established in Assam at Guwahati and Bongaigaon since the first refinery commissioned in 1901. The present capacity of refineries (Table 4.1) in operation of India is 51.85 Million Tonnes Per Annum (MTPA). Three more refineries are coming up soon.

The present refining capacity of the refineries

Table 4.1 : Pertoleum refining capacity in India

Refinery	*Years of commissioning*	*Installed capacity (MTPA)*
A. *Refineries in Operation*		
1. IOC, Digboi	1901	0.50
2. IOC, Guwahati	1962	0.85
3. BRPL, Bongaigaon	1979	1.35
4. BPCL, Bombay	1955	6.00
5. HPCL, Bombay	1954	5.50
6. HPCL, Vizag	1957	4.50
7. IOC, Baruani	1964	3.30
8. IOC, Koyali	1965	9.50
9. IOC, Haldia	1974	2.75
10. IOC, Mathura	1982	7.50
11. CRL, Cochin	1966	4.50
12. MRPL, Madras	1969	5.60
	Total	51.85
B. *New Projects*		
1. Karnal		6.00
2. Mangalore		3.00
3. New Assam Refinery, Numaligarh		3.00

of Assam *viz.* Digboi, Bongaigaon and Guwahati is 2.70 MTPA. It will go up to 5.70 MTPA as soon as Numaligarh Refinery (NRL) is commissioned. NRL is likely to be in operation from about 1996-97. There was a ripple for environmental pollution as the proposed refinery is near the Kaziranga Game Sanctuary, the only place in the world, where one horned rhino still survives. The present demand of crude oil for Digboi, Guwahati, Bongaigaon and Baruani is met from the oil fields located in Upper Assam. To meet the requirements 5.75 MTA (OIL 2.75 MTA. ONGC 3 MTA) pumped through 1400 km pipe line to the feeding refineries at Digboi, Bongaigaon, Guwahati and Baruani (Bihar). Spanning the Brahmaputra and 77 other rivers the pipe line crosses the states of Assam, Bengal and Bihar. The pipe line is double skinned and 1400 km long. When the Numaligarh Refinery will be commissioned, the production of crude from Assam Oil fields should go up by 35.5°% multiplying the pollution problem.

With the step up production of crude, the production of associated NG will also go up. Oil and ONGC are more interested to meet the target of crude oil production and are inclined to adopt the least costly method of flaring up the toxic natural gas. The policy is against the conservation of energy. In 1989, the gross production of NG in India was 13,217 million standard cubic metre (MMSCM) and in Assam was 1414 MMSCM (Table 4.2).

From 1990 to 1993, the gross production of NG in Assam was 6075 MMSCM and the net production was 3724 MMSCM and the utilization was 61% only. In terms of rupee, N G worth Rs. 45 lakh has been burnt daily at the oil field of Assam (Dastider, 1995). So OIL and ONGC should cut down the flaring of NG and reinject the unutilized NG into the formation. The R and D of ONGC in their own view focussed more on the maximising recovery from the existing field and improving the success ratio and reducing cost. The environment protection is the fifth corporate objective of ONGC (Annual Report OIL and Natural Gas Commission 1989). Both OIL and ONGC have R and D division, which should stress on conservation and ecology. There should be close interaction between industries and universities in this regard. There is lack of monitoring of air, water and land pollution in Assam and it is a serious concern. Gujarat is in somewhat better position in this regard. Indian Petrochemical Ltd. (IPCL), Gujarat State Fertilizer Co. Ltd. (GSFC) and Gujarat Industrial Development Corporation (GIDC) are located in the midst of garden lands and village folk. The water of the Meni and the Mahi river is periodically checked. According to National Environmental Engineering Research Institute (NEERI) survey, the pH of water of Gujarat Refinery varies from 6.1 to 9. IPCL's 6 to 9 and GSFC's 6.8 to 9.85. The BOD of Gujarat refinery was 30 mg/l and GSFC was 85.9 mg/l and GIDC 120 mg/l to 3500 mg/l (Saramma, 1984). There is a periodic survey of solid and semi-solid wastes in the Refinery, Petro-chemical and Fertilizer Industry and their effect in Gujarat. In Assam, there is practically no such regular survey.

Table 4.2: Production of natural gas in India and in Assam in MMSCM in 1989

Status :	*Gross Production*	*Reinjected*	*Falred*	*Net Production*	*Utilization*
INDIA					
	13217	58	3442	9717	73%
ASSAM					
	2203	54	735	1414	64%

The CO_2 content in the atmosphere has been rising due to various activities of human being, primarily due to industrial ventures. The CO_2 gas lets in the solar radiation but prevents the escape of reflected heat resulting in warming up of the air. This is known as the greenhouse effect of CO_2 in the atmosphere. Depending on the composition. N G can be used as a feedstock for manufacture of fertilizers, carbon black and petro-chemicals like ethylene, propylene, polythene, polypropylene, methanol, formalin, ammonia, urea etc. Assam Gas Company has been supplying N G to Hindustan Fertilizer Corporation Ltd (HFCL) as a feedstock for fertilizers since 1968. In 1990-91, 464 MMSCM was supplied to HFCL. The gas company has been supplying NG to Assam Patrochemicals Ltd (APL), Namrup as a feedstock for manufacture of petrochemicals like methanol, formalin and UF adhesives. In 1990-91, 37 MMSCM of gas was supplied to APL. The gas company has been supplying N G to Namrup Thermal Power Station of Assam State Electricity Board (ASEB) where it used NG in gas and steam turbine units to generate 130 MW. In 1990-91, 160 MMSCM of NG was supplied to ASEB by the gas company (Assam Gas Company 1991). The gas company supplies NG to 122 Tea gardens as fuel for roasting tea and to 4000 domestic and 100 commercial consumers of

Sibsagar, Nazira and Duliajan. Still there is no parity between demand and production of N G. The non-utilised gas is flared up. The non-utilization not only causes national waste but also increases the production of green house gases. At present about 6.00 million standard cubic metre per day (MMSC MD) of associated gas is produced by OIL and ONGC in Upper Assam. This is expected to go up to 8.99 MMSC MD (OIL 6.11, ONGC 2.88) by 1999-2000 (Khaund, 1995).

As a safeguard against flaring of NG, Assam Government can look for royality of gross production of NG from Assam oil fields from OIL INDIA, ONGC and Assam Gas Company.

Based on many scientific data there is a scientific projection regarding the global green house effect. The projection (Valadiya, 1987) predicts the average increase of global temperature will be of the order of 5°C by 2100. So OIL and ONGC should cut down the flaring of N G and reinject the unutilised N G into the formation. The R and D of ONGC focussed more on the maximising recovery oil. OIL India and ONGC designed flare up N G pits to cut out heat and light radiation for flaring the surplus N G. The N G can be better utilized by extracting the heavier (Ethane +) and still using the lighter components for fertilizer, power generation and tea processing. Butane, pentane can be used as LPG for domestic cooking. Assam Oil Division (AOD) of IOC embarked LPG marketing from 1982 and by 1989-90 set up 80 public distributionships. AOD set up an LPG bottling plant near Silchar at the cost of Rs. 727 lakh (Batori, 1990) and proposed a similar plant at Guwahati. The OIL INDIA, Duliajan produces about 55,000 tonnes of LPG through turbo expander process every year. In the 8th Five Year Plan OIL pledged to produce 305 thousand tonnes of LPG. Guwahati Refinery produced about 8.8 thousand tonnes of LPG in 1987-88. The prospect of industriés based on natural gas of Assam was highlighted by government sponsored trade fair long ago (Acharyya, 1979) though the progress is very tardy. The gas cracker proposed to be established at Tengakhat can use ethane and propane for production of ethylene and propylene and subsequently producing all the polymers of IPCL, Baroda.

In Assam, there are two petrochemical companies now, Assam Petrochemicals Ltd (APL) and Bongaigaon Petrochemicals Ltd (BRPL). APL is manufacturing formalin, methanol and Urea/formaldehyde resin from N G. BRPL is producing 30,000 MTA of polyester staple fibre from naphtha of Bongaigaon refinery and Gauhati refinery.

It is the time to think on the use of N G as vehicle fuel. Petrol driven cars can be converted to LPG fuel by fitting with a suitable conversion compressed natural gas (CNG) kit. Countries like Holland and Italy have done this conversion to almost 50% of their total cars on road. Such utilization of N G is environmentally friendly. Such cars can easily be run in the three districts of Dibrugarh, Sibsagar and Jorhat of Assam where Assam Gas Company Ltd (AGCL) has its pipe lines. CNG stations can be established along the side for the production of CNG (Lahkar, 1990).

Now let us have a look at the production of crude and petroleum products from the pollution point of view. Crude oil and its products are the major polluters of environment. The wastes from crude oil production are drilling mud, produced water, free and emulsified oil, tank bottom sediments, scraps of metals, acid sludge and N G.

India receives about 3 trillion m^3 of rain water and Assam has the major share. So there is a great possibility that pollutants being washed into the rivers, lakes, ponds destroying aquatic animals and aquatic plants. Very low concentration of hydrocarbons below 50 mg/g enhances the photosynthesis and may boost the agricultural product (Chemistry Education 1995). But above this critical level it has a destructive affect. If the annual plants are oiled during flowering time, the generation is impaired. During the year 1995, Upper Assam faced four floods and oil slicks aggravated the situation.

AOD, ONGC and OIL have effluent treatment plants (E T P). The Effluent Treatment Plant (ETP) with trickling filter and secondary biological activated sludge had been commissioned at AOD, Digboi only after one hundred years of the establishment. It cost AOD Rs. 6.81 crores. Anyway, this will arrest the on going process of pollution. The refinery at Guwahati is exerting a powerful stress and strain on the ecosystem. The river Brahmaputra and Bharalu flowing through Guwahati and now becoming the dumping ground of industrial wastes and domestic wastes of the city. The contaminated water is not only affecting the human health and hygiene but also reduces spawning of aquatic animals. The calcination of raw petroleum coke (RPC), a by product of Guwahati Refinery has created health hazard in the Noonmati area of Guwahati. The tall chimneys of such units blow up small particles and dust which can cause cancer, asthma and eye diseases. The pollution problem of Namrup became so acute that Assam Pollution Board recommended the closure of Unit I and Unit II of Namrup Hindustan Fertilizer Corporation.

REMEDIAL MEASURE

To save the environment all the wastes, if possible, should be recycled. The R and D of OIL INDIA and ONGC should gear up their resources for treatment of effluent. OIL India's effluent treatment pits have a heavy bund. The ONGC also has pits with surrounding wall. The tank bottom sediments of group gathering stations contain a lot of wax, asphaltine and clay. The sludge of ETP contains oil, alum, calcium sulphate and other materials. They present sticky problem. But if a suitable binder can be found they can be used to produce a good value added product for wall and roof coating. The interaction between university and industry can solve such sticky problem.

In the competitive world, we must have industrial growth in an environmentally favourable condition. We must not sacrifice our fragile ecosystem by haphazard industrial growth. In this respect Assam should take a cue from Gujarat.

KEY WORDS AND ABSTRACT

KEY WORDS Petroleum. Natural Gas. AOD. OIL. ONGC. Pollution.

ABSTRACT The North Eastern region of India is very rich in natural resources and paradoxially it is one of the poorest regions in India. Assam is the gateway of N.E. region and it is endowned with petroleum, coal, lime stone, china clay, silliminite iron ores and tea. Oil was discovered at Digboi in Assam just after Col. Drake drilled the world's first well in USA. At present 5.75 million tonnes of crude oil per annum are produced from the fields of upper Assam. Assam now has three refineries of Digboi. Guwahati and Bongaigaon and two petro-based complexes at Namrup and Bongaigaon. One more refinery is coming up at Numligarh and a gas cracker plant is expected at Tengakhat. A Natural Gas (N G) based fertilizer plant was commissioned at Namrup in 1969. With the progress of industrial growth, the magnitude and remification of pollution are also increasing. Unlike in the industrially advanced states like Gujarat, Maharashtra, Uttar Pradesh etc. in Assam there is lack of facilities for monitoring air, water and land pollution and it presents a serious concern.

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Author's Address : **Dr. N.N. Dass**, Department of Chemistry, Dibrugarh University, Dibrugarh 786 004, Assam, India

Casualty to Environment : Sequel to Unsustainable Development in Assam

K.C. Mahanta

INTRODUCTION

The successive Five-year Development Plans of the Government of India since 1950 have ushered in phenomenal rise in the ways and means of life of the Indian masses compared to those in the pre-Independence times. The development activities were undertaken with a view to bringing in material growth and prosperity in the socio-cultural and aesthetic life of the people. The overall growth and development were achieved through exploitation of massive amount of natural resources. Most of these resources that got accumulated over millions of years could never be replenished once they are exhausted through imprudent and reckless use by the masses of the present generation. As at present, one could well understand that the entire material resources of the present day world are finite in quantity and volume and are indeed exhaustible in no time. Regeneration of certain resources like plants is a question of hundred, if not thousands, of years. The only inexhaustible resource that comes to us in the form of solar energy is yet to be harnessed fully for multifold benefit of the mankind. The scientific world has since become aware of the imperative need of sustainable development. In 1987 the World Bank Conference on "Sustainable Development" defined the concept as 'one meeting the needs of the present without compromising the ability of the future to meet their own needs'. Now the question arises if the sort of development envisaged under the definition as a practical proposition. Poor nations can hardly opt for priority to future generation at the cost of negation to present day development. However, it is now widely accepted that the links between poverty, high population growth and environmental degradation are mutually reinforcing. Judicious investment to improve people's lot is an urgent moral imperative. This will reduce poverty and population growth in the long run and arrest environmental degradation.

Unfortunately these parameters in the initial development planning were not kept in view in our country. To take the case of Assam, it may be noted that substantial development in fact came in over the last four decades but at the heavy cost of large-scale environmental degradation and consequent economic disasters. The paper aims at highlighting the environmental metamorphoses in the post - 1950 years till date and the socio-economic consequences befalling the people of Assam on account of lack of sustainable perspectives in the planning and execution of development processes.

TOPOGRAPHY AND HISTORICAL PERSPECTIVES

North-East India, a composite geo-political unit comprising 2,55,000 sq km in area enjoyed the unique distinction of being the last region of the sub-continent to come under the ambit of western civilization when it came to be annexed to British India in 1826. The mountainous highly inaccessible regions of North-east India remained socio-politically dull and dormant with stereotyped age-old life patterns till around mid-twentieth century. The erstwhile British political suzerainty did not extend to the remote out-lying inaccesible regions but kept itself confined to some hill townships adjacent to the plains of the Brahmaputra valley, a major and to some extent relatively vibrant constitutent region of the North-east. The entire region received since prehistoric times intermittant waves of immigrants from the heartland of the Indian sub-continent as well as from South-east Asiatic countires across the eastern most Himalayan ranges. Most such immigrants turned into sendentary settlers in course of time either in the wide valley or in the highlands.

The western culture and civilization dawned in this part of the country by the early decades of the last century. Till then the region was a highly terraneous one abounding abundantly with evergreen impenetrable rain-forests. The nature of the land is highly riverine being criss-crossed by numerous streams and tributraies of the mighty river Brahmaputra that has originated from the Himalayan glacial ranges. The land is also studded with numerous bogs, marshes and swamps and a large number of perennial natural pools of storm-waters locally called *beels*. All these physiographic and topographic features have kept the region, besides making it most epidemic-ridden and inhospitable, in virtual isolation and aloof for centuries on account of inaccessibility due to difficult terrains. Notwithstanding the formidable natural barriers and impediments successive immigrations did occur under highly imperative obligations as often occasioned by famines, warfares, epidemics etc. and multple other natural calamities both in the heartland of the sub-continent in the west and Indo-Chinese peninsula in the Far East. Floods, droughts, invasions of swarms of insects etc. and earthquakes did befall this reverine-cum-mountaneous land over the centuries sending forth hordes of immigrants into the plains and sub-mountane regions of the North-east till early decades of the last century. Almost all such immigrants were none but agriculturists and traditional artisans with little scientific know-how, who used to settle in the region from time to time and pursued their old traditional subsistence level cultivation combined with foraging of the highlands. Virtually meagre cultivation in association with collection of natural resources was the mainstay of the people of the North-eastern region till before the advent of the western ways and means of eking out livelihood. The people - both the highlanders and the valley-dwellers - over the ages used to live in close proximity and in most perfect harmony with the environs obtaining there in the region. There is hardly any historical evidence of natural resources ever failing the people of the region. Throughout the pre-westernization period in the Indian sub-continent the people could have their overall sustenance in multiple forms from the land, and in the process of deriving it, they did develop a symbiosis with the habitat over the ages. One could well visualize the age-old symbiotic relationship the people habitually cultivated and maintained with the environment of the region. Traditional agro-based subsistence economic life of the people was in fact circumscribed by certain material needs that were limited in scope and extent. Absence of aspirations for lofty material accumulation and growth and possession of material wealth could well nourish and sustain the natural resources to the people's optimum needs. The common concern of all and sundry for sustainable means of livilihood kept the life-sustaining habitat and its resources in tact and unimpaired till recent years. It was only since mid-twentieth century that ensued a good deal of topsy-turvey of the habitat situation. The entire North-east with its luxuriant wealth of flora and fauna could well suffice the subsistence needs of the people. Throughout the ages the cereals and the vegetables produced from the primitive cultivation are invariably supplemented by hunting of wild games and gathering of wild roots, shoots, tubers, flowers, seeds and honey etc. The natural pools of water, *i.e.*, the *beels* were the perpetual prime sources of prodigious quantity of fish and other aquatic edibles that were available almost round the year. Thus the life the people lived in North-east India over more than three millennia must have been a harmonious and compatible one that created nothing but congenial interaction needed for sheer survival of the population as well as the denizens of the forests.

ADVENT OF WESTERN ELEMENTS

The annexation of Assam with British India early in the nineteenth century unfolded a separate history in North-east India. Prior to Assam' take over by the British, the whole of India had come under the British suzerainty. The British occupation of the North-east opened up the flood-gate of alien ideology - western norms and practices having intruded into the Indian socio-cultural life. The traditional Indian notion of ultimate human value or aims and fulfilment of man's existence began to be metamorphosed with notions of "relation between man and man and between man and his environment" (Prabhu, 1940 : 76). Shortly after annexation, metamorphosis of Indian socio-cultural life began in the wake of steady flow of westernization and urbanization since about mid-seventeenth century by slow degree. Following the British occupation Assam began to encounter a good deal of westernization in certain distinct aspects of life - transport and communication, trade and commerce, production system with heretofore unknown impetus for profit and development with an inevitable urge for capital growth. It heralded the age of railways, interstate transport by means of steamer service in the river-courses and also interstate road and telecommunication around the third quarter of the last century especially in the Brahmaputra valley regions. All these innovations came as the precursor of modernization in the life pattern of the people in North-east India. Western thoughts and ideas percolated among a substantial section of the population resulting in coming into being of an elite group. This came about with the introduction of western formal education system with the opening of schools, colleges and universities. The age-old traditional *Tol*[1] system of indigenous education came mostly to be replaced by new mode of primary education all over the State. Further unlike traditional learning that remained confined to a select group of elite population, the western system became open to all. The enlightenment that came in following British occupation over the region opened the flood-gates of communication and profit-motive in the day to day life of the people. From around the mid-nineteenth century the British, the alien rulers of India, began reclaiming thousands of hactares of forest land especially in the plain valley regions and set up the world's largest agro-industry in the form of tea-estates before the closing of the last century. The British who initiated reclamation of the virgin lands for commercial purpose, however, refrained themselves from disturbing the evergreen virgin forests in the outlying Himalayan highlands. The large-scale reclamation of low forested lands along the river-valley terraces in no way affected the overall topographical and geo-climtic situations of the region; rather it had enriched the topographical features of the land with large-scale coverage of tea-bushed and thousands of shade-trees. Nevertheless a small section of the native population who came to be groomed in the art of land-use for profit-making also jumped on the bandwagon of the foreign agro-industrialists and opened up a few tea-estates in the foot-hill regions bordering the Assam plains. Over a period of about 100 years from the mid-nineteenth century to mid-twentieth century, the coverage of tea industry in Assam increased in terms of both area under cultivations and production. Sharma (1990:5) says, "Area covered under tea which was about 58,000 hactares in the Brahmaputra valley in 1882 increased to 2,11,323 hactares in 1982. With a total of 802 tea-estates having 574 tea-factories in Assam, tea is recognised as a largest single industrial sector of the State". It is obvious that the primitive virgin forests both in the plains of Assam and the outlying farflung Himalayan highlands remained more or less intact and undiminished till around the mid-fifties.

PRACTICE OF SELECT WESTERN NORMS

It is a well known fact that westernization and urbanization that had come to Assam shortly after British occupation in the thirties of the last century were on a miniature scale. These could hardly have any impact on the indigenous Assamese people for more than half a century. By the fag end of the last century the people of Assam became somewhat awakened to the western ways of life. It must be understood that the western system of education was taken advantage of by a select few of the Assamese society. Age-old socio-cultural norms very much prevented the proliferation of enlightened western customs including alien education. Till nearly the fag end of the nineteenth century prevailed the Assamese people's traditional notion of getting ritually polluted or outcaste on coming into physical contact with alien christian white men. The notion of ritual pollution worked for more than half a century since the British take over of Assam. Western education itself was viewed with awe and alarm and was thought to be the stigma on the part of those receiving it. In course of time, by the dawn of the twentieth century a break through came about in the age-old notion through the undaunted acquition of western education by a few enthuciastic Assamese.

In this context it is to be noted that the western impact reached Assam much later than elsewhere in India as this was practically the last region to come under the British. It may thus safely be asserted that during the entire British period the western impact on Assam, and for that reason, in the entire North-esatern region was indeed superficial and shallow. During the period of alien regime, the western impact had its reflections on a few aspects of the traditional socio-cultural life of the Assamese. That was the period when the people of Assam were highly selective: certain western elements were preferred to others. Western education, of course, later around the beginning of this century, became the most attractive one of the all other western norms like dress, food habit etc. Another aspect that had spontaneous response was the mode of transport and communication and associate miniature trade and commerce. However, most spheres of the Assamese culture remained impervious to the western modernized ways till 1950. It is only by 1950 when in consonance with the nation-wide launching of Five-year Development Plans in the country by the Government of India came in westernization and modernization in Assam on an unprecedented rapic scale unwitnessed ever before. However insignificant and incipient the western impact on Assam might be during the British time, it was nevertheless a direct one involving the Europeans, the bearers of western norms, and the Assamese, the receptors. Compared to the contact metamorphosis in Assam, the other far-flung terraneous regions of the North-east experienced even lesser degree of innovations in the socio-cultural life of the people in these regions. In fact, while the Assamese of the Assam valley experienced some development in certain sectors of life in the fifties, there was hardly any trace of development during the period in the entire highland region of North-east India presently called Arunachal Pradesh, Datta (1991 : 32) states, "It is necessary for us to keep in mind that for the whole of NEFA[2] there were only three jeepable roads of 170 km only two lower primary schools and only thirteen make-believe health units in 1947. No veterinary aid was available till 1951 and there were only 6 post offices till 1954". Under such a situation the people's plight beggared description. There was hardly any trace of communication; and it hampered the people's mobility for ages. Most tribesmen knew only their most immediate neighbours. As the plains were more easily accessible than the terraneous neighbourhoods, trades and other social activities were pursued with the plain's people of Assam rather than with their tribal brethren.

PHENOMENAL DEVELOPMENT

It is only after the Sino-Indian border conflict in the HImalayan ranges in 1962 that the entire spectrum of age-old isolation changed. The whole region began to witness development especially in the sphere of transport and communication. Incentives came to be provided in all round development of the entire periphereal outlying hilly regions since the later part of the sixties. On the aftermath of the Sino-Indian border conflict, there came up the exigency of achieving a quick all round socio-economic development for the entire North-eastern region. Accordingly the Government of India enacted the North East Council Act, 1971, on the basis of which a regional body called "North Eastern Council" (NEC) was established on August 1, 1972. It has since been acting as an advisory body for discussion on common problems and formulation of unified and coordinated regional plan for balanced development of the region. Over the last more than two decades the common problems of the region that came to be identified for NEC's attention in the field of economic and social planning are interstate transport and communication, power generation, flood control and a host of other aspects of human resource development. Over the year, following the Sino-Indian conflict, the North-eastern region as a whole has achieved substantial development in contrast to the previous 100 years or so in the shape of material growth and prosperity to some extent. Ever since its existence the NEC has vigorously pursued the development course in the fields of hydro-power generation, forest and mineral resources. Apart from the NEC the national successive five-year plans have also ushered in an array of projects-establishment of small, medium and giant industrial plants, and construction of roads and highways, dams and embankments, building of industrial townships with modern infra-structures, transport and communication etc. Construction of all weather roads into the most anterior remote regions among the mountains, training of rivers and installation of hydro-electric power stations with associated spread of urban life along with human resource development projects and institutions are presently on the offing aiming at an integrated development of the region. Also there has taken place considerable improvement over the last 30 years or so in the field of health and hygiene - deadly diseases like cholera, small-pox etc. were all exterminated and infant mortality got abated considerably. Almost all far-flung tribal villages presently are having provisions of clean drinking water and primary health service centres. All these have effected, along with the waning of child mortality, considerable increase in longivity.

Various post-1950 development works could be wrought in the North-east not without heavy influx of population from the heartland of the country. It has proved more baneful than any plausible regional human factor. The influx of non-indigenous population was, however, inevitable considering certain pressing developments obtaining in the North-eastern region during the initial years of national plan periods. There was lack of local expertise and paucity of labour for construction of plants and manning of modern establishments. It caused flow of huge number of skilled, semi-skilled and unskilled non-indigenous labourers from other states of the country. Not unnaturally there was a large-scale influx of Bangladeshi nationals being lured by prospect of having employment and possessing of virgin agricultural lands. Over the years since 1950, dearth of indigenous man-power has led to great influx of non-indigenous people for catering to varieties of needs - food, housing, water supply and multiple other material amenities. Instantly there has developed pressures on available resources of the region since around 1950.

In this connection it is worth pointing out that immigration of non-indigenous people into Assam and other regions is not a new phenomenon developing after 1950. Almost right from British occupation, immigration of labourers for engagement in the newly opened tea-estates from all over the sub-continent in their thousands was an uninterrupted phenomenon till the forties of this century. Further there was immigrants from pre-partition Bengal of Muslim land-hungry agriculturists also in substantial number. Yet there was hardly any effect on the ecology of the land. Immigration of either category of people in fact enriched the virgin waste lands. The immigrant agricultrists reclaimed the waste lands for growing food crops and the labourers raised tea-estates all over the valley and the foot-hill regions.

The advent of western ways and means introduced the heretofore unknown element of competetion in the sphere of trade and commerce. Many other components came in. There appeared buyers and sellers with money as medium of exchange; sky-recketting aspirations for more and more profit began to tell upon the resources - dwindling them on an enormous scale within the short period of some 40 years to such an extent that the life sustaining balance of the eco-system began to tilt showing ominous sign.

MATERIAL GROWTH AND BIO-DEGRADATION

The bane of western economy that is invariably accompanied with sprawling industrialization and urbanization set in with the result of fast dwindling of resources and degradation of life-sustaining eco-system of the region, as stated above, around the mid-fifties of this century and has since been working havoc all round jeopardising and crippling the very existence of the human life in the imminent future. Along with infrastructural growth and development, there took place a spurt in the human resource development. The initial two decades of NEC-sponsored plan-programmes could be visualized as a period of large-scale resource mobilization and rapid execution of plan-project in the North-eastern region. The aftermath of these plan-projects was visibly reflected in the form of large-scale defacement of the region's topography and physiographic features. A good deal of defacement occurred owing to felling of forest trees for unscrupulous commercial gain, reclamation of terrain lands for construction of modern townships and multiple other associate installations, such as hydro-electric dams, national highways and a network of roads and pathways and extraction of minerals and crude oil and other natural products of the mountainous regions. The tradition-bound tribal population of the region are by nature not so fast-moving as to keep pace with these neo-phenomena. However, the present day conditions for disease-free and hygienically improved life have become, of late, more congenial for living than before. The refined life pattern has considerably heightened the people's longivity lessening to a great extent premature mortality and increasing fertility and growth-rate. The large-scale population growth-rate over the last three decades has brought in the cognate problem of reclamation of more and more virgin lands. The after-effect of most of these neo-phenomena in the highlands are more acutely reflected in the plains in the Brahmaputra basin zone than in the highlands.

A region's material development through systematic planning within a time-frame is highly inducible but is inevitably fraught with multiple adverse side-effects. It may so happen that development wrought in a given area may result in disasterous consequences in very many ways over a much wider area on a relatively large scale. In such an eventuality development is hardly commensurate with the loss that is incurred perpetually for generations. Most such losses or adverse consequences emanate from environmental distortions that are usually caused through man's reckless unwholesome aspirations for material growth. Mostly losses appear in the sphere of yield to staple crop, fruits and vegetables, drinking water sources or medicinal or timber-yielding plants, mulberry plants, etc. Environmental distortions result in a sort of chain reaction, one aspect of the habitat affecting most others in the chain of life-sustaining ingredients.

POST 1950 DEVELOPMENTS

In our country systematic planning for alround material growth and development began from early fifties of this century. It aimed basically at bringing about national or overall community prosperity and enhancing quality of life. The national endeavour in the matter of socio-cultural uplift was an unprecedented one in the history of the country. It heralded a new era of development. Naturally the national endeavour calls for judicious input of human expertise, skill and ingenuity, factors that are hardly spontaneous and self-developing. These need to be cultivated and activated through expert guidance and supervision. Planners and administrators at the initial stage of planning in their very enthuciasm and euphoria for ushering in a new era of development and prosperity lost sight of the long term consequences of disfigurement of the ecology and environment that have become glaringly manifest in the course of the last four decades or so in every nook and corner of the country, including the industrially poor North-estern region. The new socio-economic spurt that came in over the years invaded the traditionally tranquil landscapes of the North-east by sheer impruent unplanned activities in the name of development. In the wake of planning for development in the last few decades since early fifties there was hardly any eco-friendly conceptualization in the sphere of developmental activity. As already referred to in the forgoing pages, apart from age-old primitive traditional spurt and burn cultivation, that is intrinsically incompatible with the ecology of the region, the period since 1950 has encountered various modern eco-degrading urban activities. Certainly all these activities are development - oriented and designed to mobilize resources for augmenting the standard of living with enhanced quality of life for all and sundry. While most of the development - oriented activities are most essential for economic prosperity, what was lost sight of was the most uncongenial environmental effect on the population in the long run. Following are some of the present day commercially biased undertakings that came into effect over the last four decades or so, mostly causing eco-imbalance in the sub-montane regions of the North-east:

(a) *Slash and Burn Cultivation* : This primitive slash and burn or jhumming cultivation has presently lost its traditional innocuous nature. In the post-1950 years owing to enormous increase of population growth following improved hygienic living and consequent sharp decline of mortality, jhumming has begun to manifest its side-effects. With increase of population ever larger and larger areas were brought under jhumming, at the same time reducing the period of keeping infertile plots of land fallow from 30 years or so to as low as 4 or 5 years. In the traditional pursuits of hunting and gathering economy in the North-eastern Himalayan highlands "man was using the annual yield of the nature-system without intervening in it in any significant way" (Sharma, 1984:5). Shifting cultivation, virtually a process of "human intervention in the nature-system in the early states was quite insignificant compared to the regenerative natural forces operating in extension forest regions" (Sharma, 1984:5). Thus the productive forces of nature kept the natural setting of the land undisturbed despite man's exploitation with his technological devices. Man could allow a time-lapse of 30 years or so for regenerative natural forces to work to recover the natural setting. Presently under the changed sociocultural milieu, in the context of increasing population impact, the natural regenerative forces have failed to keep pace with the ever expanding volume of arable land in the forest lands for jhumming leading to extensive heavy soil-erosions and denudations of forest lands.

(b) *Lumbering and Deforestation* : Since 1950, commercial motivation with enormous ambition of profit-making is the root cause of ecodisturbance in the whole of North-eastern region. Wanton felling of forest trees over the years has denuded the forest cover exposing the hill-soils to rapid erosion. Highland soils become prone to erosion once the virgin forest cover is removed. Plantation of seasonal crops like pine-apple, ginger, potato or even semi-perennial crops like coffee or citras trees can hardly keep the top-soil in tact. Extensive jhumming and cash-crop plantation has since been causing enormous erosions of the highland soils that get accumulated in the river-beds and the *beels*, the inland perennial water bodies, in the plains of Assam.

(c) *Establishment of Townships or Industrial Units* : Over the last four decades, one can visualize rapid spread of urban civilization in the shape of newly built townships and industrial units with networks of roads and highways. In course of the build-up process, filling of swamps and bogs demanded large-scale earth-cutting in the highland regions that eventually turned bereft of natural vegetation. Of late, large number of townships have come up along with networks of all weather motorable roads in the vast expanse of North-eastern highland ranges. Uncovering of these mountainous regions of natural vegetations have made them susceptible to heavy soil erosion in the highlands. The huge volume of loose highland soil finds its passage during the four month-long rainy season over the year.

(d) *Recovery of Minerals* : Since quite recent times open cast mining is being widely resorted to for extracting coals in Assam. Recovery of minerals and constructive material require removal of vegetal cover that inevitably reshapes topography with resultant disruption of surface and ground water circulation. The process generates huge volumes of debris. The network of roads constructed for servicing mining operations further aggravates the problem of land degradation. In open cast mining in the mountains, rock masses get scrapped off and mixed with loose soil and flow downslope, causing widespread damage to vegetation and springs and streams. Thus flow of muddy slurs from the open cast mining zones pollute the potable water sources as well as the agricultural fields. For nearly last two decades open cast mining for recovery of coal is being carried out in the Ledo and Margherita coal fields in Upper Assam. Despite utmost precaution to stop pollution in the open cast mining operations at Ledo and Margherita, agricultural lands, various water bodies and the surrounding atmosphere are reportedly badly affected from steady pollutions from the mining operations.

Besides pollutions resulting from coal mining, lime stone mining also equally creates all-pervading pollutions of land, water and the atmosphere. The mining of the lime stone quarry at Dalai Parbat in Mikir Hills District is a constant source of pollutants that affect a wide region around the quarry.

DISCUSSION AND CONCLUSION

The ethnographer met a number of septuagenarians and nonagenarians of the Bhramputra valley who could well recall and perceive the contrasting environmental situations obtaining in Assam in the pre and post - 1950 years. The entry of a good many western material component and aesthetic way of life in the post - 1950 years nevertheless enriched and refined the human life of the region - replacing the age-old concepts and notions and thus improving the standard of living and consequently diminishing the pre-1950 aweful incidence of mortality in Assam. The dreadful diseases like small-pox, malaria, cholera, black fever etc. that were quite endemic since ancient times got virtually exterminated, and the people's longivity registered an ascendance not only in Assam but also in the Himalayan highland tribal regions. Over the last three or four decades all over the vast number of North-eastern Himalayan tribal villages, there has since been phenomenal population rise, and consequently more and more jhum lands have been brought under cultivation. The age-old practice of keeping a jhum plot fallow for a cycle period of 30 years or so for natural regeneration of vegetation sharply declined to as low as 4 or 5 years, as indicated above. While in the pre-1950 years jhumming was a most innocuous process, it changed to a highly destructive one in the post-1950 years. The traditional life-sustaning practice of jhumming has since acquired a baneful role under the forces unleashed in the process of wide-spread westernization. This destructive practice of jhumming has got combined with multiple other associate western and its concomitant urban practices and processes that have already been referred to in the foregoing pages. The aftermath of westernizing and urbanizing processes brought into being non-indigenous entrepreneurship and a prodigious profiteering motive that was associated with intense and most often ugly competetion and drive to acquire wealth from all available sources. The entire burnt of this new found intense motivation for ever increasing sense of profiteering came to be borne on the natural resources of the region. Multiple non-indigenous modern methods and devices came to be adopted for speedy exploitation of the resources - virgin lands, forests and mineral wealths. Apart from slow depletion of the material resources, defacement and erosion of land masses, defilement of the habitats with pollutants and other forms of casualties to environment have begun to result. Rapid distortion of the natural settings came to be wrought with unprecedented western scientific and technological innovations. For nearly last four decades the virgin, impenetrable forests of Assam became the easiest and most lucrative target to be exploited for unscrupulous profiteering. A two-pronged process had depleted the forest wealth of Assam over the years: One, forest lands were reclaimed for establishment of townships and settlement of land-hungry immigrants with ancillary infra-structures and roads and lanes and bylanes. Two, along with licensed mature trees for lumbering, thousands of immature trees were felled by unscrupulous lumbermen with the connivance of, or in conjunction with, the forest authorities. Most of the development activities were carried on and effected hardly keeping in view their sustainable aspects so as to avoid passing on an empty landscape to the oncoming generations. The aforementioned various development activities like building of townships, mining, earth-cutting etc. have still been having the cumulative effects that are steadily distorting the ecological balance in Assam. The present day practice of jhumming on an enormous unprecedented scale compared to pre-1950 years have been causing top-soil erosion over the last four decades besides heavy land-slides that have become accelerated over the years on account of earth-cutting in connection with construction of roads and establishment of townships all over North-eastern Himalayan ranges. The massive loose soil mass in the torrential rains of the region moves down into the numerous tributaries and rivulets mostly flowing southwards from the Himalayan highlands into the Brahmaputra. The result was the large-scale silting of all the river-courses including the entire 700 km course of the mighty Brahmaputra. The old men of the valley referred to above still recall how the British - owned Joint Steamer Company used to ply from Calcutta regularly throughout the year their steamers laden with cargoes all along the course of the Brahmaputra up to the easternmost town of Sadia. Most of the big tributaries of the Brahmaputra like the Kalong, the Buridihing, the Dikhow, the Dhansiri, the Sowansiri etc. were all navigable in the pre-1950 years. The silting of the river-beds and their uplifting has since been fraught with disasterous consequences. The most ominous result of silting of the rivers and the rivulets of the valley is the increased frequency of floods during the annual monsoon seasons in Assam. In the aftermath of the silting of the rivers, Assam faces four to five cycles of devastating floods as against two to three times in the earlier years. Another morbid feature of the multiple cycles of flood is the large-scale silting of the inland perennial pools of storm-water bodies or *beels* and other swampy regions of the land. This is caused as a result of aggradation of flood water borne debris that is left off while the floods recede from the vast open inundated agricultural fields covering most often the *beels* and the swamps. Presently almost all perennial water - bodies that once served as the excellent sources of fish and various edible aquatic herbs became shallow and are on the verge of disappearance. The recurring annual visitations of floods have got another the most disasterous effect of river-bank erosion. It has since become an annual scourge of the people of Assam. The flourishing commercial towns of Palasbari and Dibrugarh have almost completely been washed away as a result of erosion that followed high floods in 1952 and 1953. Apart from these towns, a large number of villages have also disappeared owing to erosions of the Brahmaputra and several of its tributaries.

It may well be understood that most of the development works under the successive plans were initiated without having any sustainability perspective in view. That disasterous effect would follow eventually in the long run could hardly be anticipated at the initial stages of the development undertakings. A clear instance of unsustainable development could be cited in the sphere of people's health among the tribal masses in Arunachal Pradesh. As a result of introduction of western medical system in the last four decades pandemic diseases like cholera, small-pox etc. disappeared and the scourges of child mortality diminished and consequently longivity increased. The overall result of the new modern system of medication was the sharp rise in the population curve that has its repercussion in the extension of jhumming over wider areas that led to ever increasing soil-erosion. The rise of population and its multiple side effects could not either be anticipated or were simply belittled. Multidimensional ways and means could have been adopted to counter the scourge of population rise. These could well have included intensive birth control, introduction of ecologically compatible avenues of occupation, opening of some modern vocational trades like weaving, sewing, photography etc. Measures for birth control combined with opening of avenues of engagement would have cumulatively definitely reduced the pressure on land for jhumming.

The increased incidence of jhumming in conjunction with various construction activities that have continued over the last four decades have caused profuse soil erosions in the entire Northeastern sub-Himalayan ranges in Arunachal Pradesh. On the top of these activities, unscrupulous reckless felling of trees for commercial purpose has almost completely denuded the hill-sides of the Arunachal Pradesh forests. The siltations of the Assam river-beds and obliterations of the land-locked *beels* all over the valley are directly attributable to these unsustainable development activities in Arunachal Pradesh.

The non-industry biased basically agricultural folks of Assam have since time immemorial been solely dependent upon the habitat for their basic needs of life. These needs include rice, the staple cereal, various building materials for construction of dwelling houses and indigenous fibres for clothings. These could all be procured from the habitat itself. Apart, from the staple, the people have the habit of consuming a large variety of wild and domestic leafy and tuberous vegetables that grow in the wild all over Assam. And the most important and essential item of food the people most obsessionally procure and consume is fish that once abounded in abundance in the Brahmaputra, its tributaries and the rivulets besides the large number of *beels* and swamps. The Assamese have the great crave for fish. The whole of Assam abounds with more than 400 *beels* ranging in area from 2.5 sq km to 25.00 sq km each. These natural water-bodies were all susceptible to annual flooding of the Brahmaputra and the hilly torrents. During floods certain varieties of river-fish[3] would get into these *beels* for breeding. These used to get permanently lodged in the *beels* after the final recession of the floods. Besides the flood-borne river-fish certain varieties of mud-water fish would make the muddy beds of the *beels* their permanent abodes. These varieties were the excellent catches to the village folks all over Assam after the recession of the floods during the the lean dry months of the year. The people used to catch fish almost round the year, though most intensively in the post high-flood period lasting from mid-June to January.

Besides fish, the people used to raise an indigenous variety of paddy called *boradhan* (Oryza sativa var Boro) along the shores of the *beels* shortly after recession of flood-waters in the winter months from October to December. The cereal served as a highly nutritious item of breakfast or tiffin throughout Assam.

Apart from the aforesaid yields from the natural sources of the valley, the sprawling jungles at the outskirts of the villages and backyards of the people's abodes yield throughout the year various herbs and shrubs that provided as vegetables in the people's diet. Further many varieties of herbs and shrubs are put to use by the village folks for curative purposes as herbal folk medicine. Also most village people are aware that most wild herbs and tubers, some taken as raw and others as cooked, render medicinal value (Mahanta, 1995 : 105-117) and that these have well known curative and health sustaining properties.

From the above delineations it can be understood that the Brahmaputra valley has since time immemorial been serving as the most sustainable habitat of the Assemese people. The land is most justifiably referred to, in the common village parlance, as "*Aakalo nai bharalo nai*", that is, literally, a land "having no scarcity or no store-house". The grand old men the ethnographer met, as referred to above, had never in their life witnessed the type of devastation - recurring floods, river-bank erosions and large-scale siltations of the river courses and the land-locked natural pools of water - in the first half of the century. According to them these are phenomena that have occurred over the last four decades. It can reasonably be asserted that the man-nature imbalance that has got built up in the course of the planned development processes over the last four decades or so is due to the most imprudent introduction of incompatible elements of culture in a highly adversely oriented setting.

The entire configuration of culture under alien impact of westernization and industrialization got badly superimposed upon the Assmese culture complex within the span of a few decades in the later half of this century. The advent of the entire set of western socio-cultural norms and patterns and ways and means of life that came to be adopted by the people of Assam, as those of elsewhere in India, has in fact become a round peg in a square hole. The notion of compatibility was belittled and ignored, and the prospect of instant benefit from pursuit of western model of development outweighed the crucially important aspect of sustainability. Owing to enormous environmental metamorphoses, people have faced a good deal of miseries and deprivations of basic needs of life from natural sources. The emergent socio-cultural situations calls forth new mode of adjustment. Over the years there has developed a good deal of maladjustment among the young folks of the region that obviously owes its origin to improper priority to western development-baised items of innovations introduced into the region with undue haste.

NOTES

1. Tol - Sanskrit school.
2. NEFA - The present Arunachal Pradesh was known as North East Frontier Agency (NEFA) between 1954-72.
3. River-fish - Not all varieties of river-fish are habituated to getting into the inland water sources during floods. The avrieties that breed in the *beels* are as follows : *Rou (Labio mohita, Aree (Mystus meuods), Chital (Notopterus chitals), Bamee (Mastacembelus armatus), Kandulee (Notopterus notapterus), Boralee (Wallago attu), Tingra (Mystus vittatus), Bhagon (Labeo leoga).*
4. Mud-water fish - Some of the mud water varieties of fish are as follows: *Kawai (Anabas testudineus), Singi (Heteronopuestes fossilis), Magoor (Clanius betracus), Sol (Channa striatus), Goroi (Channa Puntatus) Chenga (Channa chua), Sal (Chana marulius), Khalihana (Colisa faciatus) Batiya (Lapidocephatichthys guntea).*

KEYWORDS AND ABSTRACT

KEY WORDS Sustainable Development. Five-Year Plan. Tea Estates. Bio-Degradation. Unwholesome Aspirations.

ABSTRACT Till 1950, almost the whole of North East India barring the Brahmaputra and the Barak valley regions, abounded with virgin forests. The successive 5-year plans brought multifarious development schemes due to which large-scale urbanization combined with westernized outlook crept in. In the course of nearly half a century since 1950, valuable natural resources especially virgin forests came to be depleted. Phenomenal population growth owing to improved health and hygienic conditions, resulted in ever increasing demand on more and more virgin lands that led to large-scale eco-degradation. The development planners in their enthusiasm to usher in quick development could hardly think of the incompatibility that might eventually result in the foreseeable future.

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Author's Address : **Dr. K.C. Mahanta,** M.Sc., Ph. D. Professor, Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India

Geoenvironmental Studies of The River Jhanji, Assam

P.Kotoky, J. Baruah, N.K. Baruah and J.N. Sarma

INTRODUCTION

Rivers are the natural architect changing the face of the earth - the most active component of the hydrological cycle involving continuous mobiliy of water, as well as erosion, transportation and deposition of dissolved, suspended and tractively carried materials. Since ninty per cent of continental weathering products are transported to the ocean through the rivers, the knowledge of river basin covering the role of hydrodynamics and geochemistry is very much useful as it dominates the life cycle of plants, animals and human kingdom.

The degradation/damage to the natural functioning of the biosphere by the accidental contamination of man's waste is an outcome of modern civilization. This will not only affect and damage the aesthetic quality of environment but will also be responsible for deterioration of human health, vegetation, animals, crops, soil and water. These imbalances in an ecosystem will degrade the dynamic interrelationship between the living forms and their physical environment which in turn creates problem in maintaining the life sustaining processes.

Fresh water is a valuable natural resource for man's personal use and food production, it is also indispensable for many industrial processes. Moreover, river water from which domestic and industrial supplies are extracted are also being used for disposal of waste effluents. In future, such dumping in rivers of insufficiently treated effluents will only result in lesser water availability and increasingly expensive supply of pure water. This is one of the major dilemma in respect of present water supplies. Water resources, whether rivers, lakes, canals or the sea are also the source of enjoyment, recreation and transport for millions of people.

Industrialization has led, in the last few decades, to an increased mobilization of trace metals either as a direct action or as an indirect consequence. Thus in recent years the fluxes of many trace elements from terrestrial and atmospheric sources to the aquatic environment have increased (Forstner and Wittman, 1981). As a result of complex physical, chemical and biological processes, a major fraction of these trace metals is found to be associated with the bottom sediments. The processes and factors that control the scavenging of trace metals by the sediments and their release to the overlying water in changed environmental conditions must be understood if impacts on the environment are to be predicted. The stream sediments are considered as "voice recorder" of the stream behaviour which is either due to natural or anthropogenic causes. The mobility of the metals in sediments in relation to their chemical forms also controls the environmental impact.

STUDY ON INDIAN RIVERS

In India, our attention towards environmental degradation has been drawn only recently, but even now the pace towards the same has not been paid to them.

Literature on Indian rivers are relatively few. Ajmal and co-workers (1985a, b) have opened up the study through their efforts on the Ganga-Brahmaputra river systems. They have investigated the water and sediments for the heavy metals and their interaction with water. Sing (1986), Chattopadhyaya et al. (1984), Choudhuri et al. (1980), Pandey et al. (1980a, b), Mehrotra et al. (1982, 1986a, b), Sinha (1986) and Srivastava (1986) have contributed significantly. The other notable contribution on the river system includes the work of Subramanian (1979, 1980, 1983, 1985 a, b, 1987), Sarin and Krishnaswamy (1984, 1989, 1990, 1992), Sebastian et al. (1990), Seralathan (1982), Saikia et al. (1988), Goswami (1985), Lal and Bhattacharyya (1990), Pandey (1994), Baruah et al. (1994) and others.

However, a very limited work has so far been conducted on the Brahmaputra river system except a few piece meal type work on certain major aspects. The nature of the river system and the anthropogenic attributes to them can be considered as a frontier area of study in environmental impact

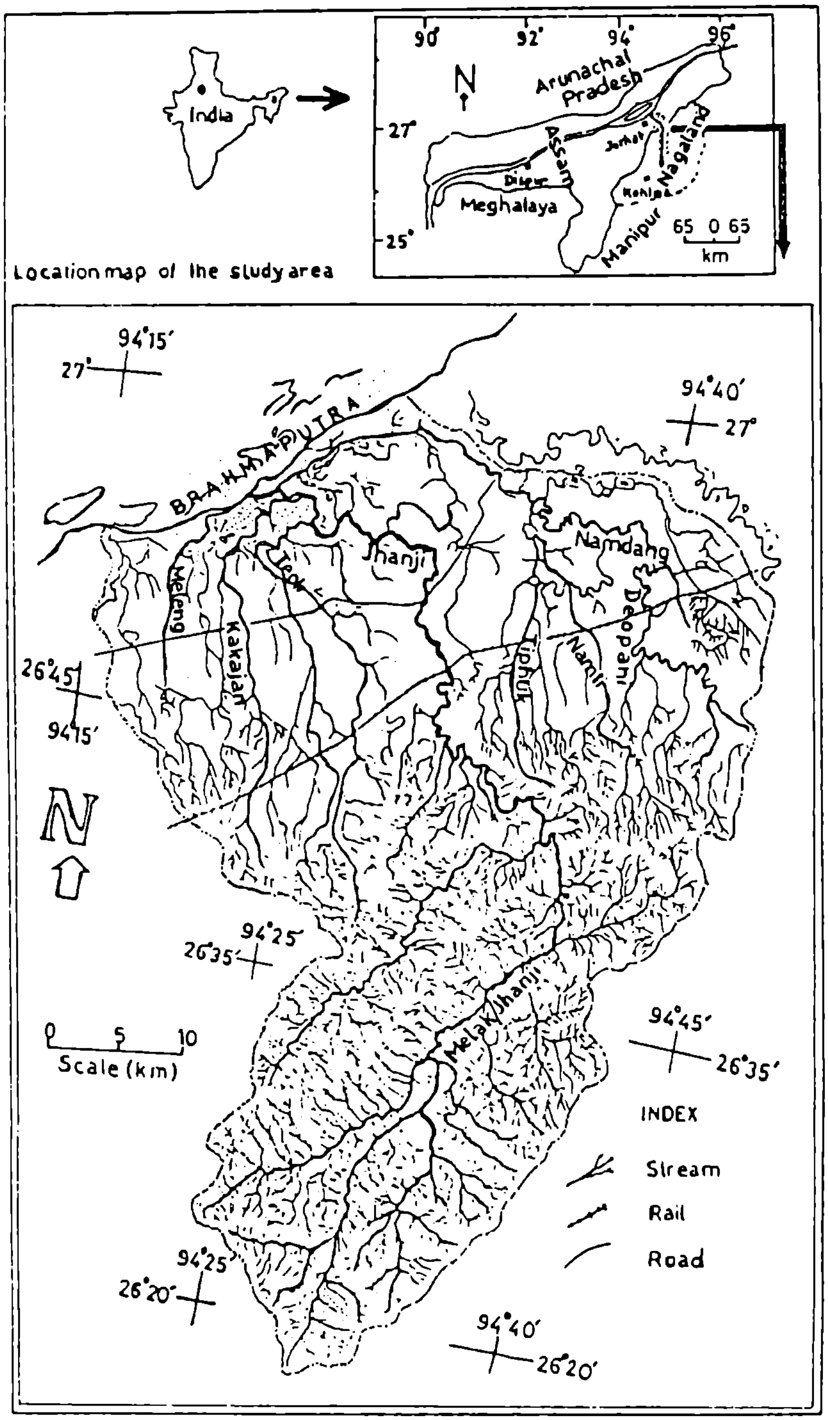


Fig. 6.1. Drainage basin of the river Jhanji, Assam, India

assesment for this naturally rich part of N E India.

JHANJI RIVER BASIN

The river Jhanji, a tributary on the southern side of river Brahmaputra, bears its origin in Naga Hills at an altitude of 1416 metres near Mokakchung. The river drains an area of 1350 km^2 including both hills and low lying alluvial plains. Out of the total catchment area, 873 km^2 is in the state of Nagaland and about 477 km^2 is in Assam. The basin extends (Fig. 6.1) longitudionally from 94° 15'E to 94° 45'E and latitudionally from 26° 20'N to 27°N with about 50 per cent of the total area above 250 metres from the mean sea level.

The river Jhanji, on its way towards the mighty Brahmaputra, flows through the states of Nagaland and Assam. The river crosses a number of tea gardens near and foothills and a vast cultivated land in the low lying plains. The river constitutes a major water source for the people along its banks. The quality of once tranquil and quietly flowing river is considered to be destabilised with the tempo of industrialisation and population growth. Apart from the 100 tonnes/day capacity Tuli Paper Mill (which is not functioning at present) commissioned in the year 1971 at Tuli, Nagaland, a large variety of agro-chemicals and pesticides drained out from the large number of tea gardens around also aggravate the situation.

HYDROMETEOROLOGY, HYDROLOGY, VEGETATION AND LAND USE

The Jhanji river basin is in temperate climatic zone. The mean temperature during the summer months is about 30°C and during the winter the mean temperature decreases to 10-12°C. The average annual rainfall is about 1865 mm. Rain and thundershowers generally start from April, sometimes it is in late March or early May. Heavy monsoon rain strats from June and lasts generally till September, also occassionally extending to October. The dry winter season prevails from November to February.

About 50 per cent of the hilly area of the river basin is covered by forests. In the sloping foothill region a number of tea gardens are situated. The vast alluvial plains lying beyond the foothill region is extensively used for paddy cultivation. In the hilly areas slash and burn method of shifting cultivation (Jhum) prevails.

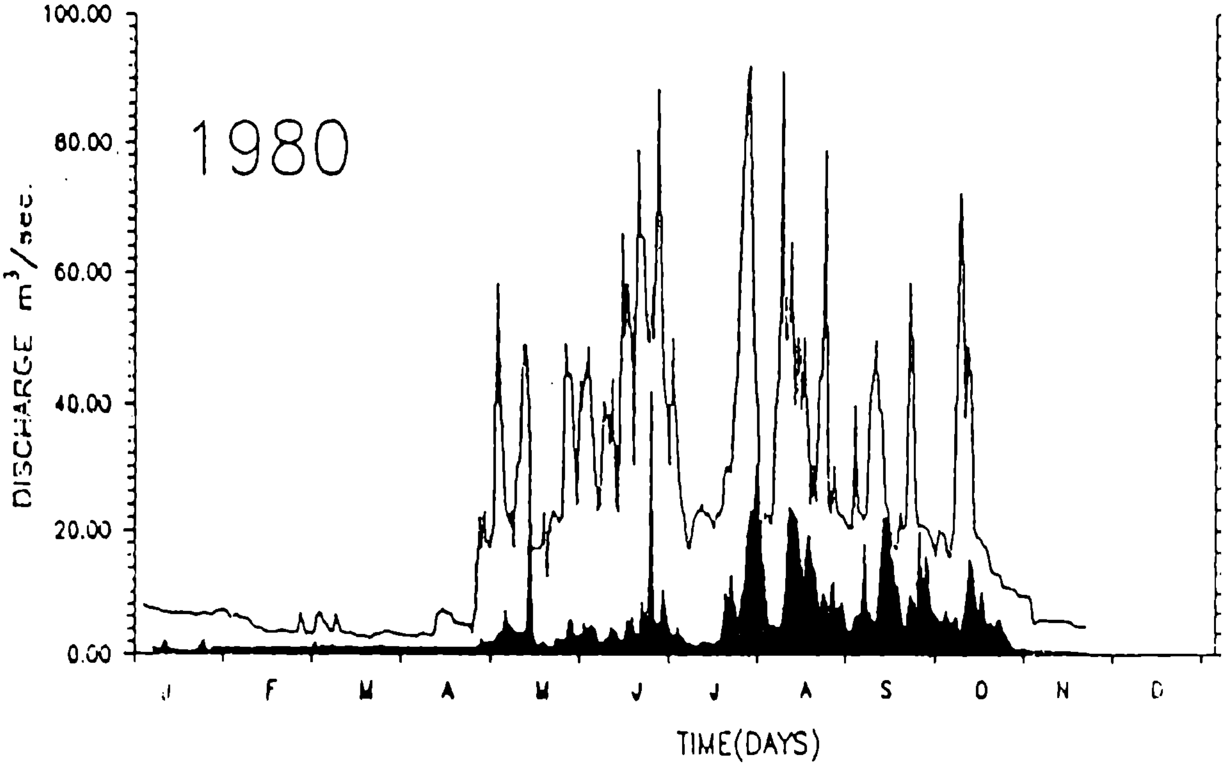
The water and sediment discharge data for twenty years (1971-1991) are collected from the Investigation Division, Flood Control Department, Government of Assam. The data show maximum daily average sediment discharge of 8215 metric tonnes on July 21, 1976 with a corresponding water discharge of 130 m^3 sec^{-1}. Almost a stabilished sediment influx-cum-water discharge can easily be attributed from the simultaneous occurrence of highest sediment discharge with the peak water discharge (Fig. 6.2). The high rate of collapse of soft alluvial banks just after the flood peak may be the reason for high sediment concentration after the peak flood.

The mean annual sediment load during this period is 2,52,015 metric tonnes. The amount of sediment load and effective basin area the river Jhanji represents an overall soil denudation rate of the order of 0.11 mm/year.

PHYSICOCHEMICAL PARAMETERS

The Jhanji river water exhibits an alkaline nature with an average pH 7.4, (Table. 6.1) like all other Indian rivers. The slight depletion of pH during monsoon may be attributed as dilution affect of rain water. An enhancement of major ion concentration during the monsoon period is also reflected by the EC values over the basin as compared to the non-monsoon period. Total dissolved solid (TDS) content varies from 91.1 to 151.5 ppm in non-monsoon period and 94.5 to 151.9 ppm in monsoon period. The increase in concentration of major ions towards downstream is supported by the icrease in TDS values in downstream direction. The DO, BOD and COD values are within the acceptable limit. The high rate of DO in the monsoon period might be due to high flow rate of the river for which atmospheric reoxygenation takes place. Though the turbidity values in non-monsoon period are within tolerance limit but during the monsoon it is too high and is not acceptable. This high value of turbidity correspond well with high values of total suspended matter present in the system during the monsoon period.

The Cl^- and SO_4^{--} concentrations are much lower and comparable to other Indian rivers. Kaolinisation and cholritisation may enhance the dissolved



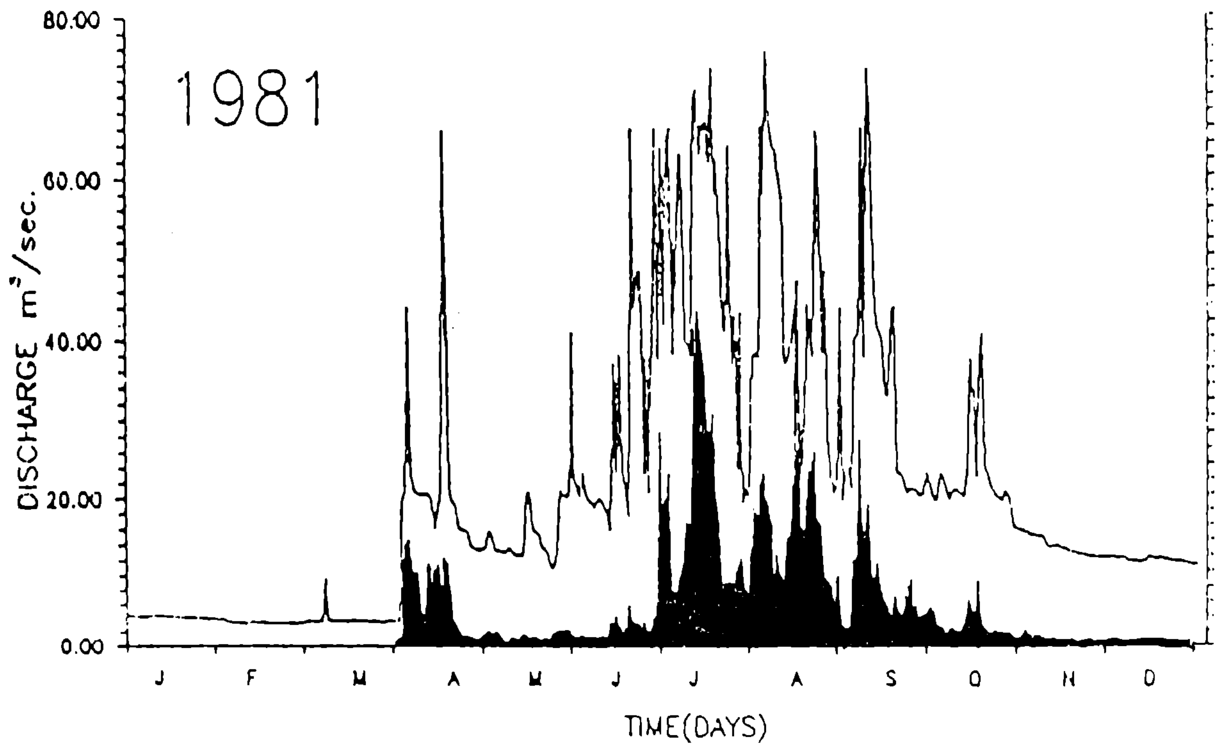


Fig. 6.2. Combined water discharge and sediment load curve of the Jhanji river near NH37
Solid line : Water discharge
Shaded curve : Sediment load

Table 6.1: Variation of physico-chemical parameters in river Jhanji, Assam

S. No.	Temp.	PH	EH	EC	TURB.	DO	BOD	COD	TSM	TDS	TS	ALK.	DIS SiO_2	NH_3-N	NO_3 and NO_2-N	PO_4-P	Cl-Cl	SO_4	Free CO_2
									Pre Monsoon										
1	23.4	7.54	148	138.3	2.66	8.0	1.90	3.80	20.00	95.50	115.5	48.3	6.2	0.54	0.21	ND	10.0	6.90	2.79
2	23.8	7.55	155	145.5	2.96	7.2	1.80	3.80	22.00	101.20	123.2	49.5	6.8	0.54	0.23	ND	11.3	7.66	2.76
3	23.4	7.47	157	148.5	3.08	7.3	1.80	3.44	26.00	103.20	129.2	50.5	6.8	0.48	0.25	ND	12.5	7.50	3.73
4	23.4	7.24	168	169.5	3.80	6.5	1.30	2.45	32.00	118.20	150.2	58.6	6.8	0.39	0.26	ND	12.8	7.80	6.74
5	23.2	7.31	168	173.4	3.45	6.5	1.30	2.72	29.00	120.60	149.6	59.2	7.2	0.42	0.29	ND	13.3	8.20	5.79
6	23.7	7.47	170	182.5	4.50	6.8	1.40	2.76	38.00	127.3	165.3	64.3	7.8	0.42	0.34	ND	14.2	8.50	4.22
7	25.0	7.71	174	185.2	4.52	6.8	1.50	3.14	38.00	129.5	167.5	62.5	8.2	0.69	0.38	0.05	14.8	8.80	2.44
8	27.7	7.68	175	198.2	5.10	6.8	1.50	3.22	43.00	138.10	181.1	68.5	8.4	0.72	0.41	0.06	16.5	8.80	2.86
9	28.8	7.48	189	202.5	5.70	6.9	1.60	3.36	48.00	140.4	188.4	68.5	8.6	0.74	0.48	0.08	16.6	9.14	4.54
10	27.8	7.48	193	207.5	6.52	6.8	1.50	3.14	55.00	144.4	199.4	70.5	8.8	0.72	0.48	0.12	17.6	9.18	4.67
11	28.2	7.45	197	210.7	7.95	6.9	1.85	3.88	67.00	146.4	213.4	72.4	8.8	0.75	0.54	0.14	17.6	10.24	5.14
12	27.9	7.47	197	218.9	9.25	6.8	1.85	3.93	78.00	151.5	229.5	72.6	10.5	0.82	0.54	0.14	17.6	11.33	4.92
									Monsoon										
1	35.2	7.23	180	131.5	24.42	15.00	2.68	5.20	350	91.1	441.1	55.5	8.6	0.21	0.27	ND	3.8	3.8	6.48
2	35.4	7.15	182	132.3	28.45	12.80	2.24	5.50	360	91.2	451.2	56.8	7.2	0.24	0.31	ND	3.9	3.7	8.04
3	35.1	7.06	184	134.3	32.40	11.90	2.12	5.32	362	93.6	455.6	58.8	7.2	0.22	0.34	ND	3.9	3.8	10.24
4	34.5	7.16	185	154.2	38.50	11.60	1.78	3.95	375	1.7.3	485.3	67.5	8.8	0.22	0.35	ND	3.8	3.8	9.34
5	34.5	7.18	189	155.8	42.60	12.10	1.74	3.62	405	108.4	513.4	68.2	8.8	0.28	0.38	ND	3.9	4.2	9.01
6	34.6	7.13	189	171.3	48.5	11.80	1.54	3.21	438	118.7	556.7	75.8	9.2	0.33	0.42	ND	4.8	4.2	11.23
7	34.8	7.26	192	174.5	52.5	9.50	1.87	3.95	475	121.3	496.3	75.8	9.2	0.36	0.46	1.12	5.2	4.8	8.33
8	35.4	7.38	193	183.5	54.3	8.80	2.14	4.32	512	127.9	639.9	82.5	9.4	0.38	0.35	0.16	5.2	4.5	6.88
9	34.8	7.26	195	189.5	65.2	8.40	2.25	4.50	572	131.5	703.5	84.5	9.4	0.41	0.61	0.18	5.2	4.7	9.29
10	35.4	7.17	196	192.3	68.8	8.20	2.35	4.82	612	133.4	745.4	86.9	9.6	0.35	0.68	0.22	5.9	4.8	11.75
11	35.1	7.27	201	200.8	71.4	8.60	2.60	4.85	774	139.4	913.4	90.5	10.2	0.44	0.78	0.22	5.9	4.8	9.72
12	35.4	7.20	205	211.3	84.4	8.80	2.92	5.32	788	147.3	935.3	94.2	12.5	0.48	0.88	0.26	6.2	5.3	11.89
									Post Monsoon										
1	26.6	7.35	160	134.2	2.38	8.0	1.70	3.2	25	94.5	119.5	48.5	6.4	0.46	0.19	ND	11.5	5.9	4.33
2	23.9	7.62	165	138.5	2.37	8.0	1.70	3.2	20	96.9	116.9	48.5	6.3	0.52	0.20	ND	11.9	6.4	3.33
3	24.9	7.38	166	143.3	3.45	0.0	1.60	3.80	29	100.2	129.2	49.8	6.2	0.43	0.20	ND	11.9	6.5	4.03
4	24.2	7.35	170	164.5	4.02	8.0	1.40	2.38	34	114.9	148.9	58.5	6.5	0.36	0.22	ND	12.6	7.6	5.23
5	24.1	7.27	172	170.3	3.08	7.2	1.40	2.92	26	118.8	144.8	60.3	6.4	0.38	0.22	ND	13.6	7.6	6.48
6	24.3	7.35	178	178.5	4.15	8.0	1.30	2.78	35	123.5	155.5	62.5	7.6	0.43	0.31	ND	13.8	7.9	5.58
7	23.6	7.62	178	179.6	4.98	7.5	1.50	3.21	42	124.5	166.5	62.8	7.8	0.58	0.35	0.06	14.2	8.2	3.01
8	23.7	7.55	178	192.6	5.21	7.8	1.70	3.40	44	134.8	178.8	68.5	7.8	0.63	0.40	0.08	14.6	8.95	3.86
9	24.0	7.42	178	197.3	5.92	8.2	1.40	2.92	50	137.8	187.5	70.5	8.2	0.70	0.44	0.09	14.9	8.80	5.36
10	23.7	7.46	182	2.4.5	6.64	8.1	1.50	3.42	59	142.7	201.7	71.2	8.4	0.70	0.46	0.09	15.6	9.98	4.94
11	24.4	7.43	184	210.5	7.35	8.0	1.75	3.51	62	146.9	208.9	72.2	8.8	0.74	0.56	0.09	17.3	9.45	5.36
12	24.5	7.36	190	217.8	8.78	7.9	1.78	3.55	74	151.9	225.9	72.4	11.2	0.73	0.48	0.11	17.4	10.58	6.32

All parameters are n ppm unit excetp Temp. (c) PH, EH (in mV), EC (in micro mhos/cm), Turb=Turbidity (in NTU). TDS=Total dissoleved solid, TSM=Total suspended matter, TS=Total solid, ALK=Alkalinity (in ppm $CaCO_3$)
ND=not detected. Dis.= Dissolved

silica concentration in the Jhanji river water. PO^{-3} is below detection limit. Values of ammonia-N^4, nitrate and nitrite-N are within acceptable limit. The higher free CO_2 content in the monsoon period may be attributed to the increase in alkalinity during that period. The physicochemical parameters, except pH and DO; indicate an increasing tendency towards downstream with a minor fluctuation in time and space.

The HCO_3^- in non-monsoon period varies from

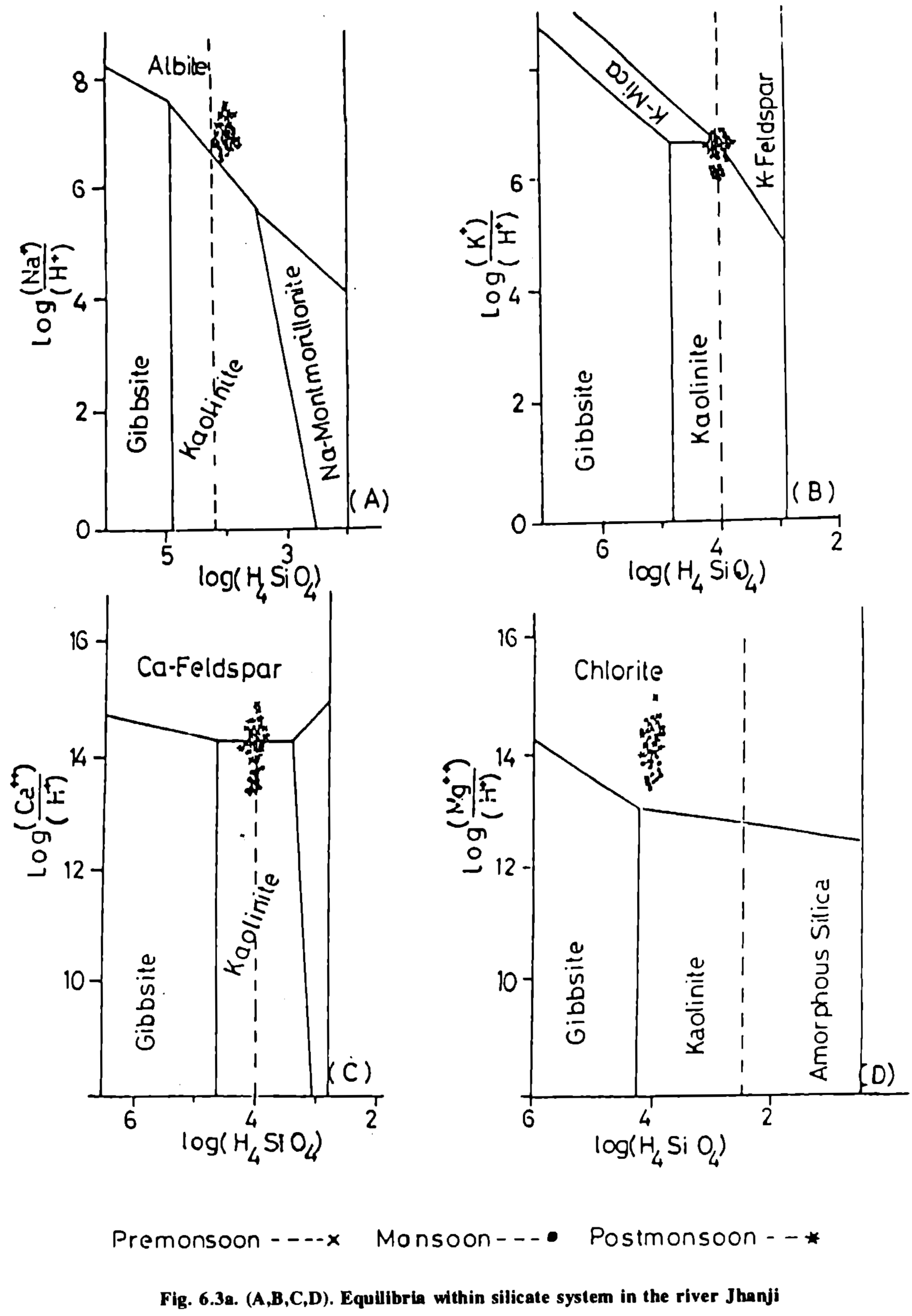


Fig. 6.3a. (A,B,C,D). Equilibria within silicate system in the river Jhanji

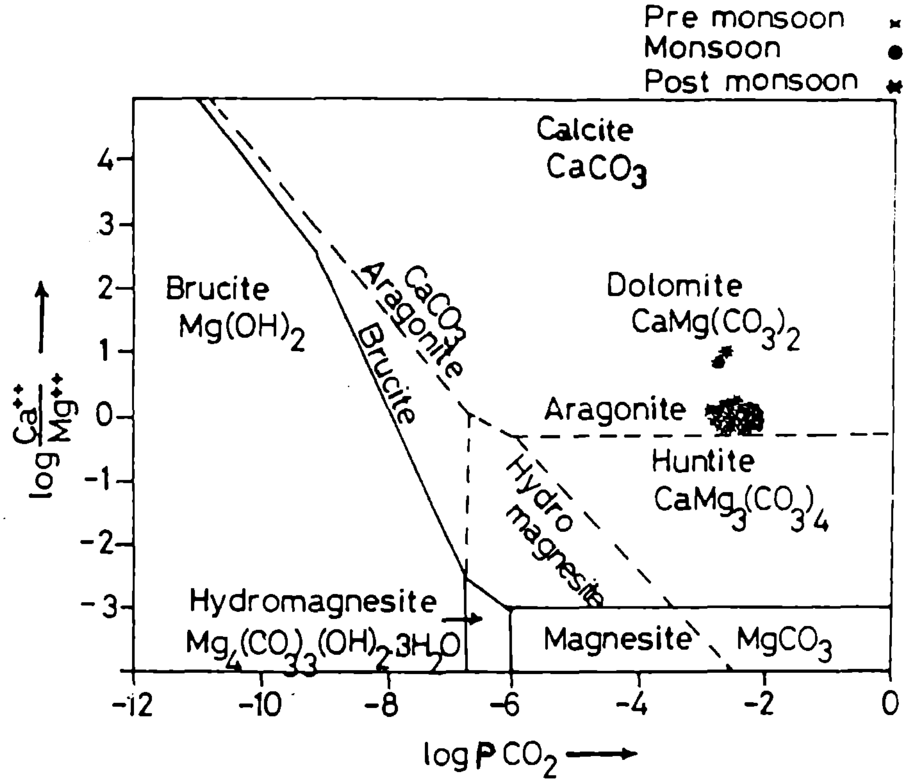


Fig. 6.3b. Carbonate equilibria within water system of the river Jhanji

48.30 to 72.60 ppm and in monsoon period it varies from 55.50 to 94.20 ppm indicating a prevalence of intense chemical weathering within the basin. The water chemistry of the river reflects the existence of dominant silicate weathering within the basin. The plot of Na^+, K^+, Ca^+, Mg^+ in silicate system (Garrels and Christ, 1965) indicate equlibrium with albite, kaolinite, Ca-Feldspar, and chlorite (Fig. 6.3 a,b). The XRD studies on bed and suspended sediments also show the presence of chlorite, kaolinite and illite in differential proportion. Subramanian (1979) reported that independent of cations considered, kaolinite is the theoretically expected mineral in the rivers of India. Aragonite and dolomite are the stable mineral phases within the water chemistry of river Jhanji. About 68% of the silicate in the water system is derived from silicate weathering and 32% from the carbonate weathering.

SEDIMENT CHEMISTRY

Determination of metal concentration in the suspended and bed sediment is more sensitive than dissolved concentration as indicator of concentration in the hydrologic cycle. Table 6.2 (a,b) represents the average sediment composition of the bed and suspended sediments of river Jhanji. The suspended sediments are more enriched in heavy metals as compared to bed sediments. This can be explained in terms of its fine nature, higher clay content, higher organic matter content and Fe-Mn coating. The downstream decreasing tendency of Cr, Ni, Co, Cu and Zn may be attributed to higher lithogenic influx. The relative mobility of elements in suspended and bed sediments can be given as follows:

Bed sediments:

Fe > Mn > Zn > Cr > Ni > Co < Cu > Pb > Cd > Hg.

Suspended sediments:

Fe > Cr > Zn > Mn > Ni > Co > Cu > Pb > Cd > Hg.

A better understanding towards the association of heavy metal content in sediments can be ascertained after fractionation of sediments to its different sizes. It is especially significant that heavy metal concentration are dramatically differ-

Table 6.2a : Variation of geochemical components along the Jhanji river

Sampling Points	pH	Org. Mat.	Carb. Cont.	Pb	Zn	Cu	Ni	Co	Cr
					Pre-monsoon				
W1	4.23	0.45	0.35	12.78	288.08	45.69	101.5	54.33	287.21
W2	4.19	0.50	0.38	13.44	155.40	45.68	98.8	52.12	62.02
W3	4.66	0.27	0.35	13.23	140.66	44.28	98.0	50.46	65.64
W4	5.52	2.24	0.32	12.22	58.20	36.62	59.3	35.23	99.22
W5	4.45	2.63	0.35	12.24	52.50	36.61	59.8	35.25	55.80
W6	6.33	1.96	0.28	12.66	64.22	34.22	61.1	34.29	56.73
W7	5.76	1.49	0.24	11.78	88.16	44.24	56.5	24.45	96.86
W8	4.36	1.38	0.38	11.71	90.45	34.05	57.2	25.47	56.85
W9	4.84	1.27	0.41	12.11	56.00	53.34	56.0	24.22	56.52
W10	5.12	1.56	0.29	12.14	66.40	33.30	55.0	24.33	70.01
W11	4.99	1.40	0.32	13.11	36.80	52.60	50.2	22.12	55.44
W12	5.32	1.38	0.36	11.63	34.40	48.00	48.4	22.09	33.69
					Monsoon				
W1	6.12	2.25	1.08	14.92	242.50	45.20	22.30	90.24	336.51
W2	6.26	2.22	1.05	16.21	247.91	45.40	20.43	90.81	338.83
W3	6.15	2.48	1.07	15.36	222.30	46.40	21.50	87.50	348.22
W4	6.68	3.33	1.02	21.55	109.00	69.50	24.31	144.94	342.80
W5	6.61	3.29	1.02	19.55	121.00	68.40	24.32	89.90	333.30
W6	6.45	3.22	1.01	19.88	114.00	66.60	23.39	76.60	322.60
W7	6.43	3.20	1.06	31.41	186.00	55.56	22.42	97.07	399.23
W8	6.52	3.12	1.06	30.52	184.00	54.20	22.51	82.20	392.20
W9	6.32	3.09	1.08	28.89	68.13	50.22	17.54	72.19	513.83
W10	6.54	3.88	0.92	27.62	66.62	50.14	18.22	71.50	466.50
W11	6.46	3.88	0.95	21.66	88.05	54.98	22.05	78.18	259.18
W12	6.50	3.80	0.84	21.44	82.21	55.48	21.62	74.40	248.22
					Post-Monsoon				
W1	3.84	0.35	0.31	9.54	139.04	40.80	92.20	44.94	265.40
W2	3.81	0.32	0.28	9.58	135.21	40.20	85.50	45.23	58.00
W3	3.78	0.18	0.29	10.22	132.20	40.09	83.40	45.12	69.10
W4	3.76	1.85	0.36	10.05	43.30	28.62	54.50	25.22	89.41
W5	3.80	1.65	0.24	9.55	42.50	28.52	54.62	25.32	40.04
W6	3.98	1.22	0.25	9.72	43.80	28.60	52.23	26.12	48.76
W7	4.81	1.09	0.27	9.66	72.45	37.98	48.50	19.45	76.51
W8	4.63	1.00	0.32	9.45	68.22	27.95	46.23	19.48	42.27
W9	4.20	0.95	0.35	8.30	66.62	37.15	49.16	18.24	42.24
W10	4.75	1.00	0.34	9.22	52.20	26.15	45.10	18.34	64.01
W11	3.55	0.99	0.40	10.11	36.40	46.05	39.14	18.45	41.20
W12	3.53	0.95	0.21	8.66	32.20	44.18	38.50	18.98	28.50

ent between various fractions. The association of trace metals in various size fractions (Table 6.3) can be represented as :

500 μm < 250 μm < 125 μm < 63 μm < 2 μm.

The association of higher metal content with the fine fraction of the sediment plays a prominent role as it reflects the potential mobile fraction under the normal energy condition. (Table 6.3).

ASSESMENT OF CONTAMINATION

Following Satyanarayana et al. (1994) behaviour of metal content within the basin is assessed. Concentration levels of A1, Mn, Zn, Cr, Co, Ni, Cd and Hg is most of the upstream samples are higher than the background values considered for the area (Table 6.4). A significant lithogenic influx into the

Table 6.2a : Variation of geochemical components along the Jhanji river

Sampling Points	*Fe*	*Al*	*Mn*	*Cd*	*Hg*	*Na*	*K*	*Ca*	*Mg*
				Pre-Monsoon					
W1	22362	108123	382	106	110	9252	3445	5842	3562
W2	22484	105212	374	105	108	9362	3840	6212	3641
W3	22740	104121	330	99	95	9345	3848	6822	3546
W4	23620	121123	306	97	162	9336	3628	5465	3572
W5	23785	112213	275	104	145	9342	3945	5322	3840
W6	26640	82110	278	72	132	9348	3958	4845	3882
W7	29430	86052	276	86	122	9355	4216	6221	4645
W8	29624	95121	226	74	98	9456	4438	5762	5674
W9	29866	98114	228	72	90	10568	4622	7145	5980
W10	29866	98114	228	72	90	10568	4622	7145	5980
W11	30450	87212	194	54	82	10608	4834	7045	6462
W12	31284	75125	146	52	78	10702	4852	6672	6867
				Monsoon					
W1	3398	36921	58.5	58	66	13266	5150	3646	2742
W2	3491	36850	62.4	54	64	13247	5120	3773	2848
W3	3522	36450	52.5	55	54	13248	5220	3888	2745
W4	4888	29000	51.3	52	95	14242	5840	4585	3992
W5	4895	29142	49.5	49	80	14497	6331	2862	3994
W6	4898	29112	48.8	45	72	14544	649	3245	4282
W7	5240	22400	45.4	45	64	15370	6832	3205	4746
W8	5421	22394	41.9	38	54	15390	7334	3133	4832
W9	5629	22424	39.9	36	52	16080	7468	2245	4878
W10	5994	25600	38.8	48	38	17132	7672	5845	5020
W11	6374	24642	32.4	32	32	17384	7845	4264	5625
W12	7475	24332	28.5	29	28	17664	8224	3145	6250
				Post-Monsoon					
W1	22252	83113	345	108	98	8464	3150	5222	3468
W2	23385	85122	322	98	85	8480	3828	5845	3562
W3	23485	83119	296	103	82	8432	3864	6766	3500
W4	23540	85114	245	86	165	8845	3874	6628	3762
W5	23640	86145	238	94	158	8962	3882	6423	3838
W6	28392	85138	222	84	142	9232	4062	5223	4595
W7	29666	55212	259	82	125	9268	4145	4845	5432
W8	30684	55131	232	69	115	9342	4164	7231	5872
W9	30722	55121	222	69	87	9565	4192	6234	5995
W10	30812	62115	232	66	75	11522	4432	6860	6962
W11	31965	68105	188	52	68	11688	4563	6232	6134
W12	31562	67045	138	48	63	11792	4673	5160	6665

All metals are in μg/g; Cd and Hg are expressed in μg/kg.
Organic matter and carbonate content are expressed in percentages.

basin from the mineralised belts within the close proximity can not be ruled out. The pollution load index (PLI) is moderately stable over the basin. Apart from dominant lithogenic influx as indicated by the PLI, particularly in the higher reaches, no specific input from the anthropogenic sources can be attributed. The downward decrease in pollution load index values clearly indicate a dilution and dispersion of metal content within the basin. The comparison of values obtained indicates that all the values except iron are within the limit of WHO (1984) guideline values. (Table 6.5).

Table 6.2b : Heavy metal contents in suspended sediments of the river Jhanji (Monsoon Period)

Sample Location	*Fe*	*Al*	*Mn*	*Cd*	*Hg*	*Na*	*K*	*Ca*	*Mg*	*Pb*	*Zn*	*Cu*	*Ni*	*Co*	*Cr*
W1	20223	27414	220	155	78	10945	6145	3845	1421	18.82	285	62.4	124	111	549.[illegible]
W2	22845	27320	238	152	69	10758	6222	4733	1121	18.45	292	66.6	128	98	588.[illegible]
W3	26445	08452	232	148	74	10848	6245	5845	1024	17.22	275	63.2	98	95	475.[illegible]
W4	28241	28423	240	125	105	12845	6543	4468	2052	32.24	261	71.8	147	96	415.[illegible]
W5	25323	26321	252	136	84	12622	6315	3533	1648	24.40	258	78.8	142	98	402.[illegible]
W6	24641	25330	226	105	76	13323	6421	5321	2568	24.20	215	76.6	139	92	425.[illegible]
W7	24545	25312	214	104	68	13848	6123	3972	2623	35.50	225	85.5	151	112	436.[illegible]
W8	24342	24526	202	112	62	14421	7240	6845	2538	32.20	232	84.2	158	94	428.[illegible]
W9	23320	26324	194	118	57	14623	7389	5852	2755	32.40	204	58.8	156	115	425.[illegible]
W10	22421	28321	178	98	44	15470	7746	4213	3228	21.50	188	65.1	181	129	445.[illegible]
W11	22283	25623	168	94	41	16893	8234	7345	3465	38.41	172	69.5	162	116	418.[illegible]
W12	20425	25214	142	76	35	17589	9248	4469	4238	4082	165	68.2	172	104	378.[illegible]

All metals are in µg/g; Cd and Hg are expressed in µg/kg.

Table 6.3: Seasonal variation of heavy metal contents with respect to grain size fraction of the sediments of the river Jhanji

Metals →		*Cu*	*Co*	*Cr*	*Ni*	*Pb*	*Zn*
500 µm	a	6.8--18.8	10.8--25.80	24.4--57.2	10.9--36.6	5.4--24.2	13.2--87.3
		(11.27)	(15.33)	(32.30)	(17.67)	(11.42)	(26.87)
	b	4.5--10.6	5.5--14.20	10.8--24.3	6.8---8.8	3.4---7.2	8.7--57.8
		(6.77)	(8.93)	(15.47)	(9.85)	(6.67)	(17.75)
	c	6.7--17.8	9.8--27.80	22.2--64.4	11.5--37.3	6.5--20.1	12.9--92.1
		(11.17)	(14.55)	(33.00)	(18.32)	(11.08)	(28.10)
250 µm	a	10.4--36.6	12.5--30.20	26.6--88.8	11.2--46.6	7.9--26.6	16.4--110.5
		(17.92)	(18.70)	(39.42)	(20.55)	(15.32)	(33.68)
	b	6.6--22.8	7.9--15.30	12.5--36.6	7.2--22.5	5.8--17.8	9.8--67.5
		(11.00)	(10.28)	(19.18)	(11.13)	(8.67)	(21.02)
	c	12.6--38.8	13.8--28.9	23.3--92.2	12.4--48.5	8.3--32.2	17.2--112.3
		(18.50)	(17.70)	(38.55)	(20.93)	(16.48)	(34.82)
125 µm	a	14.4--48.8	14.8--32.2	35.4--105.2	12.8--48.5	10.4--33.8	18.3--123.8
		(22.08)	(20.27)	(57.62)	(21.67)	(18.03)	(38.63)
	b	8.8--28.8	9.7--18.2	20.6--52.2	8.4--24.5	6.2--20.3	10.4--73.2
		(14.37)	(12.06)	(27.10)	(12.50)	(9.53)	(23.98)
	c	14.3--50.6	15.4--33.8	38.8--98.8	13.7--51.3	13.6--34.6	20.4--126.4
		(22.30)	(21.00)	(51.67)	(23.57)	(19.82)	(39.72)
63 µm	a	17.4--72.4	16.6--38.8	54.5--137.2	15.6--76.2	16.8--42.2	23.3--163.3
		(32.07)	(22.85)	(72.53)	(32.03)	(23.40)	(50.38)
	b	10.7--36.2	10.4--24.4	22.2--69.3	10.4--28.7	8.2--29.3	11.6--85.50
		(18.53)	(15.92)	(34.97)	(14.73)	(13.75)	(27.73)
	c	15.8--78.5	17.3--42.2	55.5--142.5	17.3--82.5	17.4--44.4	26.6--160.3
		34.78)	(24.22)	(72.87)	(35.53)	(24,48)	(51.02)
<2 µm	a	28.5--88.4	22.2--52.2	63.5--165.2	16.3--84.4	18.9--66.4	31.9--175.4
		(44.15)	(31.23)	(84.95)	(35.42)	(29.98)	(56.93)
	b	11.2--42.2	12.5--26.4	24.5--74.4	12.4--37.3	10.4--36.3	12.8--92.2
		(26.60)	(17.17)	(36.60)	(18.85)	(16.80)	(31.15)
	c	27.5--85.4	20.8--50.3	64.5--168.3	18.4--87.5	20.4--63.8	31.7--178.3
		(43.83)	(31.47)	(85.72)	(37.12)	(30.68)	(58.90)

All metals are in µg/g, Average concentration of metals are in parentheses, a = Pre-Monsoon period, b = Monsoon period, c = Post-Monsoon period.

Table 6.4 : Average concentration contamination factors and pollution load index (PLI) of the sediments of the river Jhanji

	Al		*Fe*		*Mn*		*Pb*		*Zn*		*Cu*		*Co*		*Cr*		*Cd*		*Ni*		*Hq*		*PLI*
Back	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	*A*	*B*	
ground	*6.44*	---	*1.95*	---	*182.66*	---	*14.71*	---	*86.43*	---	*43.99*	---	*48.42*	---	*163.74*	---	*0.068*	---	*47.41*	--	*0.14*	---	----
Sample Ponit																							
W1	7.59	1.18	1.60	0.82	261.83	1.43	12.41	0.84	223.21	2.58	43.90	1.00	63.17	1.31	355.47	2.17	0.090	1.31	72.00	1.5	0.091	0.65	1.25
W2	7.56	1.17	1.65	0.85	252.80	1.38	13.08	0.89	179.51	2.08	43.76	0.99	62.72	1.30	205.50	1.26	0.086	1.26	68.24	1.44	0.086	0.61	1.14
W3	7.45	1.16	1.66	0.85	226.17	1.24	12.94	0.88	165.05	1.91	43.66	0.99	61.02	1.26	175.90	1.07	0.086	1.26	67.53	1.42	0.077	0.55	1.09
W4	7.83	1.22	1.73	0.89	200.77	1.10	14.61	0.99	70.17	0.81	44.91	1.02	68.46	1.41	195.94	1.20	0.078	1.15	46.03	0.97	0.141	1.01	1.05
W5	7.57	1.18	1.74	0.89	188.50	1.03	13.79	0.94	72.00	0.83	44.51	1.01	45.67	0.94	151.20	0.92	0.070	1.03	45.56	0.96	0.115	0.82	0.99
W6	6.53	1.01	2.00	1.03	182.93	1.00	14.09	0.96	74.01	0.86	43.14	0.98	45.67	0.94	151.20	0.92	0.070	1.03	45.56	0.96	0.115	0.82	0.95
W7	5.44	0.84	2.14	1.09	193.47	1.06	17.62	1.20	82.20	0.95	45.92	1.04	46.99	0.97	170.71	1.04	0.074	1.09	42.47	0.90	1.104	0.74	0.98
W8	5.51	0.86	2.19	1.12	173.30	0.95	17.23	1.17	80.89	0.94	38.7.	0.88	42.88	0.89	145.10	0.87	0.069	1.01	41.57	0.88	0.094	0.67	0.92
W9	5.74	0.89	2.20	1.13	162.63	0.89	16.46	1.12	63.58	0.74	45.90	1.04	38.21	0.79	144.00	0.88	0.060	0.88	41.24	0.87	0.079	0.56	0.87
W10	5.85	0.91	2.22	1.14	166.23	0.91	16.33	1.11	61.74	0.71	36.53	0.83	38.05	0.79	152.20	0.93	0.062	0.91	39.40	0.83	0.068	0.49	0.85
W11	5.98	0.93	2.30	1.18	138.13	0.77	14.96	102	53.75	0.62	51.21	1.16	38.06	0.79	118.59	0.72	0.046	0.68	37.08	0.78	0.061	0.44	0.79
W12	5.54	0.86	2.35	1.20	104.17	0.57	13.91	0.95	49.60	0.57	49.22	1.12	38.49	0.80	103.44	0.63	0.043	0.63	36.02	0.76	0.056	0.40	0.74

A=Avarage Concentration (Fe and Al in z and others in µg/g, B=Contaminatise Factor.

Table 6.5 : Comparison of Results with guide line values of water

Parameters	*Present Study*	*WHO (1984)*	*Max. Ads. Con. (MAC)*	*Remarks*
DO.	6.5-15.0	6.0 (min)	----	Except Fe. all the values are within the limits as proposed by WHO/ISI. The high iron con. needs measures to taken before being used for human consumption.
BOD.	1.3-2.92	6.0	----	
COD.	2.38-5.55	10.0	----	
pH.	7.06-7.71	6.5-8.5	----	
TDS.	91.1-151.9	max. 500	----	
Fe.	0.48-2.72	0.3-0.5	----	
Mn.	0.0101-0.077	0.5	----	
Pb.	0.003-0.032	0.05	0.05-50.0	
Zn.	0.0012-0.0096	5.0	----	
Cu.	0.0012-0.0086	1.3	----	
Cr.	0.006-0.0058	0.05	0.05-50.0	
Cd.	0.0002-0.0056	0.005	0.005-5.0	
Hg.	0.000006-0.00095	0.001	0.001-1.0	

Except pH all the values are expressed as mg/lit.

CONCLUSION

It is a common parley that increasing industrial development along with population growth and environmental degradation are inevitable concomitants of economic development. These developments have affected the developed countries as well as developing countries.

Geoscientific studies will have to play a key role in understanding the environmental degradation of water/sediment systems and to suggest measures for minimising it. The sediments are potential carriers of organic compounds and metals from the watershed to the receiving body and on the other-hand they play a significant role in the attenuation of toxic elements in polluted aquatic environment.

The river Jhanji within the Brahmaputra river system attracts the attention of the common people towards its environmental destabilization. A multidisciplinary detailed study with critical evaluation is a prerequisite to look into the problem both by quantitative and qualitative manners. The river water which are utilised by the people for their personal use since historical times should not be allowed to be contaminated by any means.

KEY WORDS AND ABSTRACT

KEY WORDS Geoenvironmental. Jhanji. Physiochemical. Basin. Discharge.

ABSTRACT The Jhanji river basin covering an area of 1350 sq km, on the southern side of the mighty river Brahmaputra, occupies a significant position. The water and sediment discharge data for a span of twenty years (1971-1991) exhibit maximum daily average sediment discharge of 8215 metric tonnes in July 1976 with corresponding water discharge of 130m^3 sec^{-1}. The mean annual sediment load during the period is 2,52,015 metric tonnes. The river represents an overall soil denudation rate of the order of 0.11 mm/year. Like other Indian rivers, this river also exhibits an almost alkaline nature with average pH value of 7.4. DO, BOD and COD values are within acceptable limit (WHO, 1984). The HCO_3 signifies the existence of dominant silicate weathering within the basin. Chlorite, kaolinite and illite are the significant clay minerals. Expect iron all the trace metal content in water and sediment fractions are within the tolerance limit. A pretreatment step is necessary to remove iron before being used for human consumption.

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Authors' Address : **P. Kotoky, J. Baruah, N.K. Baruah**, Regional Research Laboratory, Jorhat 785 006, Assam, India
J.N. Sarma, Reader, Department of Applied Geology, Dibrugarh University, Dibrugarh 786 004, Assam, India

Glacier Outburst Floods Threatening the Settlement Shimshal (North-West-Karakorum)

Lasafam Iturrizaga

INTRODUCTION

The high mountain village Shimshal (3080-3200 m, 36° 26' N/75° 17'E) located on the North-declivity of the Karakorum Main Ridge, is surrounded by three potential glacier dams in the upper course of the Shimshal valley (Fig. 7.1). In this century the settlement Shimshal was several times affected by the sudden outburst of glacier dammed lakes. The village lost nearly a third of its scarce settlement area. The locations of settlements are mainly restricted to the sediment accumulations of the valley floors, *i.e.* mudflow fans, the alluvial fans, the glacial terraces and morainic deposits. Due to the aridity in the valley floors agriculture is only possible by means of irrigation. In Shimshal, the meltwater streams of two lateral glaciers, the Hodber and the Chukurdas, are used for irrigation. Glacier oscillations represent a permanent threat for the persistence of the irrigation channels and therefore for the existence of the oasis Shimshal.

THE GLACIAL SITUATION IN THE NORTH-WEST-KARAKORUM

In the present time 30 large scale glacier dams exist in the upper Indus valley and in the Yarkand valley; since 1826,35 glacier outbursts have occurred (Hewitt, 1982:259). In the Karakorum Mountains nigh valley floors at a height between 4500 and 2500 m in combination with high catchment areas of up to 8000 m favour the formation of an expansive valley glaciation, the largest glaciation outside the Antarctic. Glaciers of several deca-kilometer length descend to the subtropical warm and arid valley floors with not more than 100-150 mm/a precipitation. The Karakorum-North-declivity sends six large glaciers down to the Shimshal valley: the Lupghar glacier (13 km), the Momhil glacier (35 km), the Malangutti glacier (23 km), the Yazghil glacier (31 km), the Khurdopin glacier (47 km) and the Virjerab glacier (35 km). The last three glaciers represent potential glacier dams in the Shimshal valley (Fig. 7.2). The snowline runs between 4800 and 5300 m depending on the different expositions. Up to 65% of the annual runoff in the Karakorum Mountains, of which the major source is melt water occurs in the month of July and August (Ferguson, 1984:584). Apart from seasonal flood events caused by meltwater peaks, glacier outbursts can exponentially increase the discharge amount. Peak discharge amounts of 6270 m^3/s are known from the glacier outburst flood at the 4. Sep. 1961 from the Kagun glacier in the East-Karakorum. The flood volume was 1.5 x 10^8 m^3 (Feng Quinghua, 1991 : 258).

THE POTENTIAL GLACIER DAMS IN THE SHIMSHAL VALLEY

Figure 7.2 shows the location of the Virjerab glacier, Khurdopin glacier and Yazghil glacier in the upper head area of the Shimshal valley, 10 km valley upwards from the settlement Shimshal. The Khurdopin glacier enters with its totally debris-covered glacier tongue into the Shimshal valley at a height of 3400 m and stretches over a distance of 5 km. The highest catchment area of the Khurdopin glacier rises with the Kanjut Sar up to 7760 m. The orographic right hand side of the Khurdopin glacier almost dams the valley exit of the neighbouring Virjerab valley. The corresponding meltwater streams are restricted to a narrow river bed of some decameters between the lateral moraine of the Khurdopin glacier and the orographic right hand side of the Shimshal valley. The Virjerab glacier ended in August 1992, 1500 m before its valley exit. A distance of 5 km separates the tongue of the Khurdopin glacier from the Yazghil glacier. The Khurdopin glacier terminates at a height of 3300 m with a flat endmoraine. In the transition zone between the glacier tongue and the end moraine a lake of 300 m length and 50 m width has developed. Its drain-

Directly westwards of this locality described the Yazghil glacier joins the Shimshal valley (Fig. 7.3). The highest point of its catchment area culminates in the 7852 m high Kunyang Chhish. The "white", debris-free glacier tongue expands in the shape of a hammer-head at a height of 3190 m on the Shimshal valley floor. The glacier itself separates into two branches, which broke through its original morainic mantle. The bifurcation of the glacier tongue can be explained by the fact that the Yazghil glacier is pressed into a relatively narrow valley course and the broad Shimshal valley floor allows an expansion of the ice masses. The frontal moraine also represents a certain resistance against the advancing of the glacier tongue. The Shimshal river is restricted to a narrow river bed between the orographic right hand flank of the Shimshal valley and the Yazghil glacier tongue. A further advance of the Yazghil glacier would undercut the late-glacial moraines (*c.f.* Kuhle, 1995) on the orographic right hand side of the Shimshal valley. Large scale landslides would be the consequence. Two major damming localities are present due to the bifurcation of the glacier tongue. The end moraine of the orographic right hand side of the glacier has already been partly swept away by former glacier outbursts caused by the Khurdopin glacier. Besides the fact that the Yazghil glacier breaks through its end moraine, the glacier shows other signs of an advance. On the orographic right hand side, at a height of 3700m, the glacier undercuts its adjacent kames. The ice masses break through their lateral moraine, which is also locally absent. A little bit further valley upwards a lake has been dammed in a lateral glacial valley due to the advance of the Yazghil glacier in the year 1986. At its present stage the lake is 60 m long and 15 m broad. Lake terraces upslope indicate the former higher water level. The volume of this lake (c. 9000 m^3) is not sufficient to threaten the settlement of Shimshal by a flood event.

The Malangutti glacier lies valley downwards of the settlement Shimshal. Accompanied by lateral moraines up to 200 m high the glacier almost blocks the Shimshal valley. Moranic deposits on the opposite side of the glacier tongue on the orographic right hand side of the Shimshal valley prove a former glacier tongue position. At present, the Shimshal river has just enough space to flow through this narrow pass; its drainage is partly subglacial. On the opposite side of the glacier tongue a small settlement is located. In contrast to the upper Shimshal valley area, the meltwater streams of the Shimshal-Pamir and the upper Shimshal catchment area are added and therefore a larger hydrogaphic network would be dammed in case of a blocking by the Malangutti glacier. In regard to the settlement Shimshal a potential lake would flood the flat parts of the settlement area. High deposited lake sediments are geomorphological evidence of a former postglacial lake.

HISTORICAL GLACIER OUTBURSTS IN THE VALLEY OF SHIMSHAL

The glaciers discussed here caused in the past several extreme flood events in the Shimshal valley. These floods occurred in the last 100 years on an average of every nine years (s. Charles, 1984:89). But it is not clear whether the Malangutti glacier, the Khurdopin glacier or the Yazghil glacier were responsible for the blockade. The extreme flood events all occurred in the summer months of June and August. This seasonal occurrence is linked with the annual temperature change in the subtropical high mountains. With increasing temperatures in the summer months which can rise up to 35°C, melting processes are induced, causing a higher discharge rate. The warmer water temperature can also enlarge subglacial drainage channels and destabilise ice dams. If a blocking of the main river course happens in the summer time, when the drainage rate shows at least several 100m^3/s, the water level rises very quickly. But in particular mass-movements in the slope areas, caused by heavy thunderstorms (like the one in July 1959), can be swept into the lake and the water level will be suddenly raised. The occurrence of flood events in subsequent years (1905-1907 and 1957-1961) indicates lakes which are dammed by glaciers. From the Shyok valley a comparable situation is known: The Kumdun glacier tongue dammed the Shyok valley every two years in the 1930's, followed by catastrophic flood events (Visser, 1938 : 90). Before the outburst of the Khurdopin glacier lake, the lake was 3.5 km long, 1.5 km broad

Fig. 7.3. View from 3850 m northwards to the Yazghil glacier tongue (3200 m) entering the Shimshal valley
(Photo: M. Kuhle 22.08.1992)

and 88m in depth (Hewitt, 1982:263). Supposing a dam height of 100 m the glacier lake could attain a volume of c. 375. Mill. m^3 water.

GLACIER OUTBURST FLOODS AND THEIR EFFECTS ON THE SETTLEMENT SHIMSHAL

The village Shimshal lies 40 km eastwards of the main settlement concentration of the North-West-Karakorum, the Hunza valley. Shimshal is divided into several settlement areas, which are spread over a distance of 10 km on the distinct sediment accumulations along the Shimshal river. The settlement ground lies at a distance of 9-14 km from the potential Yazghil and Khurdopin glacier dam. A valley floor which is up to 2 km broad connects these two localities. The settlement ground of Shimshal lying between two end moraines of the side valleys shows a convex indentation which was caused by undercutting processes due to glacial flood events. According to the inhabitants of Shimshal, the settlement area of "Shimshal-Centre", the oldest settlement part, reached in former times 300 m nearer the river bed (Iturrizaga, 1994 ; 70). In 1925, the core settlement area, the so called "khan-area", was still existent (Visser, 1925: 47-48). In the years before glacier outbursts had already reduced the limited settlement ground. "Shimshal-Centre" is located on a flat glacio-fluvial sediment fan and is, in comparison to the adjacent mudflow fans with escarpment heights of 40-60 m, very exposed to flood events. In former times the main part of the khan-area occupied in a central position, but nowadays the remains of the khan area occupy a marginal position directly on the shoreline. The present central position is occupied by the Jamaat Khana, the prayer house of the Isamelitic Shimshalis. After a partial destruction of the khan-area the end of the 50's by a flood event, the concentrated pattern of settlement was changed. The farm houses are now isolated or in house groups scattered over the field area. The advantages of the khan-area, which was primarily designed for defence purposes, were, apart from its space-saving aspects, protection against the cold high mountain climate through a minimal number of outer walls. In particular long transport distances between the field area and the farm houses supported the new settlement form close to the corresponding field areas. Nowadays the settlement of Shimshal includes 135 households.

In the Shimshal area technical protection against floods was not present, whereas in other remote valleys, like the East-Karakorum for example, although they were much less affected by floods events, extensive flood prevention measure could be observed. The dimensions of the flood events in Shimshal seem to lower the motivation for effective prevention measures.

Not only was the settlement Shimshal badly affected by the glacier outburst in the year 1959, but also the settlement Pasu (2650 m) which lies 50 km westwards of Shimshal. At the valley exit of Shimshal the flood height rose up to 30 m (Finsterwalder, 1960:787). The gorge shape of the valley exit canalized the flood masses, increased their speed and raising the water level.

CONCLUDING REMARKS

At the present time lakes due to glacier damming could not be observed, but glacier advances of only tens of metres could block the Shimshal valley and provide the conditions for severe flood events. The location of the settlement Shimshal, in the vicinity of the potential glacier dam localities, proved to be not more unfavourable than the location of the village of Pasu, 60 km away from the Khurdopin and Yazghil glaciers in the upper Shimshal valley. The isolated location, which seems be quite exposed to natural hazards - but not more so than settlements in the Hunza valley - provides for the c. 1000 inhabitants of Shimshal and their yak herds extensive pastures, while in the main valley of Hunza, the pasture ground is due to the high population very scarce. The hazard of glacier lake outburst is considered by the inhabitants not as primary a natural danger, whereas mass movements like rockfall and mudflow events, which are highly frequent processes, represent for them a permanent source of danger.

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KEY WORDS AND ABSTRACT

KEY WORDS Natural Hazard. Glacier Lake Outbursts. Remoted High Mountain Settlements.

ABSTRACT The high mountain settlement of Shimshal comprising 135 households, as being surrounded by three potential glacial dams in the upper course of the Shimshal valley, is affected by sudden outburst of the glacier dammed lakes. The settlement which is restricted to sediment accumulation of the valley floors consisting of alluvial and morainic deposits, is also ravaged by glacial flood events. In the arid valley agriculture is possible only by means of irrigation. However, the hazard of glacial lake outbursts is considered to be less primary natural danger than the high frequent processes of mass movements like rockfall and mudflow events.

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Author's Address : **Lasafam Iturrizaga**, Institute of Geography/Highmountain Geomorphology, University of Goettingen, Goettingen, Germany

Land Degradation in Arunachal Pradesh : An Aftermath of Natural Disaster

S.C. Goswami

INTRODUCTION

Land degradation in Arunachal Pradesh is the result of both human activity and natural factors. Arunachal Pradesh lies in a high rainfall belt. When a hill slope is covered by vegetation, the soil loss is minimum because the vegetation provides a cushion effect by preventing rain drops from directly hitting the soil at great force. Soils constitute some of the most basic natural resources possessed by mankind because they form the substratum in which terrestrial plant life is rooted. Majority of the tribal population of Arunachal Pradesh are dependent on a shifting type of cultivation called "Jhumming". The hill slopes, much of which should have been under permanent vegetation cover, are being burnt and laid bare for "Jhumming" resulting in erosion of top soil, vital for agricultural production. Landslide also causes land degradation as it causes the movement of surface and near-surface soils down slope and towards river valleys and coastlines impeding agricultural and forest productivity in hill slopes. The principal factors which initiate or trigger landslides are : (i) heavy and prolonged rainfall; (ii) excavations on hill slopes for construction of road, building etc., and (iii) earthquake shocks and tremors. All these factors operate in the Arunachal Himalaya region resulting in high incidence of landslides that cause frequent distruption of surface communication to the rest of India and large scale degradation of land.

SEISMIC EFFECTS

The release of energy from earthquakes results in seismic waves travelling through the ground which gets accelerated. Such dynamic loading increases the shear stresses in a slope and decreases the volume of voids within the material of the slope leading to an increase in the pressure of fluids in pores and fractures. Thus shear forces increase and the frictional forces to resist them decrease. The factors which affect the repose of a slope are: (i) the magnitude of the seismic accelerations, (ii) the dynamic strength of the materials affected, (iii) the dimensions of the slope, and (iv) the duration of seismic accelerations.

Bolt et al. (1975) discussed seismic effects on landslides. During and following 1971 San Francisco California Earthquake, thousands of landslides occurred in the Sun Gabriel mountains and caused a prominent dust cloud over the strongly shaken area for days together. Arunachal Pradesh lies in an area that ranks among the most active seismic belts of the world. Therefore it is no wonder that large scale landslides should occur in parts of Arunachal Pradesh in response to the Great Assam Earthquake of 1950.

THE GREAT ASSAM EARTHQUAKE OF 1950

At 19 hrs. 39.5 minutes I.S.T. (14 hrs. 09 minutes G.M.T.) on 15th of August, 1950 there occurred off the north-eastern boundary of then Assam an earthquake whose violence and intensity rank as one of the greatest of which we have historic records. It was felt over an area of about 44,02,979.6 square kilometers. It caused in present Arunachal Pradesh and Assam, extensive landslides and rock falls, subsidence of ground, gapping features, oozing of sand, mud and water rendering cultivable lands unserviceable, and destruction and damage in varying degrees to buildings, roads, railways, bridges and telegraph and telephone posts and lines. Banerjee (1953) estimated the energy of this earthquake of magnitude 8.6 to be of the order of 10 ergs. Paramanik and Mukherjee (1953) recorded position of the epicentre at 28°06'N and 96°00'E. According to them, the nature of the shock was of tectonic origin, the depth of focus being some 14 km below the surface. They, however, estimated the energy of the shock at 3×10^{27} ergs and noted that the duration of the earthquake's main shock was of about 4 minutes. From the destruction and damage caused, the acceleration at the epicentral region was estimated by them to be of the order of 0.5g.

EXTENT OF LANDSLIDE

An aerial reconnaissance revealed the gigantic

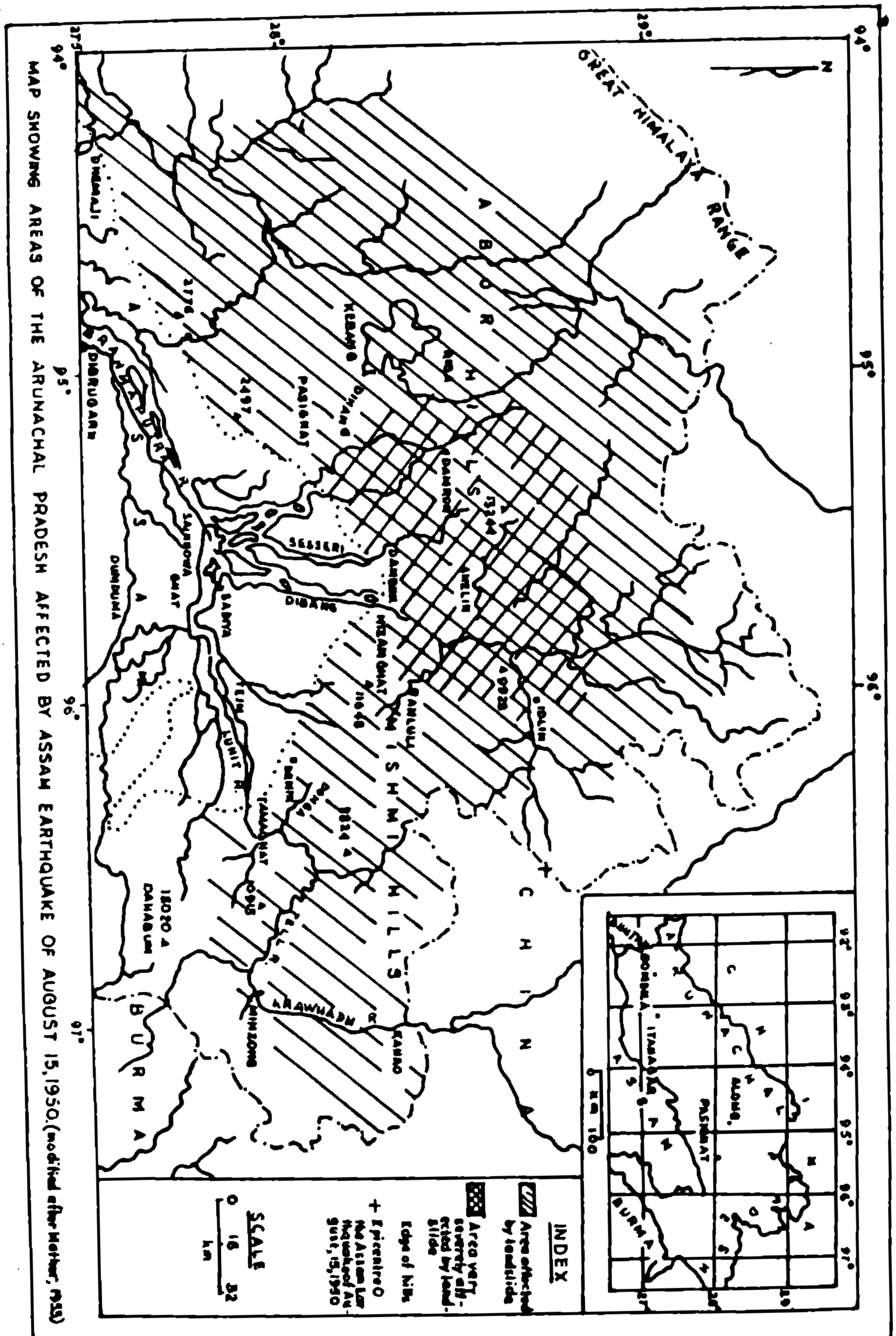
MAP SHOWING AREAS OF THE ARUNACHAL PRADESH AFFECTED BY ASSAM EARTHQUAKE OF AUGUST 15,1950.(modified after Molter, 1953)
GREAT HIMALAYA RANGE
ABOR HILLS
MISHMI HILLS
CHINA
BURMA
ASSAM
INDEX
Area affected by landslide
Area very severely affected by landslide
Edge of hills
+ Epicentre of the Assam Earthquake of August 15,1950
SCALE
0 16 32
km
DIBRUGARH
SADIYA
DIBANG
LOHIT R.
PASIGHAT
SESSERI
DAMBUK
MIZAMGHAT
TEZU
KAHAO
DUMDUMA
SAIKHOWA GHAT
KEBANG

Fig. 8.1

scale on which landslide had occurred in the Abor and Mishmi Hills between the Subansiri and Luhit valleys of the present day Arunachal Pradesh as a result of the Great Assam Earthquake of 1950 (Fig. 8.1). To the west, the affected region ended abruptly at Ranga Nadi (27°20' : 94°00), immediately to the east of which the landslides were seen on the outer hills only. In the inner ranges, much landsliding was not noticed to the west of Subansiri but eastwards the landsliding increased progressively. The worst affected area was between the Dihang and Dibang valleys. Here hills several thousand feet high were sheared from top to bottom. The scale of landsliding was reported to be more in crystalline rocks than in the Tertiary sedimentary rocks. In general, landslides appeared to be dominant on the southern slopes of the hills.

Landslides east of longitudes 96°00', though quite considerable, appeared somewhat less in extent than those to the west. Some areas such as those to the northeast of Tidding valley were, however, very severely affected. The entire region affected by landslides - about 15,539.92 sq km - once covered with lush vegetation became a region bare of vegetation. The depth of landslides was estimated at 3 to 30 metres. An enormous volume of soil and rock got removed downslope.

STRIKING ENVIRONMENTAL IMPACT

A considerable portion of the debris from landslides directly fell into the rivers filling their gorges and blocking their courses. Big blocks fell into the Subansiri, Dihang, Dibang and Luhit rivers and also into most of their tributaries. Most of these blocks burst a few days after the earthquake causing destructive flash floods in the rivers. The flash floods carried down the slopes huge quantities of sand, silt and tree-trunks more than the carrying capacity of the rivers. As a result the river beds got silted up.

As the blocks in the tributaries burst successively, there were repeated floods in some rivers such as the Dibang. The silt deposited in this river near Eragaon, about 10 km north-east of Sadiya, was reported to be over 8 metres thick. The level of banks were raised due to silting during over-flooding. The outfalls of the tributaries were blocked and as a result they spilled all over the country side.

The impact of landslides, caused by the Great Assam Earthquake of 1950, on the Brahmaputra river and its northern tributaries had been long-lasting. With their catchment areas laid bare of vegetation, their gorges in the hills full of debris and with their beds in the plains silted up, the Brahmaputra and its northern tributaries continued to be in high floods for many years after the Great Assam earthquake of 1950.

KEY WORDS AND ABSTRACT

KEY WORDS Natural Disaster. Shifting Cultivation. Tribals. Himalayas.

ABSTRACT Land degradation in Arunachal Pradesh is attributable to both human activity and natural factors. The tribal population of Arunachal Pradesh practise shifting cultivation called "Jhumming" for which the permanent vegetation cover of hill slopes is burnt. The bare hill slopes then get degraded due to erosion of top soil, vital for agricultural production. Landslide also triggers land degradation in Arunachal Pradesh as it causes the movement of surface and near-surface soils down slope and towards river valleys and coastlines impeding agricultural and forest productivity. One of the principal natural factors which triggers landslides is earthquake. In this paper, the extent and impact of landslides as observed in the present day Arunachal Pradesh following the Great Assam Earthquake of 1950 are discussed.

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Author's Address : S.C. Goswami, Department of Applied Geology, Dibrugarh University, Dibrugarh 786 004, Assam, India

III. BIODIVERSITY AND ECO-DEVELOPMENT

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Conservation of Biodiversity and Eco-development in North-Eastern Region of India

T.C. Sarma and S.C. Nath

INTRODUCTION

The North-Eastern region of India is comprises of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura. The total geographical area is 2,55,037 sq km with hills and plains. This region is about 8% of India's total area. Physiographically, it is divided into three divisions : (i) The Meghalaya plateau (ii) The North-eastern hills and basin and (iii) The Brahmaputra valley. The North-eastern hills include the Himalayan ranges in Arunachal Pradesh. The Brahmaputra valley represents the sub-Himalayan feature of biogeographical zone in the eastern India. Approximately, 47% of the total geographical area is under forest, representing half of the total flora of the Indian Sub-continent.

This region represents almost all types of vegetation ranging from (a) tropical and sub-tropical vegetation with dense forest of *Shorea robusta*, different species of *Adina, Dalbergia, Dillenia, Bauhinia, Anogeissus, Litsea, Lagerstroemia, Terminalia* and palms more of green elements of epiphytes (b) The temperate vegetation extends on elevation from 1,500 to 3,500 metre and contains mostly broad leaved deciduous forests of different species of *Quercus, Michelia, Rhododendeon, Acer, Symplocos, Abies, Larix, Picea, Taxus* etc. representing coniferous belt and (c) The alpine vegetation represents the presence of various species of *Juniperus, Rbododendron* (bushy type), *Androsace, Arenaria, Cassiope, Saussurea, Meconopsis, Iris, Lloydia, Primula, Potenlilla, Corydalis, Epilobium, Delphinium, Sedum, Stellaria* etc. In this region, temperate plants dominate and elements of Chinese, Japanese and Malayan plants also occur. In a nutshell, this region is the treasure house of different flora and fauna.

The plant and animal worlds are facing a critical threat of imbalance and extinction in the world, and out of 18 such susceptible areas, the North-Eastern region of India is one of them. Among 12 great areas of 'Biological Diversity', India is very important. Here deforestation, erosion, flood etc. are causes for destruction of biological world and creation of desert.

Swaminathan has rightly pointed out that some of the dense reserve forests are facing destruction owing to social trouble, ethnic quarrel, poacher's stealing of timber etc. and the region becomes the paradise of anti-social elements.

To conserve the forest areas, if necessary, military or State Task forces should be employed. The present need for the region is to form a task force to preserve the bio-diversity of the region. This region is rich in different varieties of rice, orchards, orchids, bamboos and aromatic and medicinal plants. Swaminathan is of the opinion that this region should fix a target to accrue income of Rs. 1,000 crores per year within the year 2000 AD. Approximately, commodities of Rs. 2,50,000 crores are produced presently from medicinal plants in the world. Though India can be proud of being the home land of a large number of medicinal plants; it produces goods worth of Rs. 1,000 crores only from its medicinal wealth.

NORTH-EAST ECO-SYSTEM

The North-Eastern region of India is a juncture of Himalayan and Sub-Himalayan regions. It represents an extremely fragile and complex eco-system. Varied altitudes and physiography contribute to a great deal of climatic variations representing temperate, sub-tropical and tropical areas. The Himalayan ranges in Arunachal Pradesh extend upto 5000 m, the highest peak Kangto being 7090 m, above the mean sea level. This region is characterised by high rainfall and humidity. Rainfall varies from 1200 to 5000 mm annually. The highest rainfall of 12000 mm per year is recorded in Mawsynram of Meghalaya. Likewise, the region is featured as one of the wettest zones of the world. Thus, the ecological diversity due to variation in topography, elevation and overall monsoon pattern provides an unique status to this region. It is rich in vegetation and bio-diversities.

The vegetation occurring in this region are classified as:

(a) Tropical Evergreen Forests,
(b) Tropical Moist Deceduous Forests,
(c) Sub-tropical Forests,
(d) Mountain Temperate Forests,
(e) Temperate Forests,
(f) Alpine Forests and
(g) Wetlands

Likewise, this region has 5000 species of flowering plants (Khashoo, 1992) out of 17000 species that grow in the sub-continent, while the entire Himalayan belt contains 8000 species. Out of 6850 species endemic in India, there are 3165 species confined to the Himalayas alone (Chatterjee, 1939).

A large number of endemic species are found in North-east India, too. The Brahmaputra valley with tropical and sub-tropical forests represents a high degree of species richness with evolutionary activity, resulting in pockets of high degree of endemism. The valley is also beautified with herbivorous animals like the famous one-horned rhino, buffalos, swamp deer, hog deer, pygmyhogs and hespid (Rodgers and Panwar, 1988). This region is having typical grass lands that are grazed by these animals. With the rise of the Himalayas, there were many micro-climates due to altitudiual and latitudiual factors leading to large number of small, rather isolated pockets. Such a situation not only isolated geographically many widespread species, but also presented newer sites for colonization. 'Sang gai' - an endangered deer species found in the swampy area of Logtok lake is an example of location specific fauna.

The North-eastern region of India is a homeland of people belonging to diverse ethnic and tribal groups (Table 9.1), with different socio-economic and socio-cultural norms. The total population of the region is more than 19,582,296 out of which 59.07% is tribal, against the country's total tribal population of 6.94%. Popultion belonging to rural background comprises 90.57% and most of them are living in the isolated pockets and remote areas maintaining their tribal solidarity with a primitive state of economic life. These people form the predominant elements of rural ecosystem in the region. The rural setting of the region is based on ecological socio-economic and cultural factors, and on the interactions between the human and natural resources. Thus, land and water form the backbone of the resource base in the region for agriculture, forestry and animal husbandry.

The resource base of North-east India has been threatened considerably due to the biotic factors. Population pressure and indiscriminate exploitation of land and water resources of the hills and plains has brought about large scale landscape transformation that has impact on hills as well as the adjacent plains. Deforestation, shifting cultivation (Jhum) and tree-felling have created grave damage to the ecosystem. As a result of encroachment, tree-felling etc., the area under dense forest got reduced to 26% only (Table 9.1). Ideally speaking, the forest cover in plains should be 33% and in hill regions, 60% of its geographical area. Arunachal Pradesh fulfills the requirement, whereas the three State - Mizoram, Nagaland and Tripura donot have the required protected area under forest. The soil eco-system and the biodiversity of this region are being constantly disturbed owing to jhuming practices in the hill areas, forest burning, urbanization and mining op-

Table 9.1: Geographical and forest area of N. E. India with its tribal and rural population*

S. No.	*States*	*Geographical area, sq km*	*Forest area percentage*	*Population %*		*Tribes (Nos.)*
				Tribal	*Rural*	
1.	Arunachal Pradesh	83,578	65.13	79.02	96.30	110
2.	Assam	78,522	20.19	10.99	91.18	34
3.	Manipur	22,356	23.77	31.18	86.81	15
4.	Meghalaya	22,489	14.75	80.48	88.45	39
5.	Mizoram	21,087	20.29	94.26	88.64	39
6.	Nagaland	16,527	21.29	88.61	90.05	39
7.	Tripura	10,477	17.40	28.95	89.57	13
	Total	265.036	26.11	59.07	90.50	-

Source : *Basic statistics of North eastern region 1980, NEC publication, Government of India, Shillong eration etc. Available land is being lost to erosion and lands have become unculturable due to natural and manmade factors. The wastelands in North-East India is estimated to be 97.21 lakh hectar. Statewise area is given in table 9.2.

Due to loss of habitat, the eco-system is disturbed and the plant population got reduced. Even many species become endangered and disappeared. A list of endangered plant species from North-east India is enclosed at *Appendix* 1.

Table 9.2 : Wasteland in North East India

States	*Area (Lakh hectares)*
Arunachal Pradesh	14.90
Assam	17.30
Manipur	14.34
Meghalaya	19.18
Mizoram	7.90
Nagaland	13.86
Tripura	9.73
Total	97.21

Hotspots in North-East India

The North-East region is very rich in flora and fauna. It is considered to be the original home of many species. The rare insect eating plant - the pitcher plant (*Nepenthes khasiana*) is found in Meghalaya. Among the fauna, it abounds with all kinds of cat from the Royal Bengal Tiger to the clouded Leopar, Leopard cat, wild cat and the one-horn Rhinoceros. It is also the home of the Binturony (*Arcticitis binturong)* - a rare animal, so also the Hoolock (*Hylobates hoolock*), the only true ape found in India. There are a number of special features in this region, and because of such importance the whole area is potted as 'Hot spot'. Twenty-six 'hot spots' have been identified in India, where high rate of deforestation and endemicity exists (Khoshoo, 1991). One of these is the Himalayan belt as a whole. It constitutes one mega hotspot, eight areas in the Himalayas are specially critical. Arunachal Pradesh, Mizoram and Meghalaya are well represented in the list. Other parts of North-east India, particularly the hilly areas, are internationally recognised as 'Hotspots' (Mayer, 1981).

Conservation of Biodiversity

Biodiversity and bioproductivity are interdependent and that is why they are critical for the survival of mankind. The poor section of the society mainly depends on the biomass from diverse flora and fauna. At one time, agriculture was essentially based on high diversity with low productivity. The green revolution agriculture is based on the high productivity and low diversity. In fact, eco-development is a movement for restorative ecology and is based on the willing participation of local people to generate sustainable biomass base at very grass-root level. Obviously, it depends on plant and animal diversity of relevance to the local environment and its people (Khoshoo, 1992c).

Khoshoo (1991) was of the opinion that conservation of biodiversity has lagged behind in the scientific and technological context. Due to the tropical and sub-tropical agro-climatic conditions, this region is vastly rich in biodiversity both in species and genetic level. Genetic level is a critical input to agriculture, horticulture, forestry, animal husbandry, fisheries and bio-industry. Its role in the development of hill agriculture is well recognised (Joshi and Rathore, 1986).

In-Situ and Ex-situ Conservation

The conservation of biota is a holistic concept. While it encompasses the whole spectrum of activities from *in-situ* conservation dealing with population, communities and eco-systems on one hand, it deals with *ex-situ* involving botanical garden, arboreta zoos and zoological gardens and biological banks for storing pollens, seeds, sperms, egg embryos, tissues, organs and genes on the other.

The protected area network in North-east India includes an area of 26,214 sq km (Table 9.3). Proposed biosphere reserves that fall in the region are:

1. Manas - 2837 sq km
2. Namdopha - 7000 sq km
3. Nokrek - 60 sq km
4. Kazirange - 37823 sq km

Table 9.3 : Existing and proposed areas under conservation in North-east India

Biome	*Total area*	*Area under Conservation*			
		Existing	*Per cent*	*Proposed*	*Per cent*
Arunachal Pradesh	83,000	3,764	4.5	11,187	13.5
Brahmapurta Valley	63,200	1,280	2.0	4,030	6.2
Other NE Hills	106,200	602	0.5	5,351	5.0
Total	252,400	5,646		20,568	-

Total protected area (5646+20568)=26,214 sq km

The total area constitutes about 9.8% of the region. Based on the availability of biomass in an eco-system, plant consitutes upto 90% biota followed by fungi, bacteria, earth worms, anthropods, algae, protozoa, human-kind, wild animals and birds. The last two constitute only about 0.008% (Khoshoo, 1988).

'Sacred Groves' and Biosphere Reserve

'Sacred groves' is an old concept for protection of plants and animals. In Meghalaya, tribal people keep some pockets of forests undisturbed and thereby the important vegetation resources are protected representing the original flora and fauna of the locality. The concept of 'Sacred Groves' stops deforestation and leads to the formation of 'Biosphere Reserve' like Nambor forest of Assam.

Ecology Park and Botanical Garden

To preserve the important flora from extinction, large area should be covered under Ecology Park or Botanical garden, where representatives of plants belonging to the seven States can be acclimatised and regenerated. The North-East Ecology Park (NEEP) has already come into being in the Regional Research Laboratory, Jorhat. It is a bold step forward for conservation of rare and endangered important plants of this region. Enterprises like NEEP and Botanical garden should be encouraged for conservation of biodiversity of the region.

Gene Bank

In conserving the biota of the region both living and non-living, herbarium gene banks should be maintained. Gene banks for the endemic or location specific species must be kept like the sacred groves.

North East Biological Diversity Conservation Task Force

To protect the biosphere reserve, national sanctuary and forest areas with biological diversity, emphasis should be given in forming a Task Force of North Eastern region for conservation. To form such a security force, the common council - the North-Eastern Council, Shillong should take the initiative.

Resources Utilization

Though the North-east region is full of natural resources, the proper utilization is not being made in many spheres. Land and water resources are very vast. The agricultural system that is followed in the hilly areas is very critical for socio-economic development. The whole system becomes very complex and therefore, a concept of 'Green Technology' needs to be developed incorporating the modern agro-forestry system in traditional farming system, so that the land and water resources could be properly managed.

The process of development entails exploiting of a country's natural resources. Their indiscriminate exploitation results in degradation and depletion of these resources and ultimately leads to a situation of ecological imbalance, with an adverse effect on the quality of life of the present and future generations (Sahani, 1993).

Awareness for Eco-Conservation

The literacy level in this part of the country is indeed low, and the people are not environmentally conscious. Unless the people are ecofriendly and educated, it is a difficult task to conserve the ecosystem. Even though man has achieved spectaculare progress in the field of science and technology, he is not so aware of his environment. Our own activity may make this planet, which is endowed with the life supporting environment, a dry habitat incapable of holding of life form. It is, therefore, high time to educate people regarding conservation biodiversity and building public opinion against the assault on environment. It should not be forgotten that the human beings are also an element of nature. Over-exploitation of nature is fraught with the grave danger of destruction of the mankind itself.

KEY WORDS AND ABSTRACT

KEY WORDS Biota. Hot-spots. Ecosystems. Ecological Parks. *In-situ* Conservation. Sacred Groves.

ABSTRACT North-Eastern region of India with 2,55,037 sq km geographical area is the homeland of 50 per cent total flora of Indian sun-continent. More than 3000 plant species of medicinal value occur in Assam alone. The plant and animal worlds of this region are facing a critical threat of imbalance and extinction. The whole region, particularly the hilly areas are internationally recognised as "Hot-spots". The conservation of biota is a holistic concept and encompasses the whole spectrum of activities from *in-situ* conservation dealing with population, communities and ecosystems, on one hand and on the other, it deals with *ex-situ* involving Ecological parks, Botanical gardens, Arboreta Zoos, Zoological gardens, Gene banks, preservation of

biosphere reserve maintaining 'Sacred Groves'. Conservation Task Force for protection of environment, judicious use of natural resources and arousing awareness for conservation of our own environment.

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APPENDIX 1

Endangered Plants of North-East

Abies delavaryi, Plcea brachytyla, Cephalotaxus griffithii, Cyathea gigantea, Angi-opteris evecta, Helminthostachys zeylanica, Osmunda regalis, Psllotum nudum, Botrychium virginianum, Bralnea insignis, Magnotia pterocarpa (beloved to be a most primitive living *angiospermous* plant), *M. griffithii* and *M. qustavi* (endemic to Upper Assam) *Tetracentron sinense* var *himalense* Bomdila-Arunachal : an ancient vesseless (gymnospermic feature) dicotyledonous), *Nepenthes Khasiana* (Meghalaya), *Mitrastemon vamanotol* (Root parasite), *Sapria* himalayana (Root parasite and close ally of the world famour *Raflessia* arnoldii fo Malyasia Flower 15-35 cm in diameter (Arunachal, Assam, Manipur), *Ormosia glauca, Populus gamblei* (Sikkim and North Bengal), *Rhododendron arizelum, R. dalhousae, R. edgeworthii, R. nivale, R. nuttallii, R. santapaul, R. tawangensis, Olax nana* (collected recently by Sas Biswas from Kachugan Reserve Forests, Assam) *Dischidia rafflesians* (a botancial curio), *Drosera pletata* and *D. burmani-insectivorous* plants) *Elaeocarpus prunifloius* (Manipur and Meghalaya), *Helwingia himalaica*. (Flowers on midrib of leaf), *Coptist teeta* (Mishmee Hills - a medicinal plant) *Mototropa uniflors, Meconopsis betonicifolia* (E. Himalaya) *Balanophora dioica, B.* Incolucrata, Phyllostachys bambusoides (Arunachal Pradesh).

Santho-xylum scandens

India accounts for about 1300 species of orchids, of which 600 species are in North-east region alone. Sikkim can be considered as one of the richest orchid areas in the world. The main endangered and spectacular orchids of the region are : *Paphiopedilium fairieanum* (Sikkim, Arunachal) popularly known as "Asian Lady's slipper" and "Lost Orchid" Saunders, the famous orchid firm in U.K. offered a prize of 1000 for its first collection from a wild. *P. insione, P. hirsutissimum* (Meghalaya, Nagaland, Mizoram), *P. villosum*. (Lushai Hills-Mizoram), *P. Venustum, Vanda coerulea* "Blue Vanda", Dendrobium densiflorum and other spp., *Arundina graminifolia* "Bamboo Orchid", *Galeola flaconeri* (Terrestrial orchid), *Calanthe whiteana* (Pradhan 1979 refers to this plant as "extremely rare or perhaps extinct". *C. biloba* (Sikkim and North Bengal Himalaya), *Renanthera* Inschootiana "Red Vanda" (Manipur) *Cyperipedium elegans, C. himalaicum, C. tibeticum*. These species are threatened due to trade, *Cymbidium grandiflorum, C. sikkimense, C. gigrinum, C. gignanteum, C. lowianum, C. eburneum* and *C. macrorhizon* (only terrestrial leafless Indian cymbidium).

Source : Forest Research Institute Burnihat, Maghalaya, India

Authors' Address : **T.C. Sarma and S.C. Nath,** Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India

Management of Biophysical Resources in Agropastoralism at The High Altitude Village - Senge, Kameng Himalaya

Zahid Husain

INTRODUCTION

Management of biophysical resources is a challenging task in the mountains. The Himalaya mountain is no exception to it where extreme climatic conditions in the high altitude belts (*i.e.*, above 2500m) certainly have telling influence on life forms and human activities including the agropastoralism. It is well known that in the mountains there exist altitudinal belts of different bioclimatic characteristics having corresponding influence on natural and human activities. For example, cultivation of plants remains viable upto a particular altitude, beyond which pastoralism prevails upto the highest available alpine pastures (Fig. 10.1B). In fact, practice of combination of agriculture and pastoralism is a strategy to utilize resources of different vertical belts, ensure sruvival in case one system fails, and have a balanced diet. Agropastoralism provides a broad base to human sustenance, and thus it is considered most suitable 'adaptive strategy'. Both can be practised by a single human group or separate groups as well.

Husbandry of land and animal is possible with hard labour and indeed with wise, proper, rational, and economically and ecologically sound management of resources of the area. 'Alpwirts-chaft' or 'mixed mountain agriculture' system based on agropastoral transhumance is a peculiar adaptive strategy to Kameng Himalaya Mountain Ecosystem too, alike other parts of the Himalaya, the Alps, and the Ades mountains. This paper discusses management of biophysical resources in agropastoralism at the high altitude village of Senge, Kameng Himalaya. It is based on village study and primary data collected during the field works in December of 1982 to 1983. Technology and strategy employed by man to harness environment for his subsistence and survival have been focus of human adaptation study in ecology. In this study emphasis is placed on the strategy.

The concept of environmental management in ecology and environmental conservation sprang from "the intense debates of 1960s following the North American desire for programmes of management designed to produce 'environmental quality'. Environmental management attempts to integrate natural and social systems to the benefit of the latter and without detriment to the stability of the former" (Simmons, 1975:263). All the biotic and abiotic elements of environment comprise the biophysical resources of an ecosystem, to which human resources are also added. Interaction between natural ecosystem and human systems results into human ecological system (Fig. 10.1C), which has been tried to explain in case of Monpa of Senge.

SENGE DZONG AND ITS BIOPHYSICAL RESOURCES

Senge Dzong (3000 m) is situated on a high spur (sun facing slope) south of the Tse La (pass) in West Kameng District of Arunachal Pradesh (Fig.10.1A). It lies on an old trade route connecting Tawang to Udalguri, and now Tezpur-Tawang road winds through the village. Senge has the distinction of being the highest permanent settlement in Kameng Himalaya. There are eight hamlets in the village.

The land of Senge is rugged terrain with high mountains and deep valleys, varying in height from 2200 m to 6000 m. The angle of slope varies from 20°-70°. There is a small filled-in river terrace with 10°-20° slope which is the most preferred site for agriculture as level surfaces are rare in the mountains. Coniferous and broad leaved evergreen temperate forest with preponderance of pine and oak trees occur in the lower elevations of Senge. Sparse alpine vegetation is found above 3500 m. Grasslands are common in both the bioclimatic belts. In the immediate vicinity of the village hill slopes are covered with secondary growth of vegetation. Monkeys, porcupine, wild boar, bear, dear, wild goat, squirrel, rats and birds are some of the fauna inhabited in the forests. Most of them are the worst enemies of the domesticated crops. Sandy loam greyish soil is found on the hill slopes, whereas loamy sand soil lies on the small river terrace. Near

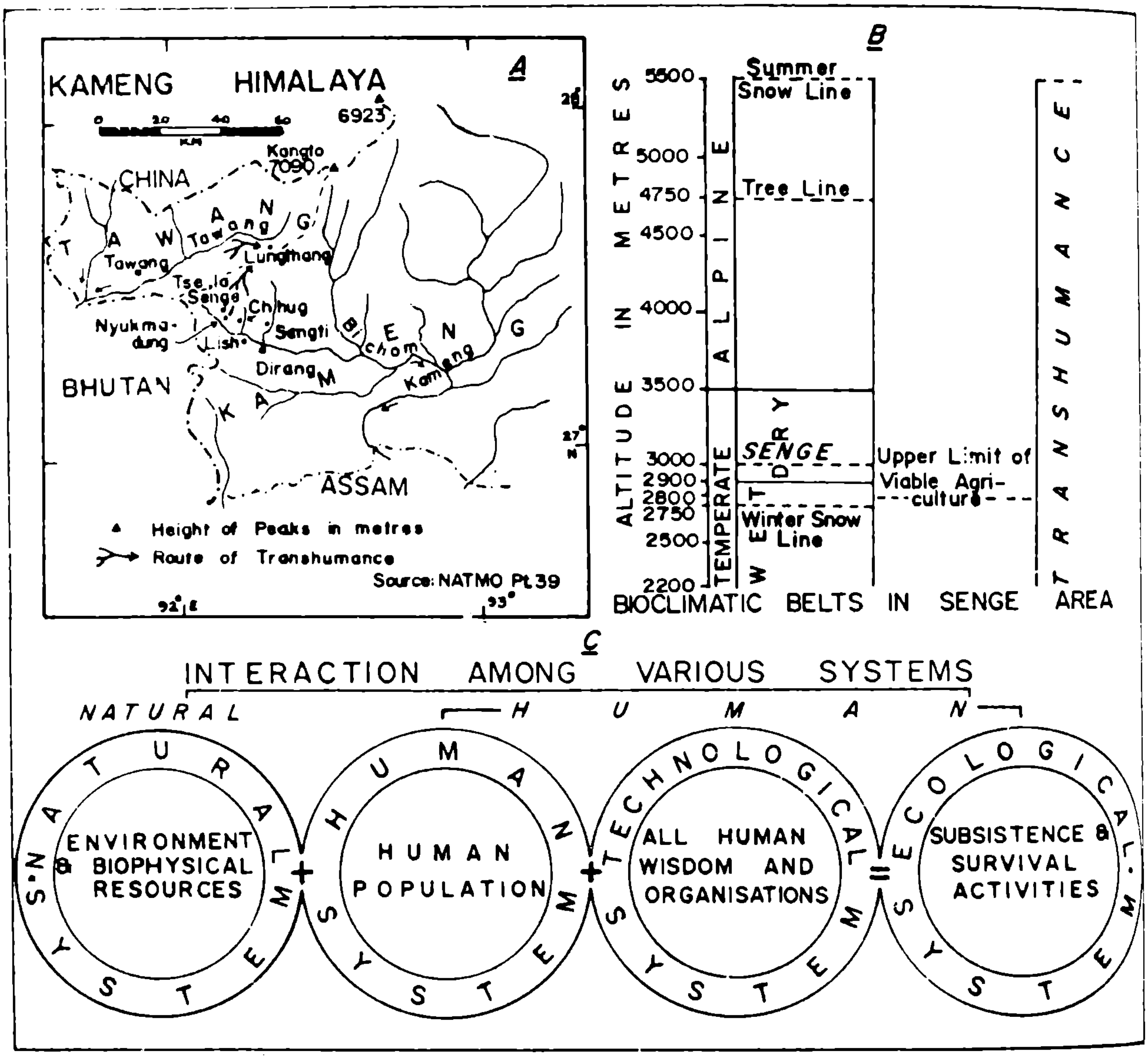

Fig. 10.1

Dundri hamlet sandy clay loam soil occurs. Except on the steep slopes, the soil cover is thick, but rock outcrops, rills and gullies can be seen in excessively cultivated fields and deforested areas.

Extreme climatic conditions are characterized by severe and long winters. Snowfall, intense solar radiation, dryness, rarified air, chilly and strong winds, low atmospheric pressure and sharp sunshine are other extreme climatic features. The rainfall is below 100 cm in the area. It is mainly caused by the southwest monsoon. But low rainfall is compensated by snowfall in the winter. Snowfall and frost occur from November to February, but sometimes from October to March which also marks the long winter season. Around the height of the village snowfall is 20-50 cm nowadays, otherwise it was about 100-150 cm in the past. Of course, on higher elevations snowfall is definitely more. Strong winds blow during March-April-May damaging the rabi crops and roofs (wooden planks) of the stone houses.

Senge is a uniethnic village, occupied by the Monpa who follow lamaistic Buddhism. Total population of the village is 443 persons with sex ratio of 965 and literacy 17.76 per cent. Percentage of the minor (below 14 years), adult (15-59 years), and aged (above 60 years) is 34.01, 57.66 and 8.33, respectively, indicating adequate work force and longevity. Agropastoralism is the mainstay of their economy.

The *Brokpa* (pastoralists) established the village in the long past when animal husbandry was the only means of subsistence. In course of time cultivation of plants also started and now agriculture is predominant human activity in Senge. About 70 per cent of them are exclusively engaged in agriculture while nearly 20 per cent pursue pastoralism. However, livestock rearing is practised in almost every household. Thus it can be said that Senge is strategically located at the junction of upper limit of viable agriculture and zone of predominance of animal husbandry. The altitude of 2800 m is limit of the successful agriculture which happens to be near the winter snow line and the boundary between the wet and dry temperate bioclimatic belts.

The *mangma* (village council) runs the villages administration and social mechanism, of which the traditional *gaonbura* is head. This along with practice of reciprocity, division of work by sex, team work and socio-economic-cultural-religiuos organisations, keep the villagers as a single entity to enable them to face the challenges of life and environment. Though they are busy round the year in agropastoral activities, the peak season spans from March to November during which the herdsmen take their livestock to alpine pastures in their own village and also in the Lungthang area of Tawang valley in the north following retreating/melting snow line, while remaining members engage themselves in the strenuous activity of raising plant crops (Fig.10.1A).

MANAGEMENT OF BIOPHYSICAL RESOURCES

In Agriculture

The Monpa of Senge practise subsistence, settled hoe agriculture which is completely rainfed. Traditionally there are separate fields for maize, millet, buckwheat and barley. Almost every household maintains a small *dumro* (kitchen garden) to grow vegetables, roots and tubers. Agriculture at Senge is practised on the natural hill slopes without terracing. Out of vast village area, only 51.70 ha is used in plant cultivation (Husain, 1990). Forests cover 3580.61 ha in area (Barthakur, 1976).

On the basis of ownership the village area is divided into five categories; i) Village land comprising forests, water bodies (river, lakes and springs) and vast expanses, ii) Community land includes agricultural fields and grazing grounds, iii) Gompa's land consisting of specified forests, grasslands and agricultural fields, iv) Sacred groves, and v) Private land includes *neyjing* (barley fields), orchards, potato fields and area of houses.

Household is the basic unit of economy, as such land is owned and distributed householdwise. Except barley fields all agricultural fields are under customary communal ownership in which usufructuary right passes from one generation to another. Head of the household is given cultivation right by the *mangma*. However, on *neyjing* traditional private ownership is enjoyed, as in the past each head of family then present was allotted *neyjing* land by the *mangma*. Immigrant families are not allowed to own land here. The Gompa's land is utilised by the Lama. However, they can allow grazing on grasslands for village livestock. There are some sacred groves as an evidence of traditional conservation practices, extraction of any product from these is prohibited. Owing to rugged terrain and male equigeniture rule of inheritance the agricultural fields are small (av. 0.15 ha) and fragmented. On the other hand the practice of polyandry stops further fragmentation of the fields as wife of a brother agrees to become the co-wife of her husband's brother.

For a successful husbandry of land to derive food in uncongenial environment, equal participation of males and females, co-operative or reciprocity team work and adjustment or distribution of male work force in agropastoralism are major aspects of strategy. The females play substantial role in hill-farming from preparation of fields to harvesting of crops. Agricultural products are carried by both male and female from the fields to homesteads. However, drying of crops in sunlight, thrashing, winnowing, storing and pounding are works of females. Grinding of grains in *rangda* (hand operated grinding stone wheels) is done by females while grinding in water-mill (stone wheel operated with flowing water for grinding) is males' job. Oak leaves are collected and carried by both to the fields in the end of winter season for their use as manure in kharif crops. Carrying of human excreta from pit latrines to the *neyjing* in October is exclusively done by the female members of the household. After this tedious work they are entertained with lot of butter,and local liquor. In a family of two or three brothers, one prefers to go for animal husbandry, while the remaining members engage themselves in agriculture works.

The traditional *brangpa* is a typical example of reciprocity and collective work in agriculture operation to accomplish the task in difficult environment. Otherwise, it is not possible for a family to manage all the works only by themselves. Weeding, guarding of the crops, harvesting, transporting, thrashing and winnowing are collective or group works in which families help each other. In the annual rotation of maize and millet fields, location of the former is selected very intelligently in one pocket so that it becomes easier to protect collectively this valuable cereal from its enemies. It is because the agriculture fields are very small in comparison to the surrounding forests where the wild enemies escape after eating the domesticated crops. Fencing the fields yields no results. The only effective method is close watch day and night by group of people. Beating of tins and drums, and shouting are the methods used to ward off the enemies.

Sometimes a family may request a few people to help it in certain agricultural work, in lieu of which they are entertained with feast and drinks. In the house of a rich person, his poor and needy relatives do stay to carryout agropastoral activities. Some industrious cultivators till other's land on share-cropping basis, in which the production is equally shared. Though horticulture has not developed yet, its potential is found in lower elevations of the village. Areas below 2400 m can be developed under horticultural crops as around 2800 m altitude both agricultural and horticultural plants do not bear fruits due to geoecological constraints.

The Monpa of Senge till the soil on natural hill slopes with iron hoe to cultivate plant crops. Nowadays spade is also used. Unlike other Monpa people, the plough is conspicuous by its absence. In one way it is wise not to go for deep tillage which can aggravate soil erosion. In hoeing soil is disturbed to minimum possible extent.

Settled cultivation is of recent origin, because until a few years ago shifting cultivation was practised extensively. Even now, one or two fields are cultivated for one year after a gap of two to three years to raise millet. It is worth mentioning here, that to stop shifting of fields and carry on cultivation permanently, knowledge of means and ways to replenish soil fertility is a must, which the Monpa could develop and use. Secondly, the wise decision of the *mangma* to stop shifting cultivation as it damaged their habitat was a significant turn in food producing strategy and conservation of environment.

Kharif and rabi are two crops grown in a year on two separate fields. *Dao* (long iron knife), hoe, dibble, wooden hammer, rake and spade are main agriculture implements. While preparing the fields for next crops, the old straws are burnt to clear the fields, and the ash is mixed in the soil, which increases potash in the soil. Organic and compost manuring is done during the winter. Sheep excreta is used in maize fields, whereas oak leaves and litters are spread in maize and millet fields. These also control weed growth. Mixed and inter-cropping method is applied for growing vegetables, pulses, beans, roots, tubers etc. particularly in maize fields. Inter-cropping of leguminous crops like beans and pulses in heavy feeder maize fields is a strategy to maintain soil fertility. Buckwheat is sown in separate fields, and also in maize fields sometimes. Successful cultivation of barley in high altitude belts is indeed a feat in which winter moisture and water from melting snow are helpful. Choiker Festivals is celebrated in March to pray for good harvest of barley, and all works are hurriedly completed before it. Adequate manuring is done to get higher yields but enemies of crops nullify the labourious and intelligent human efforts.

In Pastoralism

Pastoralism is, in fact, the foremost human response of the Senge people to potentialities of the grasslands of the temperate and alpine bioclimatic belts (Fig. 10.1). Agriculture has developed prominence since quite recent times. The main animals tended by them are yak (*Phoephagus* or *Bos grunnies*), local cattle (*Bos taurus*, dwarf cattle), various crossbreeds (zo and zomo locally known as *Chongri*) and sheep (*luk*). Yak requires little care alike *mithun* of the tropical belt of lower elevation. As a common response to the Himalaya mountain ecosystem, the crossbreeds are preferred for their sturdiness and high milch capacity. The crosses are based on zootechnological and economical reasoning (Jest, 1978). The breeding of cattle is indeed an integral part of the Monpa economy in Kameng Himalaya and Tawang valley as a whole. The Na people (Buddhist) of Upper Subansiri region also practise it. *Churpi* (Cheese) and butter (ghee) are major milk products, while wool, hides, flesh and yak's tail are other valuable animal products.

Before the opening of the Tezpur - Tawang road, pony/mules and horses were reared in good number by the Senge people to use them as draught animals for carrying people and goods on the old trade route. The *ghorawalah* then earned quite handsome amount through this service of transportation and communication. This was an additional cause as well as effect of strategic location of Senge at the present site. The Monpa who rear yak, cattle and crossbreeds are called *Brokpa* or *Chongriwalah* while the shepherds are known as *Louzy.*

In 1983 the livestock population as recorded by the author was - 168 yaks, 301 cattle (crossbreeds), 171 sheep, 26 fowls, and 3 pigs (exceptionally reared that year only). The yaks, crossbreeds and sheep are usually tended outside the village in *got* (grazing grounds) where log or stone huts are constructed for halting. There are a number of grasslands in Senge village boundary where these animals graze from October to April. After that these are herded to higher altitude grasslands in Lungthang area of the northeastern Tawang valley (Fig.10.1A) from May to September (five months). Tax is paid in cash or kind to the *mangma* of Lungthang village for this summer grazing, where livestock of Tawang valley are also brought for grazing. Yak cannot survive below 4000 m in the summer. This movement of the herdsmen and their livestock between 2500 m to 5000 m is an ideal example of transhumance in this part of the Himalaya mountain (Fig. 10.1B). In addition to it, there is a movement of the *Louzy* of the Tawang valley in the Bichom valley for winter grazing of their flock of sheep in which they cross Senge area also.

Grazing rights over the grasslands of Senge are controlled by the *mangma* of the village. The graziers distribute the pastures among themselves keeping in view the size of the herd and the richness of pasture. Under the knowledge of 'fire-ecology' the graziers lit fire in the grasslands during winter months to enhance regeneration of the grasses. The fire also kills pests, (such as leeches) harmful to the livestock (and man also). The presence of leeches at such high altitudes (upto 4000m) only in this part of the Arunachal Himalaya is quite surprising, but it can be understood in the background of the transhumant activities in which movement of livestock and man might have acted as carrier of the pests to higher elevations. The livestock suffer from various kinds of diseases, and a lot of them died of epidemic in 1964. The Veterinary and Animal Husbandry department has introduced a number of schemes and medical facilities for a better husbandry of animals.

Symbiotic Relationship Between the Agriculturalists and Pastoralists

Barter of milk and animal products with plant products is but natural between the cultivators and animal herders. Both harness different ecozones to get optimum yield in food production. Such exchanges take place between the cultivators and pastoralists of the Senge village itself, and between the pastoralists of Senge and cultivators of the nearby villages of lower heights.

Owing to manipulation of potentiality of the high altitude belts of the Kameng Himalaya mountain ecosystem by the Senge people, the production from milk and animals is in excess. Following the common aversion to milk by the Mongoloids (the Monpa too are Mongoloids) it is not consumed as such, instead butter and cheese are made from it. These milk products are bartered for maize, rice, millet and chilli particularly from the people of Chhug village, and in general from Lish, Sangti and Nyukmadung villagers (Fig.10.1A). From wool of sheep and hair of yak cloths, garments, blankets, bags, carpets, saddles and *Shamu* (skull cap) are prepared for domestic use. The surplus items are sold. Tail of yak fetches good return in cash or kind because of its importance in ritual performances. This exchange of milk products for cereals and other vegetable products is necessary to get a balanced diet and keep fit in hostile climate and terrain. Milk products provide them with the required vitamins, minerals and fats. On the other hand cereals and plant products add starch, carbohydrates and sugar to their food intake.

Another symbiotic relationship between the agriculturalists and pastoralists is seen when the

Louzy of Tawang valley cross Senge area in course of their transhumant movement for winter grazing of their flock of sheep in the Bichom valley (the western Kameng Himalaya). While the Lousy pay tax in cash or king to *mangma* of Senge village for grazing their sheep, the graziers are also requested by the cultivators to halt the flock of sheep in their agriculture fields so that the fields are replenished with sheep excreta. The owner of the field serves meals to the *Louzy* during the halt.

CONCLUSIONS

In the background of the foregoing text following conclusions can be derived. First of all, the socalled uncongenial environment of high altitutes is not considered unfavourable as such by the Monpa of Senge Dzong (3000 m), for they have been successfully managing the limited biophysical resources in agropastoralism for centuries. They boldly face the constraints of environment, and despite demand of strenuous and labourious work in completion of the subsistence activities, they enjoy living in their respective habitat/*niche*. Though the villagers have to work hard round the year in agropastoral activities, the way they manage and operate this by their mutual co-operation and help, reciprocity (*brangpa*), team or group work, central command of the apex authority (*mangma*), and their colourful, vibrant and vigorous culture, songs, festivals and rituals, the task appears not to be so difficult. By joining hands and heads together they cope with the harshness of environment. Severe cold and rugged terrain create no hindrance in practice of agropastoral means of livelihood. Rather, such environment seems to be an impetus instead of impediment. It is because many characteristics of the biophysical environment like temperate and alpine grasslands, snowfall etc. prevail in high altitudes only, and correspondingly agropastoral and horticultural activities are pursued by man. The upper limit of viable cultivation around 2800 m altitude and suitability of higher belts for livestock grazing are some of the evidences of presence of altitudinality in this part of the Himalaya mountain ecosystem (Fig. 10.1B).

The 'no tillage' or 'minimum tillage' method of hoe cultivation on nautral hill slopes, as practised by the Monpa of Senge, is an appropriate technology and strategy of plant cultivation in fragile high mountain ecosystem. Any suggestion of deep tillage with plough or spade will accelerate soil erosion and consequently degrade the ecosystem potentiality. Therefore, the traditional technology and strategy is not only ecologically sound but holds good even today. The *mangma* took the right decision to stop shifting cultivation which was becoming more and more harmful. The impending improvement in the existing system in order to enhance food production for the increasing population, has to take these points into consideration, then only success in the development of economy and environment with ecological balance can be ensured. Undoubtedly, there lies potentiality for development of agriculture and horticulture in the lower belt, and animal husbandry in the upper belt.

The transhumance in this part of the Himalaya is significant merely by its presence itself, for it is unknown to many. This is also responsible for inter-belt/ecosystem transfer of energy and material, and utilization of different vertical belts following cyclic order of seasons and related productivity of the specific zone. In broader perspective, agriculture and pastoralism have come to exist as complementary to each other, as interaction between the two occupations starts operating from preparation of fields to bartering of each other's products. In a nutshell, agropastoralism is a broad based strategy of human adaptation of high altitude Himalaya mountain ecosystem. The high-light of all the management is that it is based on indigenous knowledge, expertise and progress.

KEYWORDS AND ABSTRACT

KEY WORDS. Management. Resources. Agropastoralism. Transhumance. Geoecology. Altitudinality.

ABSTRACT Human adaptation to high altitude mountain ecosystem is a challenge well accepted by the adventurous, strong and enthusiastic human groups of the world. The Monpa of the western Arunachal Himalaya are one of them. This paper is a case study of Monpa of Senge village (3000 m), who in wise and strategic way manage the limited biophysical resources of temperate and alpine altitudinal belts to pursue the primary means of subsistence - agropastoralism. All human efforts and wisdom are unitedly channelised to derive food from the so-called uncongenial environment, which are strengthened by various organisations. Division of labour, different categories and ownership of land, reciprocity and central control of the village council are main tools to cope with inimical environment of high altitude (above 2500 m). Husbandry of land and animal, and transhumance are the result of harnessing potentialities of vertical

belts in seasonal cycles, indicating presence of altitudinality.

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Author's Address : **Zahid Husain,** Research Associate (Ecology), Anthropological Survey of India, Upper Lachumiere, Shillong 793 001 Meghalaya, India

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Influence of Karyotypes on The Ecotype Formation of Chilli (*Capsicum annuum* L.)

P.K. Borua and Alakananda Baruah

INTRODUCTION

The genus *Capsicum* (Family-Solanaceae) includes approximately 30 species spread over different parts of the world, either in the wild or in cultivated form. The chilli plants as a whole appear to be native to the West Indies and tropical America. From remote past, chilli was brought and cultivated in India. In North East India, particularly in Assam, chilli varieties grow luxuriantly under favourable soil and climatic conditions (Singh and Wadhawani, 1983: 21). Almost in all seasons of the year chilli plants are grown in this region. The economic importance of this group of plants is known to all. Besides its condiment property, *Capsicum* has remarkable medicinal value. Externally, it is used for lumbago, neuralgia and rheumatism. In the form of ointment, it is applied to painful joints in rheumatoid, arthritis etc. (Kanjilal et al., 1984: 365). The chilli fruits owe their pungency due to the presence of volatile phenolic compound closely related to vanillin, known as capsaicin ($C_{18}H_{27}O_3N$) which is distributed throughout the plants but tends to be concentrated in the placentas of the fruits. The fruits are good sources of vitamin C and contain some amount of vitamin A and E. Highly pungent fruits are used as condiment in the preparation of hot sauces and in pharmacy while the large non pungent fruits are used as salad vegetables or may be stuffed with meat and cooked. A large quantity of dry chilli is regularly consumed within India.

In Assam different cultivars of *Capsicum* under the common name chilli (*Capsicum annuum* L.), are grown in cultivated state. The climate of Assam is very suitable for the growth and development of chilli. But this plant shows wide range of variability in morhpology and adaptation. These variations in morphology include stem length, number and size of leaves, mode of branching, flower and fruit characters and even in the percentage of capsaicin content (Borua and Baruah, 1995 unpublished record). Although, all the cultivars are known to be included under the same species *Capsicum annuum* yet taking into consideration the great differences in its morphology, it needs a careful examination of other characters to find out if other differences mentioned above are fixed and significant so far as the taxonomy of the plant is concerned. The present study aims at the preparation of clear karyotypes (the group of characteristics that identifies a particular chromosome set) of five locally grown cultivars of chilli namely BDS 23, BDS 240, BDS 1082, H 429 and H 446. This study will help to determine whether they have any tendency towards ecotype formation and speciation and ultimately to determine their phylogenetic relationships. Although, cytological studies on many species of the genus have been reported time to time (Kumar et al., 1978:5; Harini et al., 1990: 649; Maccammon and Honma, 1984: 541; Ohta, 1962: 42; Reddi and Rao, 1974: 581; Joshi and Khalatkar, 1978: 100), no detailed reports on somatic chromosome of these local cultivars have been found so far with the above objectives.

MATERIALS AND METHODS

Seed materials for the present investigation were collected from National Bureau of Plant Genetic Resources (NBPGR), Regional Centre, Shillong. These germplasms were collected by NBPGR from different places of this region. For karyotype analysis seeds were germinated in moist filter paper. When the root tips about 1 mm long were collected around 10-10.30 am and pretreated with PDB (paradichlorobenzene) for about 4 hours at 12-15°C. Pretreated root tips after thorough washing with distilled water were fixed in acetoethanol (1:3) mixture for overnight. After fixation root tips were hydrolysed in a mixture of 2% acetocarmine (nuclear stain solution) and 1N HCl (9:1) at 60°C for 10-15 minutes. These root tips were squashed in 1% acetocarmine solution (Sharma and Sharma, 1980:164).

For each cultivar, from a comparative study of at least five metaphase plates, the position of centromere of each chromosome was determined. The position of centromere enabled us to classify individual chromosomes as median, submedian an subterminal. However, presence of satellite on a particular chromosome could be determined by the presence of secondary constriction. The measurement of chromosomes were done carefully from camera lucida drawings. Then the idiograms (diagrammatic representation of individual chromosome) were drawn on a graph paper as recommended by Battaglia (1955:163). The chromosomess were then assigned to different types based on their relative length, position of centromere and presence or absence of secondary constrictions. Total form percentage (TF%) have been calculated by the following formula given by Huziara (1962:114).

$$\text{Total Form Percentage (TF\%)} = \frac{\text{Total sum of short arm length}}{\text{Total sum of the length of all the chromosome}} \times 100$$

RESULTS

In *Capsicum annuum* L., the best time for collection of root tip was found around 10.30 am. The five cultivars investigated have shown diploid chromosome number 2n=24 (Fig.11.1) which is in conformity with the earlier reports. All the cultivars are characterized by small chromosomes with prominent size differences. The chromosomes were nearly median (metacentric) to submedian (submetacentric) types except in Cultivar BDS 23 where 2 pairs of chromosomes are subterminally (telocentric) constricted (Table.11.1) One or two pairs in the complement were conspicuously larger in length, and the rest of the chromosomes formed a graded series from short to long (Fig.11.1). Although the general pattern of karyotype was more or less similar in all the cultivars studied, there were distinct differences in details of morphology of individual chromosomes among the cultivars. Absolute length of the chromosomes was not the same in all the cultivars studied and there was variation in the number of metacentric and submetacentric chromosomes among the cultivars. Besides, the presence of 1-2 pairs of satellited chromosomes in three cultivars *viz.* BDS 240, H 429 and H 446 was a remarkable character. Although, karyotype in all the cultivars were observed to be asymmetrical (TF value is below 50%), the TF% observed were also variable to some extent in all the cultivars (Table.11.1).

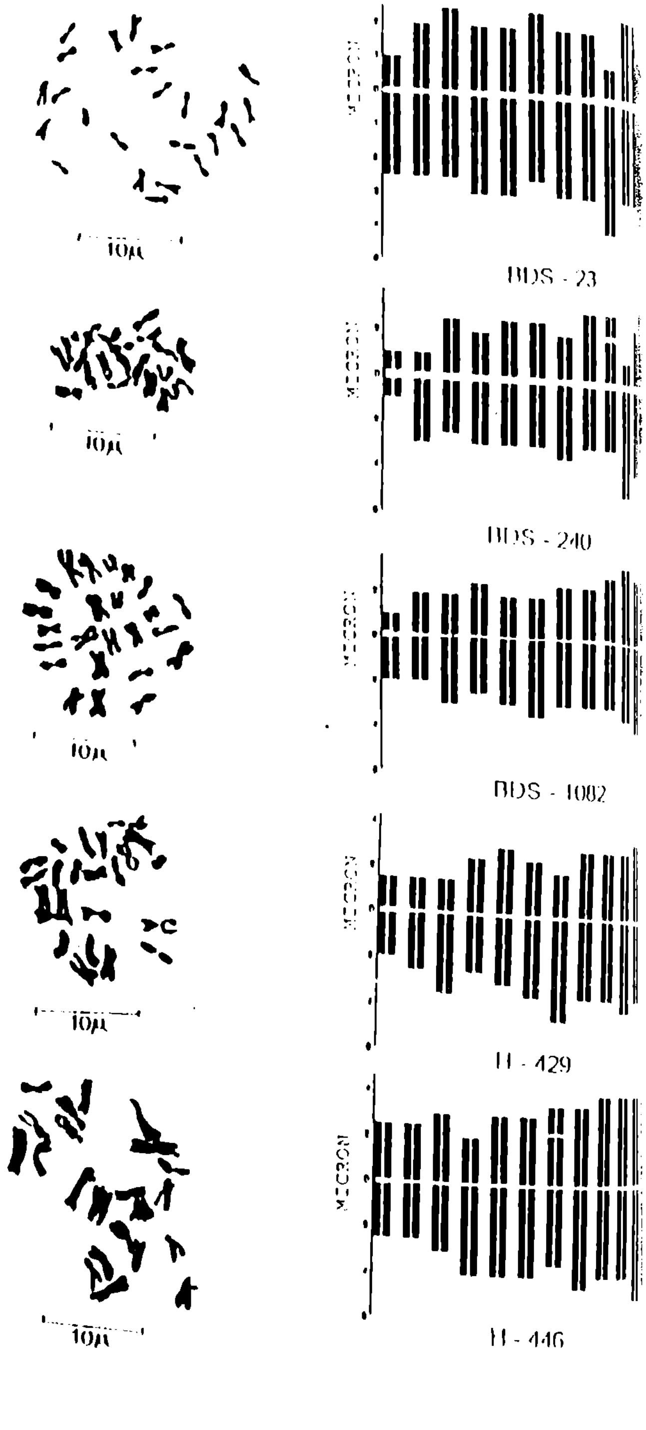

Fig.11.1 Camera Lucida drawings and idiograms of somatic chromosomes of cultivars BDS 23, BDS 240, BDS 1082, H 429 and H 446

Table 11.1 : Details of karyotype of five cultivars of *Capsicum annuum* L

Cultivars	Chromosome No.	Types of chromosomes				Average arm ratio	Length of chromosomes in micron			TF%
		Median (metacentric)	Sub-median (sub-metacentric)	Sub-terminal (telocentric)	Secondary constriction (satellited) Submedian		Absolute length	Mean length	Range in length	
BDS 23	24	4	18	2	-	0.70	119	4.9	3.5-5.5	40.3
BDS 240	24	6	12	2	4	0.60	128	5.3	2.0-7.0	38.2
BDS 1082	24	8	16	-	-	0.80	131	5.4	3.0-8.0	44.2
H 429	24	6	16	-	2	0.75	142	5.9	3.5-8.0	42.2
H 446	24	10	10	-	4	0.80	172	7.1	5.0-10.0	44.1

DISCUSSION

The somatic chromosomes in the cultivars investigated are mostly median to short size, the range of length being 2-10μm (Table.11.1). There is a great predominance of chromosomes with nearly submedian centromeres. The karyotypes are asymmetrical judging from the ratio of the longest to the shortest chromosomes in the complement following Stebbins (1958:365). This is determined by the TF% (Table.11.1), which represents nearly asymmetric type of karyotype (Kapoor and Love, 1970: 575). The chromosomes with median to sub median constriction as investigated are generally primitive while with the advancing evolution the chromosome become subterminally constricted indicating an evolution from symmetry to asymmetry (Levitzky, 1991:494). Cytological features like lesser TF value, lower chromatin length, more submetacentric chromosomes and presence of satellited chromosomes are taken into account to indicate the relative advancement of a species within a genus (Stebbin, 1950 ; Sinha and Kumar, 1979:578). In this investigation, all the cultivars have shown a tendency towards asymmetric type of karyotype. Among these, BDS 240 shows more towards advancing evolution. Considering the TF value, BDS 1082 is considered as the primitive and other cultivars are intermediate between them. But from the stand point of satellited chromosomes, presence of two pairs of the same each in BDS 240 and H 446 and one pair in H 429 in an evolutionary feature towards speciation. Thus the remarkable variations in the morphology including fruit shape and size and capsaicin content in these five cultivars are considered due to the influence of the differences in their karyotypes and thereby forming individual ecotype of the same species.

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KEY WORDS AND ABSTRACT

KEY WORDS *Capsicum annuum*. Capsaicin. Karyotype. Idiogram. TF%. Asymmetry.

ABSTRACT Karyotype analysis in five locally grown cultivars of chilli (*Capsicum annuum* L.) reveals that all the cultivars exhibit equal somatic chromosome number 2n-24. The chromosomes are ranging mainly from metacentric to submetacentric configurations exhibiting a tendency towards asymmetric karyotypes. However, variations in number of metacentric, submetacentric or satellited chromosome, chromatin length and TF value in the karyotypes of the cultivars play an important role in ecotype formation and ultimately in evolution.

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Ecological Impact of Eucalyptus on Floristic Composition and Phytosociological Studies in Man-made Ecosystem of The Brahmaputra Valley

Ajit Kumar Bordoloi

INTRODUCTION

Natural vegetation is spontaneous and reaches the climax stage without any aid of direct human action. Man and animal action, however, attribute towards a semi-natural vegetation (Transley, 1958). Plantation of indigenous species provides scopes for formation of plant communities which are quite indistinguishable from naturally formed communities. On the other hand, plantation of exotic species alters ground vegetation leading to seminatural communities, where entire floral composition is modified by immigration of herbs, shrubs and trees. Thus, a large number of plant communities are destroyed due to human activity producing fresh habitats for fresh plant communities (Transley, 1958).

Vegetation in similar habitats may also differ in relation to kinds of stands in the same geographical area. Certain habitats are more suitable for some plant species than for others, indicating a positive correlation in the distribution of species in an area and such favourable occurrence reflects the importance in interspecific association. In a complex interspecific association trees influence ground vegetation by absorbing nutrients from the soil on the one hand and depositing them in the soil surface by leaf fall on the other.

Vegetation constitutes the total plant cover of an area or a region or a place (Misra, 1968). Jain (1989-1990) broadly divided the general vegetation and floristic elements of India into 9 botanical regions, *viz*., North Western Himalayas, Eastern Himalayas, Western dry region, Gangetic plains, Eastern India, Deccan plateau, Western Ghats, Eastern Ghats and Andaman and Nicobar Islands.

Eastern India comprises the seven states of North Eastern region - a fascinating source of rich flora in natural state which does not seem to have been studied in detail so far. Of the north eastern states, the flora of Assam is itself a distinctive and interesting one because of Assam's phytogeography, heavy rainfall and high humidity. The Botanical Survey of India, after the establishment of Regional Centre at Shillong in 1956, planned a thorough floristic exploration and survey of all kinds of plants in Assam. Yet many districts remained uncovered for a long period (Santapu, 1969; Rao, 1977).

Human population is dependent upon plant resources. For this exploitation of wild plants is commonly causing tremendous loss on natural eco-system. It is very significant that human interference has been more often responsible for depletion of plant resources and consequent decline of genetic diversity. About 10 per cent (20,000 to 30,000 species) of world's flowering plants are reported to be under threat and at least one species is disappearing everyday in tropical forests alone (Singh et al., 1982). It is likely that this will lead to loss of plant species in a much faster rate than at present. The seriousness of this situation can be understood from the fact that a disappearing species can take with it 10-30 dependent species such as insects, higher animals and even higher plants (Singh et al., 1982).

Exotic tree plantations and alien weed species cause disturbances in the indigenous flora (Joshi et al., 1989). Huston (1992) reviewed the research upon natural plant communities, caused by altering the plant diversity, introducing the exotic tree species, polluting the environment and placing trees under stress with abundance of insects distribution, considered to be the pests. A number of plants have already disappeared from the surface of the earth due to such activities, while others await a similar fate. Since Independence about 50 lakh hactares of forests have been lost in India (Rahmani, 1979). The regeneration of native forests species is nullified by clearing the ground flora as well as naturally occurring indigenous tree species and introduction of favoured seedlings of Eucalyptus. Overgrazing and monoculture have changed the entire floristic complexion in natural vegetation both qualitatively and quantitatively (Nayar, 1977; Rahmani, 1979; Jain, 1990).

The change of flora in India as a result of deforestation, afforestation and introduction and naturalization of adventive weeds was discussed by Rao (1977). He observed that deforestation affected the flora by clearing the original forests for agriculture, industrialisation, human settlement and for raising artificial forests due to plantation of *Eucalyptus sp.* and *Casuarina sp.* neglecting the planting of indigenous species. Afforestation converted the barren areas into fine plantation of introduced species like Eucalyptus (Nayar, 1977). Moreover, introduction and naturalization of foreign weeds like *Ageratum conyzoides* and species of *Eupatorium, Eichornia, Parthenium, Argemone, Mikania* etc. have greatly influenced the pattern of Indian flora. Exotic weeds have also been referred to as "green cancer" in natural ecosystem (Chakre, 1983).

In addition, commercial forestry has also led to elimination of hundreds of plant species. In order to minimise the hindrance of forestry operation, quick growing trees are planted and in doing so the underbush which naturally comes up is ruthlessly weeded out. Technically such commercial areas are called forests and they help in boosting the percentage of forest areas in our country. But such areas are "ecological desert", because they harbour only a very small percentage of indigenous flora and fauna. Most of the wild animals, birds and insects are mainly dependent on the underbush for food, shelter and protection and therefore, very few wild species can be encountered in commercial plantations.

Among the exotic species introduced in our country, the species of *Eucalyptus* occupies a premiar position. This plant species indigenous to Australia was first introduced in India, in the region of Tipu Sultan from 1782 to 1802 at Nandi hills. Bangalore and Sultanpet area in the Deccan (Bhatia, 1984). Subsequently in 1843, *Eucalyptus* was introduced in the Nilgiris to meet the firewood requirement of the locality while in Assam, large scale plantation of *Eucalyptus* was taken up in 1951. One important aspect of *Eucalyptus sp.* is that they are fast growing due to which such plants have been gaining importance and are utilised in social forestry, wasteland and wetland

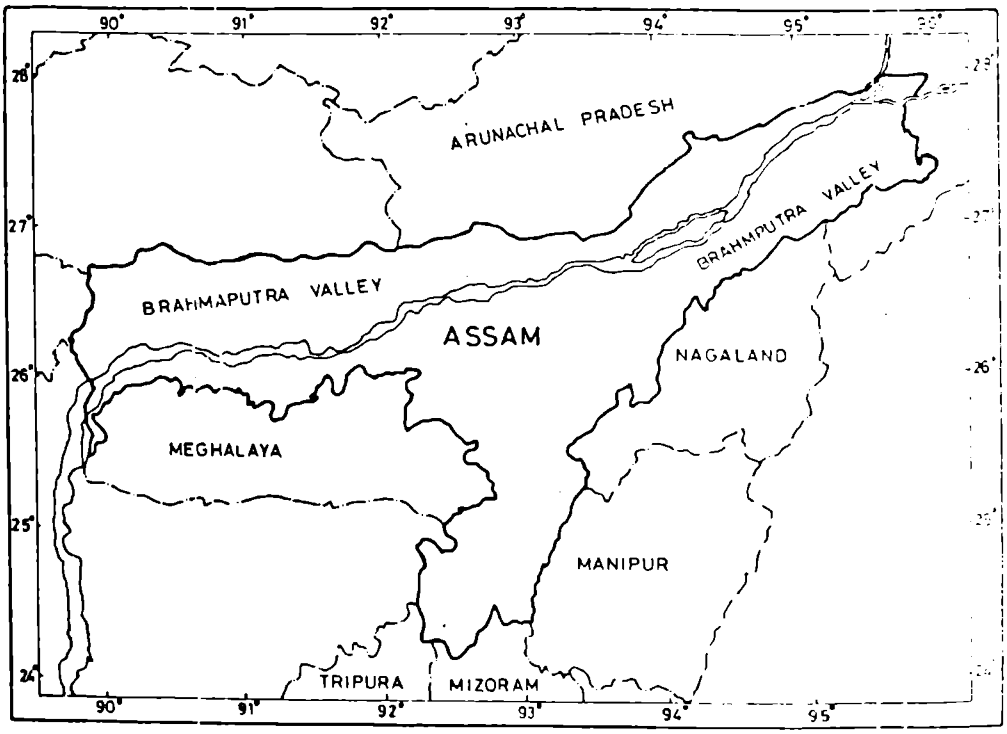

Fig. 12.1. Assam Plateau - showing Brahmaputra Valley

development programmes in India. However, controversies have been raised not for their economic importance, but for their so called affect on the group of indigenous plants, on soil, soil water and vegetation system and thereby on the ecology and environment.

In respect of introduction of exotic species, however, no study seems to have been made so far in this part of the country. Therefore vegetation characters were analysed under three situations in course of the investigation *viz.* one *Eucalyptus citriodora* plantation, two, Gamari plantation and three barren or uncovered condition, in order to derive comprehensive idea on the impact of plantation of *Eucalyptus citriodora* on natural ground floor vegetation.

MATERIALS AND METHODS

To achieve a concrete concept of vegetation, the following parameters are analysed and methods adopted as follows on those respective locations in plantation sites covered by Gamari (*Gmelina arborea* Roxb.) and uncovered or barren conditions in order to make a comparative study. *Eucalyptus citriodora* and Gamari plantations were made by Social Forestry Department, Government of Assam, in man-made eco-system regions of the Brahmaputra Valley (Fig. 12.1).

Phytosociology

Phytosociological aspects of vegetation were studied by laying out quadrats (1 sq meter size) in the vegetation covered by *Eucalyptus citriodora*, Gamari and uncovered or barren condition. Species growing under these conditions were collected for all the sites once in a week. Herbarium sheets were prepared and species were identified accordingly. Data obtained in respect of these parameters were used to calculate three important vegetation indexes *viz.*, relative frequency, relative density and relative dominance, following the method described by Phillips (1959) and Mishra (1968).

$$\text{Relative frequency (RF)} = \frac{\text{Number of occurence of species}}{\text{Number of occurence of all species}} \times 100$$

$$\text{Relative density (RD)} = \frac{\text{Number of individual of the species}}{\text{Number of individual of all species}} \times 100$$

$$\text{Relative dominance (RDo)} = \frac{\text{Total basal area of the species}}{\text{Total basal area of all species}} \times 100$$

The importance value index (IVI) was determined as summation of all these three values, in respective cases (IVI = RF+RD+RDo).

RESULTS AND DISCUSSION

The comparative account of vegetation survey under three different situations *viz.*, exotic *Eucalyptus citriodora* Hook plantation, indigenous Gamari (*Gmelina) arborea* Roxb.) plantation and uncovered or barren sites under the present investigation clearly indicates that Gamari plantation supports more undergrowth than the *Eucalyptus citriodora* plantation, while there are more floristic composition at uncovered or barren sites than Gamari plantation. *Imperata cylindrica* shows highest Importance Value Index (IVI) *i.e.* 27.91 and total 18 species are recoreded under *Eucalyptus citriodora*, whereas under Gamari plantation 36 species and 45 species are recorded in uncovered or barren sites. *Eleusine Indica* and *Agera-*

Table 12.1: Importance Value Index (IVI) of plant species under *Eucalyptus citriodora* plantation

S. No.	Species	R.D.	R.F.	R.Do.	IVI
1.	*Imperata cylindrica* (L) Beauv	9.94	6.03	11.94	27.91
2.	*Ageratum conyzoides* L.	6.97	4.15	5.26	16.38
3.	*Axonopus compressus* (sw) Beau	3.77	3.03	3.03	9.83
4.	*Eupatorium odoratum* L.	2.82	2.62	2.36	7.80
5.	*Borreria stricta* (L) K. Schum	2.70	2.02	1.32	6.04
6.	*Saccharum spontaneum* L.	0.16	2.50	3.33	5.99
7.	*Cyperus brevifolius* (Rottb) Hassk	1.84	2.22	1.32	5.38
8.	*Cyperus haspan* L.	1.22	2.07	1.55	4.84
9.	*Oxalis corniculata* L.	0.61	2.02	1.48	4.11
10.	*Cassia tora* L.	1.20	1.48	0.96	3.64
11.	*Adenostoma sp.*	0.84	0.12	1.88	2.84
12.	*Lycopodium cernuum* L.	0.30	0.40	1.18	1.88
13.	*Lygodium japonicum* L.	0.44	0.42	0.88	1.74
14.	*Mimosa pudica* L.	0.50	0.63	0.55	1.68
15.	*Centella asiatica* (L) Urban	0.22	0.55	0.88	1.65
16.	*Clerodendrum viscossum* Vent	0.69	0.42	0.44	1.55
17.	*Carex filicina* Nees	0.17	0.42	0.88	1.47
18.	*Mikania micrantha* H.B. & K.	0.02	0.42	1.00	1.44

R.D. = Relative density
R.F. = Relative frequency
R.Do. = Relative dominance

Table 12.2 : Importance Value Index (IVI) of plant species under Gamari *(Gmelina arborea* Roxb.) plantation

S. No.	Species	R.D.	R.F.	R.Do	IVI
1.	*Eleusine indica* (L) Gaertn	17.75	24.90	9.44	52.09
2.	*Amaranthus spinosus* L.	9.37	6.46	5.54	21.37
3.	*Axonopus compresus* (L) Beavu	6.26	8.97	5.65	20.88
4.	*Arundinella benghalensis* (Spreng) Druce	5.17	9.82	4.61	19.60
5.	*Cyperus brevifolius* (Rottb) Hassk	5.91	6.86	5.78	18.55
6.	*Commelina benghalensis* L.	4.83	6.92	6.06	17.81
7.	*Hypericum japonicum* Thumb	7.85	4.24	5.52	17.61
8.	*Cyperus flavidus* Retz.	2.17	4.61	9.82	16.60
9.	*Melastoma malabathricum* L.	7.85	2.88	3.16	13.89
10.	*Mimosa pudica* L.	6.67	4.32	2.64	13.63
11.	*Ageratum conyzoides* L.	3.70	5.24	4.36	13.30
12.	*Imperata cylindrica* L. Beauv.	3.51	5.83	1.41	10.75
13.	*Centella asiatica* (L) Urban	3.77	3.03	3.03	9.83
14.	*Saccharum spontaneum* L.	2.46	3.35	3.61	9.42
15.	*Carex filicina* Nees	4.81	1.96	1.53	8.30
16.	*Fimbristylis gliobulosa* Kunth	1.76	3.16	3.07	7.99
17.	*Borreria stricta* (L) K. Schum	2.33	2.82	2.62	7.77
18.	*Salmonia cataniensis* Lour	3.90	2.05	0.92	6.87
19.	*Amaranthus viridis* L.	2.03	1.71	2.56	6.30
20.	*Phyllanthus fracternus* Wabster	1.32	1.84	2.22	5.38
21.	*Litsaea assamica* Hk f	0.61	2.39	2.15	5.15
22.	*Polypodium sp.*	1.55	1.22	2.07	4.84
23.	*Amphineuron opulentum* L.	1.07	1.65	1.97	4.69
24.	*Bridelia monocia* (Lour) Merr	0.53	1.91	1.61	4.05
25.	*Fimbristylis dichotoma* (L) Vahl	1.87	0.67	0.80	3.34
26.	*Scoparia dulcis* L	.0.47	1.09	1.14	2.70
27.	*Floscopa scandens* Lour	.021	1.20	1.14	2.55
28.	*Lycopodium cernuum* L.	1.23	0.40	0.60	2.23
29.	*Pouzolzia zeylanica* (L) Beauv.	0.22	0.71	0.76	1.69
30.	*Eragrostis gangetica* Steud	0.23	0.22	0.86	1.31
31.	*Leonurus sibiricus* L.	0.55	0.40	0.31	1.26
32.	*Chenopodium album* L.	0.35	0.16	0.57	1.08
33.	*Leucas aspera* (Wild) Spreng	0.55	0.16	0.31	1.02
34.	*Pouzolzia indica* Gaud	0.21	0.22	0.57	1.00
35.	*Commelina obliqua* Ham	0.04	0.10	0.50	0.64
36.	*Vitis sp.*	0.13	0.17	0.17	0.47

R.D. = Relative density
R.F. = Relative frequency
R.Do. = Relative dominance

Table 12.3 : Importance Value Index (IVI) of plant species under uncovered or Barren condition

S. No.	Species	R.D.	R.F.	R.Do.	IVI
1.	*Ageratum conyzoides* L	7.09	29.19	8.07	54.35
2.	*Arundinella benghalensis* (Spreng) Druce	3.90	14.38	9.19	37.47
3.	*Pouzolzia zelyanica* (L) Beauv	5.87	11.15	2.33	29.35
4.	*Saccharum spontaneum* L	6.46	5.54	9.37	21.37
5.	*Hypericum japonicum* Thumb	3.57	7.87	6.11	17.55
6.	*Mimosa pudica* L.	6.67	6.19	3.05	15.91
7.	*Axonopus compresus* (SW) Beauv.	4.72	5.36	3.96	14.04
8.	*Eleusine Indica* (L) Gaertn.	6.67	4.32	2.64	13.63
9.	*Hydrocotyl rotundifolia* Roxb.	0.55	1.95	9.51	12.01
10.	*Cyperus haspan* L.	2.15	3.37	6.26	11.78
11.	*Centella asiatica* (L) Urban	1.14	6.28	4.01	11.43
12.	*Imperata cylindrica* (L) Beauv.	3.51	1.41	5.83	10.75
13.	*Oxalis corniculata* L.	1.26	5.39	3.81	10.46
14.	*Cyperus brevifolious* (Rottb) Hassk	3.03	3.70	3.03	9.76
15.	*Phylllanthus fracternus* Wabster	0.27	4.12	4.33	8.72
16.	*Desmodium heterophyllum* Wild	4.00	2.80	1.43	8.23
17.	*Clerodendrum viscosum* Vent	3.88	1.17	2.24	7.29
18.	*Borreria stricta* (L) K. Schum	1.32	2.02	2.70	6.04
19.	*Fimbristylis globulosa* Kunth	2.02	3.28	0.57	5.87
20.	*Melastoma malabathricum* L.	1.87	2.04	1.43	5.34
21.	*Amaranthus spinosus* L.	0.57	2.20	2.46	5.23
22.	*Polypodium* sp.	0.66	3.99	0.16	4.81
23.	*Selaginella manospora* Spring	0.84	1.02	2.22	4.08
24.	*Cyperus flavidus* Retz.	1.82	0.67	0.80	3.29
25.	*Kyllinga brevifolia* Rottb.	0.44	0.42	2.24	3.10
26.	*Carex filicina* Nees	1.33	0.97	0.80	3.10
27.	*Carex sp.*	0.55	0.52	1.24	2.31
28.	*Amphineuron opulentum* L.	0.59	1.15	1.01	2.75
29.	*Euphorbia hirta* L.	0.34	0.37	1.53	2.24
30.	*Rubus moeleuccanus* L.	1.00	0.28	0.80	2.08
31.	*Stachytarpheta indica* Vahl	1.18	0.36	0.40	1.94
32.	*Gonantanthus pumilus* (D. Don) Engler et Krause	0.88	0.04	0.33	1.25
33.	*Sida rhombifolia* L.	0.77	0.17	0.29	1.23
34.	*Lygodium japonicum* L.	0.29	0.33	0.57	1.19
35.	*Colocasia esculenta* (L) Schott	0.71	0.11	0.30	1.12
36.	*Lycopodium cernuum* L.	0.25	0.25	0.57	1.07
37.	*Cannabis sativa* L.	0.44	0.40	0.14	0.98
38.	*Eragrostis gangetica* Steud	0.15	0.25	0.57	0.97
39.	*Polygonum hydropiper* L.	0.18	0.16	0.57	0.91
40.	*Pouzolzia indica* Gaud	0.17	0.14	0.60	0.91
41.	*Cynodon dactylon* (L) Pers	0.15	0.14	0.61	0.90
42.	*Cassia tora* L.	0.16	0.16	0.57	0.89
43.	*Leonurus sibiricus* L.	0.37	0.12	0.30	0.79
44.	*Cassia occidentalis* L.	0.06	0.11	0.28	0.45
45.	*Leucas aspera* (Wild) Spreng.	0.03	0.10	0.26	0.39

R.D. = Relative density
R.F. = Relative frequency
R.Do. = Relative dominance

tum conyzoides are dominant species under Gamari plantation and in barren sites with IVI of 52.09 and 54.35 (Tables 12.1-12.3), respectively. Dominant species having IVI more than 5 encountered were 20 each under Gamari plantation and barren sites, while only 6 species were observed under *Eucalyptus citriodora* plantation. Hence *Eucalyptus citriodora* plantation site may be considered as decreaser species site than the Gamari and barren sites as recorder by species composition studies. The overall picture of ecological importance of a species in relation to the community structure can be obtained from IVI (Sarma, 1990). Diversity of species and productivity are related to favourableness of environmental conditions, and the greater the number and diversity of species, the greater will be the number of kinds of interaction (Hanson et al., 1965). In this respect, therefore, *Eucalyptus citriodora* plantation is likely to lead towards an unfavourable climatic situation in an area.

The greatest influence of climate on soil is exerted indirectly through partial determination of the kind of native vegetation under which the soil evolves. Conversely, introduction of exotic species are confronted with the problem of acclimatisation into an environment which may or may not be similar to that of its homeland. Both soil factors as well climate in the introduced areas play important roles in this respect. The decreased nature of mineral composition of *Eucalyptus citriodora* soil indicates an extremely nutrient deficit site, leading to a non-sustaining form of vegetation (Bordoloi, 1995). In its native habit in Australia *Eucalyptus* manages to sustain itself because it is not fast growing in its sites of natural occurrences, as Australian soils are exceedingly deficient in phosphorus and other essential mineral nutrients (Shiva and Bandyopadhyay, 1987). Outside Australia, the basic fertility levels are higher than the natural Australian habits, As a result the exotic *Eucalyptus citriodora* grow fast creating a massive deficit in soil mineral nutrients. Probably due to its faster growth entailing higher nutrients demand exchangeable calcium decreases steadily as resulting in higher acidity of *Eucalyptus* soil (Nandi et al., 1991). Potassium also may be fixed due to the acidity (Buckman and Brady, 1967; Sahai, 1990) in *Encalyptus citriodora*, and may possibly be due to some other factor, the highest amount of potassium was observed (Bordoloi, 1995). Thus exotic *Eucalyptus* modifies the properties of soils, which, in fact lead to vegetation transformation by changing the life form of floristic composition (Beadle, 1953). This finding is comparable to that of the observation by Transley (1958) who reported that calcium is the dominant basic ion in soil, without which many life forms disappeared and he illustrated that the deficiency of calcium and other bases would lead to "acid conditions" and to the establishment of acid tolerant plants and may gradually change the whole character of vegetation. Nandi et al. (1991) were of the view that *Eucalyptus* plantation modified some of the soil attributes like pH and nutrient status. Economic and Planning Council of Karnataka (EPCK) agreed with *Eucalypus* critics that *Eucalyptus* affected the pH of soil and turned it acidic (Agarwal, 1985). On the other hand, indigenous Gamari tree forms a self sustaining system of living resources. In its native habit, the effect of trees on soil is likely to be towards improvement of soil structure, soil attribute especially the pH and nutrient status like nitrogen, calcium, magnesium, sodium etc. (Bordoloi, 1995). Montagnini et al. (1990) observed similar results and suggested a potential amelioration effect of native tree species on soil fertility, especially with respect to organic matter and base contents.

KEY WORDS AND ABSTRACT

KEY WORDS Exotic Eucalyptus. Indigenous Gamari. Floristic Composition. Importance Value. Index (IVI), Brahmaputra Valley.

ABSTRACT The mounting controversy over a replacement of indigenous tree species with extensive *Eucalyptus* plantation and the effect on the local environment needs urgent attention of foresters, environmentalists and environmental concious people. Therefore, the present investigation was undertaken in order to make a comparative study on the ecology of exotic tree, - *Eucalyptus citriodora* and the leading commercial indigenous tree species - Gamari (*Gmelina arborea Roxb*). The comparative account of vegetation survey under three different situations *viz.*, exotic *Eucalyptus citriodora*, indigenous Gamari and uncovered or barren sites clearly indicate that Gamari plantation support more undergrowth than the *Eucalyptus citriodora* plantation, while there are more floristic composition at uncovered or barren sites than Gamari plantation. *Imperata cylindrica* shows the highest Importance Value Index (IVI), 27.91 and total

18 species are recorded under *Eucalyptus* whereas 36 species and 45 species recorded under Gamari and barren sites respectively. *Eleusine indica* shows the highest IVI, 52.09 and *Ageratum conyzoides* shows highest IVI, 54.35 under Gamari and barren sites, respectively.

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Author's Address : **Ajit Kumar Bordoloi**, Division of Plant Sciences and Ecology, Regional Research Laboratory, Jorhart 785 006, Assam, India

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The Tamtas (Coppersmiths) of Central Himalaya : A Diachronic Study

Maheshwar P. Joshi

INTRODUCTION

Tamtā, also spelled as Tamatā, is one of the eminent castes of the artisans (*śilpakāras*) of Central Himalaya. The etymology of the name may be traced to Sanskrit *tāmra*, meaning copper. Indeed the Tamtas are the traditional coppersmiths. Like any other influential caste groups of Central Himalaya, the Tamtas also claim to have migrated to this region from Rajasthan during the post Katyūri period (from *circa* AD thirteenth century onwards). They also claim to have served the local Chandra rulers as their mint-masters. However, this claim is unfounded, for the Chandras never issued any coins. Elsewhere, I have discussed the ideology of immigrantness at length (Joshi, 1995). Suffice it to say that among the artisans the Tamtas are the most advanced, and enjoy an enviable socioeconomic status. In order to reinforce this superiority, they claim an "immigrant status". However, in the discussion that follows, I will show that the history of copper working in Central Himalaya has a hoary antiquity, and that the ancestors of modern Tamtas were probably actors in this history.

The authors of the Gaṅgā Valley Copper Hoards are believed to be the earliest copper using people of the Gaṅgā Valley having an independent copper technology (Lal, 1951; Agrawal, 1971: 205; Yule, 1985). Their copper artefacts, often found in caches, include celts, bar-celts, antennae swords, harpoons, rings, and Anthropomorphs. Among these, the Anthropomorph is singularly unique in that it has no parallel in the entire copper-bronze age world archaeology. So far only twenty-three Anthropomorphs have been reported from all over South Asia. Among these, the one from Manbhum (Bihar) is stylistically different, two figures from Chokhopani (Western Nepal) are headless hence doubtful, and two fragments, one each from Lothal (Gujrat) and Ambala (Haryana) are also doubtful. Of the remaining ones, nine have been found in different sites situated in the Gaṅgā-Yamunā *doab*, one in Jagatpur (western Nepal), eight in Bankot, and one in Haldwani-Almora. The last three sites are situated in Kumaon in Central Himalaya adjoining western Nepal. Significantly, the Bankot figures were found in close proximity of copper mines (*see* Joshi, 1990a, for Central Himalayan figures; Mishra, 1994, for Nepalese figures; Yule, 1985, for remaining figures).

Discovery of the Bankot figures in particular leaves no doubt that Central Himalaya was one of the sources of copper of the Copper Hoards. In connection to this, mention may be made of the Bahadarabad Hoard (situated thirteen km west of Hardwar, U.P. Himalayan foothills), consisting of copper lance-heads, celts, and bangles/rings (Lal, 1953). On the basis of scientific analysis of some of the objects associated with the Copper Hoards, their antiquity may be traced to the later half of the third millennium BC (Lal, 1972). Thus, the history of copper working in Central Himalaya goes back to at least second-third millennium BC. There are continual archaeological and literary references to copper working in Central Himalaya in the subsequent centuries. Hieun Tsang (Beal, 1884 : I.198) and the Mughal chronicles (Habib, 1982 : 32) record existence of copper mines in Central Himalaya. These mines were being worked out from early times follows from the fact that we come across a large number of copper, brass, and bronze metalworks of local workmanship in Central Himalaya, datable to between *circa* AD seventh and nineteenth centuries (Joshi M.C., 1970; Joshi, 1990b: 51-52). In the revenue records of the Chandras who ruled Kumaon from *circa* AD 1250 to 1790, copper workers called *āgarīs* and *tamaṭās* had to supply copper and copper utensils as items of tax in kind (Joshi, 1992). These evidences indicate a long tradition of coppersmithy in Central Himalaya. It is likely that, if not all, some of the present day coppersmiths are the ethnic survivals of the authors of protohistoric Copper Hoard Culture of the Gaṅgā Valley.

Viewed against this background, the traditional copper working appears to be interesting. Sadly, copper mines are not worked any more. There are extremely few surviving coppersmiths who have actually worked in copper mines. Early British account recording traditional method of copper working is interesting, but, as it were, it does not record local technical terminology. Atkinson (1882 : ch. VI) has given a detailed account of traditional metalwork in Central Himalaya. It incorporates notes of early British writers on traditional metalwork in this region. But these notices were intended for colonial commercial interests. It is true that these accounts do not record the complete porcess of metalwork, but they do supply interesting ethnographic information. In the description that follows, I will try to reconstruct entire process of copper working in Central Himalaya on the basis of old records, coupled with information gathered from a few aged traditional coppersmiths - the Tamtas - who either themselves participated in the process, or else received this knowledge directly from those who had practical knowledge of copper working. Accordingly, there are the following successive stages of copper working.

Mining (Stage 1)

First, a few knowledgeable, experienced persons identified copper mines termed as *dhau-khān*, one of the marks of identification being a green vein in rock. Such rocks called *dhau-ḍhuṅg* were dug out of surface of the hill. If it was still present inside, excavations were carried into the hill in the form of a horizontal shaft measuring "about 3½ feet high by 2½ feet wide" with "floors gradually declining towards mouth" to carry off water (Traill,1828: 157). Where digging was done below horizontal surface, accumulated water was carried off in wooden buckets by one man to another until they reached the point from where it could flow out through an adit (Drummond,1838 : 939). Where necessary, frames of timber, locally termed as *ṭāna*, "formed of unsawn branches of trees, rudely and even carelessly constructed were set up to support the roof and sides" (Atkinson,1882 : 267). One can still find *deodar* rafts in abandoned copper mines in Gangoli (District Pithoragarh). The local Tamtas say that these rafts were also used to raise scaffolds (*ṭāna*) to excavate copper ore situated at higher levels. In some places, for example, at Kharahi (District Almora), mining operations were carried out by people called Āgarīs.

The tools employed in mining/excavations were *gaimthi* (pickaxe); *kuṭyaula* (wedge/gad/hoe); *sāpauu* (crowbar); *bosa* (large gad/hoe/wedge), and *byolcha* (shovel). Two or three miners worked at a time, and were relieved every hour. Excavations were done during day. *Chhiluk* (terpentine pine strips) were used as torches. Depending on the hardness of rock "an average of ten to twelve maunds of ore" a day was dug out (Atkinson,1882: 262). Mining was done during cold and hot weather.

The ore was brought out of mine by boys who picked up detached pieces and put it into buffalo hides, and then dragged along the floor by means of a rope that passed round their bodies.

Processing the Ore (Stage 2)

The second phase of copper working was processing the ore for smelting. It was done by women only. The *dhau-ḍhuṅg* (ore) was pulverized either wih a stone, or a hammer (*hathauḍa*), more frequently the former, and impurities sorted out. In this way a woman could manage one to two "maunds of ore" a day, according to hardness of the ores (Drummond,1838: 938). However, where available watermills were also used for pulverizing ore (Herbert,1832 : 244).

Washing of ores was also done by women only, who carried the stuff to a stream in baskets, and dabbed it either with their own hands, or with an iron or terracota basin called *tāśa*, to wash off mud and finer particles of earth. Then they picked out all pieces of ore they could get hold of; or in case of what might be submitted to water in a comminuted state, they worked it against the stream, so as to gather it clean at the head of a small pit by handfuls. The clean ore was then carried to the houses of the miners for smelting (Drummond,1838: 938).

Smelting and Refining the Ore (Stage 3)

The furnace is termed as *āphara*. It measured about three feet long and two feet wide. It was closed from three sides with stone masonry. The walls rose from one and a half to two feet high. The front remained open for feeding both ore and fuel, the latter being charcoal. The back wall of the furnace was provided with a burn clay pipe called *nāva* which was tied to the animal skin, dressed whole, to form bellow called *khvāla/khvāva*. It was usually made from the buffalo skin. The head and portion below knee of each foot of the animal were chopped off, and then some four or five men pulled out the whole skin in reverse position. The hide was then dippped into lime water for about a week. After that it was taken out, the remainder of flesh removed, and then dried. It was followed by vigorous rubbing of the hide with powdered sesame seeds (*tila*) until it became soft enough to be used as bellow. Then the legs were either sewn or tied, the narrower (*i.e.*, neck) end of hide fitted with *nāva* (terracotta pipe), and the other end wih a pair of wooden sticks sufficiently larger than the width of the hide to be held by two men, one at each end. When held jointly, these sticks fitted on each other so as to not allow the air pass through between them when the bellow was pressed. Ingress of air was provided by separating the sticks while pulling the bellow back to its position.

The floor of the furnace was provided with a depression in the centre. Over this depression sufficient quantity of charcoal was heaped. The ore was put bit by bit over the charcoal heap either in pulverized form or mixed with cowdung and made up into balls. Sometimes a shallow channel spouted basin called *haneli/musauḍa* was also used to keep the pulverized ore. Reporting on Agar Sera mines Beckett notes : "The workings are dry and the lode has a dip of about 30° below the horizon with a north-westerly direction. The ore is pounded and moistened with water and receives an admixture of five parts in six of limestone as flux. The charge consisting of about 6 1b. of unmixed ore, takes about half an hour to melt and is placed from time to time in handfuls on the furnace, and covered with oak charcoal which is occasionally moistened wih water" (vide Atkinson, 1882 : 287). The blast was called *svāla*. Depending on the variety of ore and charcoal, it took about half an hour when the slag commenced to flow down into the depression, and the remainder called *kiṭa* was thrown away. When about two kg of charge accumulated, fire was raked and the slag taken out with the help of a poker called *tāva*. Then followed refining.

A shallow channel spouted basin called *haneli/musauḍa*, already referred to earlier, was made from the paste of powdered hard rock (quartzite), a species of grass called *bāphila/bābhyo* and clay, and adequately fired. It was used as a receptacle for the refined molten copper. In order to prevent molten copper from sticking to *haneli*, a layer of ash was spread over it. The *haneli* with ash was put under the charcoal heap, the fire was lit, and the pieces of slag kept over it. After sometime the slag flowed into *haneli* and got deposited as a spongy mass. The fire was then raked out and *haneli* taken out. The refined copper was then beaten with a sledge-hammer (*ghana*) on an iron anvil (*aina*), measuring about five by six inches, and made up into round sheets called *chakka*. Herbert (1832 : 244) reports a somewhat different process noticed by him (?) at Dhanpur (Garhwal). Accordingly, pounded ore was roasted in "open fire or forged hearth", then smelted repeatedly for refinement. He also reports use of two bellows (see also Atkinson, 1882 : 269-70).

Forbes (1964) has reconstructed several successive stages of copper metallurgy. Using this information Agrawal (1971 :156-58) has also discussed this issue in Indian context. We are not in a position to apply this information to Central Himalayan copper products. However, these objects are not brittle, and, as we have seen, they have not been subjected to "poling". Therefore, how such sturdy copper was produced is a matter which needs further research.

Manufacturing Items of Copper (Stage 4)

In the final stage copper sheets were beaten into required shape on a stone anvil having a shallow round depression in the centre. It was called *gailyuḍi ḍhuṅg*. It may be noticed that unless unavoidable, no item was made into parts and ultimately joined together. For soldering, borax and ammonia were used as flux. Borax was imported from Tibet from very early times (Joshi and Brown, 1987). Ornamentation was restricted to a few items, notably, vases, ritual basins, pneumatic instruments, etc. It was done with a chisel. Interestingly, to avoid denting by the impact of chisel, a layer of sealing wax was applied to the copper sheet on the reverse before the commencement of chisel work on the front side. Finally, the finished item was heated to the maximum and immediately burried in a pit with a covering of rice husk and sand, called *kanakha*-

lā. When it cooled, it was vigorously rubbed with the same material to produce lustrous red coloured copper object. Possibly, this process may have created the effect of "poling".

Archaeological records from Central Himalaya reveal existence of the following items made from copper/brass/bronze : copper plates for writing records, etc., copper sheets for roofing wooden superstructures above temple *śikharas*; bells; lamps; sculptures; tridents; finials of temple *śikharas*, etc. (Joshi M.C., 1970; Joshi, 1990b: 51-52). Recently discovered archival material from Kumaon lists the following items made from copper/bronze/brass :

Copper Items : *tāmo* (lump of copper); *tāulī* (small cooking vessel); *parāta* (basin); *pholo* (vase); *gagarī* (smaller vase/pitcher); *ḍhola* (drum); *māṇā* (a tumbler like measuring utensil); *kuṇḍī* (a smaller basin used in rituals); *belo* (bowl); and *belī* (smaller bowl)

Brass Items : *Gagarī* (smaller vase/pitcher); *gaḍuvā* (spouted small vase); *parāta* (basin); *chhākala* (chain-bolt ?) ; *bahuguṇā* (musical instrument); *ḍhola* (drum); *karatāla* (cymbal); and *syāmasundara* (musical instrument ?).

Bronze Item : *ḍamaru* (kettle-drum).

Items not Specified (copper/brass/bronze): *huṇḍā* (big storage jar); *taulā* (big storage vessel); *ranasiṁga* (pneumatic instrument); *turi* (pneumatic instrument); and *syāmasundara* (musical instrument ?).

These items originally belonged to the Raikās of Sīrā and were, in all probability, made from copper mines of Sīrā. Entries of these items in the archival records made during the Raikā regime were transferred to the Chandra records when the latter defeated the former. The earliest date of transfer recorded being Śaka 1522 (AD 1600).

Ergo

At present copper working is mainly confined to Almora town which was the capital of Kumaon under the Chandras from *circa* AD 1525-1530 to 1790. It still continues to be an important political, cultural and commercial centre of Kumaon Hills proper. It is interesting to note that local Tamtas of Almora practice traditional copper working, however, with modifications. Some of them use moulds and pressing devices in shaping artefacts. Rotary fans have been substituted for bellows. However, the traditional techniques of soldering, ornamenting with chisel work, finishing items with hammer marks, and, finally, polishing it are still practiced. The Tamtas are now manufacturing modern items like water-filters, water-jugs, tumblers, vases, electrical-lamps, etc. However, they have yet to make their mark in consumer market.

In the foregoing sections of this essay I have given a brief account of copper working in Central Himalaya. Hopefully, the etymology and analysis of technical words - which are mostly local - might help in resolving the problem connected with the Copper Hoard archaeology. At the same time, it might induce the Tamtas to reorient their thinking regarding their origin. At least, they will strive to trace their roots without cherishing the received wisdom of being "immigrants", hence superior to the uncultured natives (*see* Joshi, 1995).

KEY WORDS AND ABSTRACT

KEY WORDS Copper Hoards. Gaṅgā Valley. Metalwork. Buffalo Hides. Charcoal.

ABSTRACT Although copper objects often found in caches have attracted attention of historians and archaeologists from the nineteenth century AD., it was in the later half of the present century that the Copper Hoards of the Gaṅgā Valley were assigned an independent identity. Scholars believe that the authors of the Gaṅgā Valley Copper Hoard Culture procured copper from Bihar and Rajasthan. However, recent discoveries of nine Copper Anthropomorphs - the exclusive artefects of the Gaṅgā Valley Copper Hoards - from Central Himalaya, Uttar Pradesh Hills, India, suggest that this region was also one of the sources of copper of the Gangetic Copper Hoards. Significantly, coppersmithy is still practised in Central Himalaya by the Tamtas - the traditional coppersmiths of Central Himalaya. Based on archaeological, archival, and

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ethnographic data, the present essay gives an introductory account of traditional copper working in Central Himalaya. Hopefully, it will further add to our understanding of the technique of ancient Indian copper working.

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Author's Address : **Maheshwar P. Joshi**, Department of History, Kumaun University, Sri Mallika Kunja, Malla Joshi Khola, Almora 263 601, Uttar Pradesh, India

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People of the Himalayas : Ecology, Culture, Development and Change

K. C. Mahanta, Guest Editor

Assam : Ecology and Change in Historical Perspective

S. L. Baruah

Ecology is the most important determinant in shaping the history and culture of a country or a nation. In the past, ecological factors like drought and flood promoted diffusion of people and their concentration in river valleys, leading to the rise of different civilization . Not only the material conditions of life including dress and food-habits of a people, but even their mental perspectives and philosophy of life are determined by ecological factors. For instance, the influence of the lofty, snow-clad Himalayas in shaping the spirtual beliefs of the ancient Indians had been very profound.

It is due to ecological factors that different local zones 'each with a regional spirit of its own' having certain distinctiveness in its culture emerged in India. The dense forests and the high ranges of mountains in different parts of India offered shelter to people, keeping them isolated from the mainstream of Indian life. The dry and hilly regions of the North-West and the sands of Rajasthan made the people of these regions more heroic than those living in the fertile river valleys. It has often been argued that tropical climate enervated the Indians, making them unable to resist the attack of the foreigners coming from colder regions. The destiny of a large section of the Indian people, to a considerable extent, is still determined by the monsoon coming from the Arabian Sea.

The history and culture of Assam is likewise moulded by ecological factors. It lies at the extreme eastern end of the Himalayas, which makes it a frontier territory of India. It has the river Brahmaputra flowing through its heart. This river has its source in the Chemayung Dong glacier situated to the south-east of the Manas Sorover. River being carriers of civilization in ancient times, it was through the courses of the Brahmaputra, Teesta, Dharla and the Sonkosh that the Mongoloid people from their original habitat in north-west China poured to Assam and North Bengal and thence to the sub-mountain tract of the Himalayas.

Having been located in "one of the greatest migration routes of mankind" (Mills, 1928), Assam has been receiving strains of different human races since time immemorial, which makes it a melting pot of different cultures. Along with the course of the Brahmaputra, the hills of the region provided passes for migrations from and to the neigbouring countries like Tibet, China, Thailand and Myanmar. It is because of its geographical location that Assam's culture exhibits an assimilation of tribal and non-tribal or of Indian and South-East Asian elements.

Due to its constant high humidity, Assam has a moderate climate. For being open to the moisture laden winds from the Bay of Bengal, its climate is also very damp. Rise of temperature of Assam is checked by frequent showers and thunder-storms. Shihabuddin Talish, the historian of Mir Jumla's Assam invasion (1662-63) observed that in Assam "it rains for eight months in the year and even four months of winter are not free from rain" (Sarkar, 1915). There is no change in the situation till date so far as this ecological aspect is concerned. Dampness and frequent rainfall have an enervating effect on the people tending to make them less active, mobile or adventurous, for which the British officers referred to Assam as a 'sleepy hollow'. The situation in the early stages of civilization stood as an obstacle towards large scale human settlement, when men were subjects of their environment. Rainfall promoted vigorous growth of vegetation, which soon got converted to thick forests. This could be cleared with the help of iron implements only. Discovery of iron being an event of a much later date than that of copper or bronze, Assam, and for that matter, the entire North East became suitable for large scale human settlement much later than the Indus Valley or the Ganga-Yamuna doab (Sharma, 1977).

The climate of Assam proved unhealthy for men coming from dry regions, which served as one of the factors for the failure of the Mughals to conquer the land. Mir Jumla, the great Mughal general, who occupied the Ahom capital at Garhgaon in 1662-63 decided to return without consolidating his victory, as he fell frequently ill here and died on board on his way back to Dacca. During the period of his operations, constant rains from May to October made his detachments to lie 'cabined, cribbled and confined' in their water-logged camps, isolated from one another, as well as from the fleet and regularly pestered by the night attack of the Ahoms (Bhattacharyya, 1929). An epidemic of fever and dysentery, which broke out in the Mughal camp at Mathurapur early in August 1662, which they ascribed to its 'extremely unhealthy climate' reduced the strength of their crops of 1500 horsemen in this camp to about a third (loc. cit.).

Dampness had its harmful effects on the preservation of the monuments and all articles, including manuscripts, so important a source for history writing. Although due to certain modern scientific techniques, the condition has improved to a certain extent in recent times, the overall picture remains the same.

Assam is continually affected by flood, the intensity of which has greatly increased in present times owing to large scale deforestation within the state and in the neighbouring state of Arunachal Pradesh. By early June, the south-west monsoon reaches the Assam valley and the continuous heavy rains raise the river levels rapidly. The Brahmaputra and all its tributaries remain in spate registering a series of high flood levels until October which puts the people into serious straits and causes damage to their crops and cattle.

The flood of 1954 was one of the highest ever recorded, which according to the geologists was an outcome of the great earthquake of 1950. This earthquake flattened and raised the bed of the Brahmaputra which caused larger area to be submerged than before. To check the havoc of floods, embankments have been raised by the Government in sensitive areas of the river banks, costing large sums of money but this has not served the purpose as expected. In fact, floods stand as a great deterent towards the development of certain areas like the Dibrugarh town, which during the British rule emerged as the most beautified and advanced town in Assam, but a neglected one now, having been labelled as floodprone. Half of the original town of Dibrugarh was washed away by the flood, causing changes in the settlement pattern and population complex of the area. In the north bank, the Brahmaputra has been shifting towards the west. While shifting, it is eroding the soil cover, leaving silts, which has damaged the quality of soil affecting cultivation and hence the economy of the state.

Assam abounds in rivers, which determines not only the economy but also its political development. This situation made the inhabitants of this region expert boatmen enabling them to be efficient naval soldiers. It was mainly in the naval battles that the Assamese defeated the Mughals in the seventeenth century. Navy formed an important organ of the defence force even in ancient times. Hiuen Tsang, the Chinese pilgrim who came to Kamrupa (ancient Assam) in 642 A.D. states that its king Bhaskaravarman (C. 596-650 A.D.) went to meet Harshavardhana, the king of Kanauj (600-648 A.D.) up the Gangas with a flotilla of 30,000 ships (Watters, 1973). The figure may be an exaggerated one, but the fact remains that Assam had a large navy and it had developed a ship building industry from very early times.

Rivers not only served as arteries of commerce and communication but also provided political and cultural boundaries, which is also formed by hills or mountains. Water routes were the main means of transport and communication till the days of the East India Company. The geographical division of the kingdom of Kamrupa as given in the Sanskrit work *Hara Gauri Sambada* (Kakati, 1978) is purely on river boundaries. Rivers, however, change their course and some of them get dried up due to ecological factors. The river Karatoya, which formed the western boundary of the kingdom of Kamarupa had long dried up. The Brahmaputra and the Dihing started changing their courses from about the latter part of the seventeenth century creating Majuli, in course of time, which is, the largest riverine island in the world, Majuli became a leading centre of culture in Assam, when in the seventeenth century, the Ahom kings established here the famous *Satras* or Vaishanava monastaries of Dakshinpat, Auniati and Garamur. But in recent times, following the earthquake of 1950, flood has become a serious threat to the existence of Majuli and its area is also gradually getting reduced, having suffered erosion in both the northern and the southern sides.

Rivers in Assam not only supplied fishes making it a staple food of its people but had also produced a precious metal-gold. In fact, almost all the rivers of Assam were auriforous and the technology of extracting gold by washing the sands of the rivers was known to the people of Assam since very early times. Persons skilled in the job were called Sonowals, who were organised into Khels or professional guilds during the days of the Ahoms.

According to Shihabuddin Talish, ten to twelve thousand Sonowals were engaged in the work during the reign of Jayadvvaj Singha (1648-1663), who paid to the royal treasury one *tola* of gold per head per annum. After British occupation of Assam, this profession died out, mainly due to the changed pattern of economy and disorganisation of the *Khels*, preceding their rule. After the great earthquake of 1897, it is said the gold content of the Assam rivers got greatly reduced, so that even with the application of modern technique, the chance of profitability is very small.

With various scientific inventions like hydroelectricity, in modern times, the network of rivers of Assam was found to contain a tremendous water power potential. The utilisation flow of the Brahmaputra is estimated to be 12,308 MCM and its specific yeild is believed by experts to be the highest in the world (3.50 CFS per square mile). The total hydel potential of the Brahmaputra is estimated as 12,900 MW. But till now only 3 per cent of this has been developed. If the hydel potential of the Brahmaputra is fully utilised, not only the entire north-east would be electrified but development of different sectors would become possible.

Ecological conditions make rice the staple food not only of Assam but of the entire eastern and southern zones of India, and rice culture played a key role in Assam's socio-economic and even political developments in the past. Before the invention of the plough, cultivation was done through zhuming and the practice is still prevalent among some tribes. Every man in Assam till the other day had been a peasant per excellence. Wealth in the medieval Assamese society was measured in terms of plough, cattle and granary. Kings from early times were making *agrahara* settlements and while doing it, they always took ecological points, like presence of streams, wet lands etc. within the donated area, for consideration. The Bhuyans could gain prominence in the lower and the central Brahmaputra valley, as it was through them that wet rice cultivation came to be introduced in these areas, whereas the same was performed in the eastern part of the state by the Ahoms. The root of the paik system of the Ahoms lay in rice-culture, a product of ecology. Ecology also builds the platform for creation of different kinds of amusements and festivals and through it for cultural interaction and social harmony. Alongside, it prepares the field for the growth of language and literature. Most of the place names of a country, including surnames of persons are derived from ecological conditions. Folk songs and music which provide important source materials for social history are directly rooted in ecology.

The soil of Assam in exceedingly fertile and well adapted to the cultivation of all kinds of crops. In the past, there was no practice of manuring the land, the service being provided by the rivers themselves. To quote Robinson, "The rapidity with which wastes composed entirely of sand, newly washed forward by the river current during floods become converted into rich pasture is astonishing" (Robinson, 1979). Considering the geological structure and chemical composition, Assam soil is divided into three types : red loam, laterite and alluvial. As such it is suitable for the cultivation of banana, orange, pineapple, jackfruit, different kinds of citrus fruits, sugarcane, mustard, jute, wheat, rice and different kinds of vegetables.

The soil of Asssm was found by the Britishers to be very suitable for the cultivation of tea. After their occupation of Assam, they therefore started here tea plantations and the first successful experiment with Assam tea was made in 1837. Thus started the colonial plantation economy in Assam, which led the state to be doubly exploited by the British. Various land rules were passed to serve the interest of the European planters. Labourers were imported from different parts of India in very large numbers and were given here permanent settlement, which brought changes to the demographic pattern of Assam and gradually added new elements to its culture. In course of time, ancilliary industries like those of coal and petroleum grew up and, so also a transport system linking the tea gardens with the outside markets.

The agro-based tea industry of Assam has brought significant changes to its settlement pattern but no parallel development to its economy. The tea auction centres till the other day were at Calcutta ; by now only one such centre has been set up at Guwahati where only 1/9 part of Assam teas is auctioned. The planters were formerly Europeans and at present, mostly Marwaris, the major part of plantation being under the Tata company. A few gardens still have Europeans share-holders. No doubt some indigenous people are getting jobs in the tea gardens, but the state gets only a small percentage of the profit, though it ranks as the highest tea-producing area in the country.

Ecological composition gives Assam two valuable mineral products - coal and petroleum, the exploitation of which, of course, started only during the British rule. In the year 1991-92, Assam produced 4838 tonnes of crude oil, which amounts to 58% of the total production in India, 230 tonnes of petroleum refinary products and natural gas (utilized) of 967 million cubic metres (Statistical Handbook of Assam, 1992) which gives Assam an important place in India's economy. In Digboi was established the first refinery in Asia in 1901 followed by two others of the kind, one at Noonmati (Guwahati) and the other at Bongaigaon, the fourth being under construction at Numaligarh. Although Assam has an estimated coal reserve of 850 million metric tonnes, due to high content of sulphur, Assam coal is found not suitable for metallurgical purposes. This therefore needs modern techniques for development.

Both the banks of the Brahmaputra are skirted by hillocks, which provided strategic points of defence, when wars were fought only on land and water. This had also made the native soldiers expert in guerilla warfare, that being one of the factors contributing to their success in the battles against the invaders. The hills of Assam had offered shelter to people, who having remained confined to their respective areas of habitation got alienated from one another and developed their own way of life and, hence distinct patterns of culture. Thus the Dimasas, who originally dwelt in the Brahmaputra valley, later migrated to the Barak valley and built their own kingdom there, thus getting separated from their kinsman in the former region. The Assam range is still standing as a wall of separation between the two valleys.

Assam has an extensive forest region (about one third of its total area has been marked as such), which influenced its historical development and economy. It abounds in valuable flora and fauna. Valuable woods like *Sal (Shorea), Cham, (Artocarpus), Champa (Michelia) Baonchom (Phoebe) Hollokh (Terminalia),* necessary for building houses, boats or making furniture are supplied by the forests. Animals like elephants, one-horned rhinoceroes, tigers, pigmy hog, yellow primula, deers and different specis of birds are found in the forest reserves of Assam, mainly at the Kaziranga wild life sanctuary, the largest of the kind in the world. Musk of deer and oxen had been valuable forest-based products of Assam, references to which are found in classical works and contemporary inscriptions (Choudhury, 1966). Due to the large availability of elephants, elephantry formed an important organ of Assam's army in the past. In fact, Assam had wide reputation for its elephantry. The *Mahabharata* speaks of Bhagadatta, king of Pragjyotisha (very early name of Assam) as the best wielder of the elephant squad among the kings participating in the Kurukshetra war, on the Kaurava side (Ibid.). Huen Tsang informs us that Bhaskaravarmana went to meet Harshavardhana with 20,000 elephants (Walters, 1973). The Ahom king Pratap Singha (1603-41) after getting one thousand elephants captured took the title Gajapati and the place where these elephants were kept came to be known as Gajpur. The Ahom kings were so much interested in elephants that an illustrated book on elephantology entitled *Hastividyarnava* was caused to be written by Siva Singha (1714-1744) and his consort or Ambika, its author being one Sukumar Barkaith.

With the change of time, methods of warfare also underwent radical changes ousting elephantry from the important position it occupied in the army in the past. But elephants are still in use in taking out logs from the deep forests. Possession of an elephant was a mark of aristocracy in the past, it being replaced by a car in modern times. There had been gifts of elephants to the neighbouring kingdoms like Manipur, Cachar, Jayantiya and Nara (Mungmao) by the kings of Assam. By the terms of the treaty concluded between the Mughal general Mir Jumla and the Assam king Jayadhvaj Singha in January 1663, the latter gifted 90 elephants to the Mughals and agreed to send 30 each year. Ecological conditions of Assam by nurturing elephants thus played an important role in its political and cultural history.

Assam's ecology is also favorable for the growth of certain essential oil and perfume producing plants. Reference to sandal and aloe wood of Assam are found even in the epics. The presents from Kamarupa in the Rajasuya ceremony of the Pandavas included inter-alia these woods. The Mughals were very much interested in the aloe wood of Assam and there are records of their unauthorised cutting of this wood in the forest bordering the province of Darrang (Goswami, 1922). Lac, bay leaf and pepper had been items of trade between Assam and Mughal Bengal. In the first decade of the 19th century, Assam exported to Bengal 10,000 maunds of stick lac costing 35,000 rupees and manjista or Indian madder valued at 500 Rupees (Hamilton, 1963). Medicinal herbs and many varieties of beautiful orchids, generally classed as *Kapauphul* and *Bhatauphul* are still exported from Assam, which are sold at high price in foreign countries. Assam, at present, is earning more than two crores from its forest-based industries. Its soil also makes possible abundant production of betel nut and betel vine making it an item of daily menu of an Assamese and an integral part of his culture.

Assam's traditional industry of sericulture for which she is widely known, is also a gift of her ecology, as the plants required for rearing the silk worms are found here in abundance. Of the different varieties of silk, Muga or the golden silk is produced only in Assam. This is due to the fact that plants like *Chom (Machilas), Champa (Michelia), Mejankari* or *Adakuri (Teranthera)* are found in plenty in the forests of Assam and the climate is also suitable for rearing up the delicate muga worms. The Muga silk had been an item of export to the neighbouring countries, since early times.

Assam's ecology determined the architectural plan of its dwelling houses. The architects of Assam in the past went for wood and bamboo and not brick or stone, as the state is located in the earthquake belt. Attempts, were of course, made to conquer nature and build temples and palaces with brick, but this did not survive, as the modern technique of making lintels with iron rods had not developed at that time. Fortunately, however, a few temples built in the latter part of the Ahom rule still exist to give us an idea of the architecture of the period. Because of the damp climate, houses were made on raised platforms, for which they were called *chang ghar*. The fine workmanship of the wooden palace at Gargaon was highly admired by Mir Jumla's chronicler in the following words : "My pen fails to describe in detail the other arts and rare inventions employed in decorating the woodwork of this palace. Probably nowhere else in the whole world can wooden houses be built with such decoration and figure carving as by the people of this country" (loc. cit.).

Abundance of bamboo and its wide use made the culture of Assam and of the entire North-East to be called as bamboo culture. Not only houses and fencings and implements of weaving, fishing and agriculture were made of bamboo but even items of crockery and ornaments.

It is learnt from Hiuen Tsang that Bhaskarvarman sent to Harshavardhan 'baskets of variously coloured reeds', thick bamboo tubes (containers), and 'various birds in bamboo cages' (Choudhury, 1966). Bamboo shoot and pickles made from it are still delicacies in traditional Assamese families, reference to which are found in old Assamese chronicles or *buranjis*. Thorned bamboos called *Kotoha banh* used to be planted round the boundary wall of the capital as a measure of defence during the days of the Ahoms. Tall bamboo pieces with sharp ends used as fencing are still seen in the old jails of Assam. This is being replaced by high brick walls to which sharp glass pieces are fastened at the top in the newly constructed ones.

The climate of Assame has been undergoing radical changes in recent times owing to the emergence of ecological imbalance caused mainly by large-scale deforestation and environmental pollution created by modern industrialisation. Forest based industries in Assam and in the neighbouring states of the North-East have become so lucrative that large number of timber-producing trees are cut down daily to serve the greed of the businessmen. This wanton aggression on the natural resources makes the Karbis, Dimasas and the Bodos of Assam the worst victims, which act as a catalyst to their ethnic awareness and consequensly autonomy movements. Again, the emission of carbon monoxide and other obnoxious and toxic gases from the oil fields at Lakua, Moran and Geleki are affecting vegetation in the neighbouring areas. Muga worms are reared in open air in many spots near these oilfields also. As the leaves of these trees get toxicant by the gas, the larvae die soon after they consume these leaves. The open cast mining at Tipam and Borgolai in a like way is causing harm to environment. The effect of such environmental pollution is very deep. It is both causing harm to health and promoting unemployment among women, thus increasing their economic dependence on men, and consequently affecting the quality of life.

Implementation of plans for change and development without paying any heed to the ecological conditions is thus standing as a serious challenge to the culture and tradition of the people. Exploiting the natural resources, new industries are being developed but the possibility of their causing greater harm than benefit poses serious threat to future.

KEY WORDS AND ABSTRACT

KEY WORDS River Brahmaputra. Gold-dust. Monuments. Manuscripts. South-West Monsoon, Majuli. Flood. Deforestation. Environmental Pollution.

ABSTRACT This study attempts to show the influence of ecology on the historical and cultural developments in Assam and its changing scenario resulting from natural and human factors. Ecological factors, like the presence of a large number of rivers, hills and dales determined the settlement pattern and the way of life of the people of Assam and also their military organisation and war strategy in ancient and medieval times. The rivers in Assam contained gold-dust, which enabled her to produce a large amount of gold. The soil and climate is very suitable for rearing silk worms *muga* or golden silk being her unique variety, for which she has a world reputation. Ecology determined her economy and consequently influenced the administrative policy of the rulers, and their relation with the neighbouring powers. Being located in the earthquake belt, Assam developed her own architecture of bamboo, wood and straw, in line of which, later on, the 'Assam Type' architecture grew up. After the great earthquake of 1950, the intensity of flood has greatly increased in Assam, making it a serious problem for the state. In the wake of modernisation, when exploitation of natural resources has been encouraged, wanton destruction of forests and the unplanned growth of industries are not only causing ecological imbalance and environmental pollution in the state but is also affecting the quality of life and acting as catalyst towards ethnic awareness, creating grave political problems.

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Author's Address : **(Dr.) Prof. (Mrs.) S.L. Baruah,** Department of History, Dibrugarh Universtiy, Dibrugarh 786 004, Assam, India

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Tibetan Migration and Early State Formation in The Brahmaputra Valley : A Study of the Formation of The Koch State in Assam

D. Nath

INTRODUCTION

The Koches who now form a caste in the Hindu social hierarchy in Assam, were an aboriginal tribe of North-East India (Risley, 1891: 492; Dalton, 1978 : 89) belonging to the Sino-Tibetan family of the Mongoloid stock (Gait, 1981: 47; Hodgson, 1847; VIII; Waddel, 1900 : 48; Chatterji, 1974 : 111). About the beginning of the sixteenth century the tribe formed a state in the western Brahmaputra valley that covered also a part of present North-Bengal. This state of the Koches with its capital at Koch Behar, lasted for about a little more than half a century till its decline as a result of its division into two parts about the year 1581 (Gait, 1981 : 58). During this period of its existence the Koch rulers - Biswa Singha (C. 1515-1540), his son and successor Malladev *alias* Naranarayan (1540-1587) and his brother Sukladhvaj *alias* Chilarai contributed largely to the development of polity and the growth and enrishment of the Sanskrit as well as vernacular literature in the land; and by patronising the Neo-Vaishnative movement in the sixteenth century established permanent socio-cultural link of the north-eastern region with the rest of India.

Scholars have different views about the original habitat of the Koches. Minhas-ud-din Siraj in the thirteenth century has noted that during his time the Koches inhabited the region of north-east Bengal and north-west Assam (Raverty, 1970 : 560). Buchanon Hamilton in the first part of the nineteenth century found that the original primitive Koches had lived amidst woods in the extensive regions of North-Bengal. He appears to have held the view that the Koches had their original home somewhere in the northern part of Bengal towards Dalimkot (1963: 67-68). Hodgson also supports the view (1847 : VIII). It is to be mentioned here that the Koches are mentioned in the *Yogini Tantra*, a sixteenth century Sanskrit work written under the patronage of the Koches themselves, as *Kuvacha* (Saraswati, 1979 : XI : V. 45-51, XII: 3; Sarma, 1973 : 128) while in the *Padma Purana* and in the *Darrang Raj Vamsavali*, a genealogical work of the Koch kings, they are called *Kavachaka* (Ch. 57 : Chatterji, 1974 : 113 ; Vasu, 1990 : I : 71). It is certain that the terms *Kuvacha* or *Kuvachaka* are some Sanskritised terms of some tribal forms like the words *Kamakhya* or *Pragjyotisha* (Kakati, 1967 : 5, 19, 53-54). According to S.K. Chatterji, "the word *Koc* (or rather *Komc*) comes from a middle Indo-Aryan source from *Kawomca* written *Kamoca* which can be properly sanskritised as *Kamboja*" (1947 : 113). He, therefore, applies the term to mean the Koches of Bengal (1926 : 339). Thus while the word 'Koch' is a local Prakrit form of the Sanskrit *Kamboja*, the terms *Kuvacha* or *Kuvachaka* (speakers of bad or barbaric languages) are adjectives used to denote the barbaric or the *mleccha* origin of the tribe (Nath, 1989: 7; Thapar, 1978 : 155).

Now taking it as a historical fact that the Koches were earlier known in India as Kambojas, some scholars like to point to their original habitat as somewhere in North-Western India (Ray, 1973 : I : 311fn; Majumdar, 1971 : 191 ; Vasu, 1990 : I : 166, 190). While it is very difficult to trace the story of their migration from the extreme North-West merely on the ground that there was a *Kamboja* state in that region, there are positive evidence to show that the Kamboja ancestors of the Koches originally came from Tibet.

In ancient Indian literature the term 'Kamoja' was used to mean Tibet (Chanda, 1913-14 : 44). R.C. Majumdar therefore, remarks that Kamboja is an Indian name for Tibet (1971 : 126 fn.). Foucher has mentioned that Nepalese traditions apply the term *Kambojadesa* to mean Tibet (Foucher, 1900 : 34 ; *Cf.* Smith, 1924 : 193fn.). That the *Kambojadesa* is no other than Tibet, can also be presumed from the records of the *Brihat Samhita* wherein it is found that Pragjyotisha, Lauhitya and Cina or Kamboja (Tibet and Bhutan) were contiguous regions (*Cf.* Choudhury, 1966 : 10). Interestingly, while from some epigraphic sources (*Cf.* Majumdar, 1971 : 134fn.) it is found that horses were imported to Bengal from the Kamboja country, the *Tabakat-i-Nasiri* specifies that country as being Tibet (Raverty, 1970 : 566-567). Thus it is certain that the Kamboja ancestors of the Koches were originally dwelling in Tibet before their coming down to the Bengal and Assam plains. It is to be noted that a traditional story prevalent among the Garos and the Rabhas of Assam, the two Bodo tribes akin to the Koches, is replete with references to Tibet and the neighbouring eastern Himalayan region as the land of their ancestral home (Chatterji, 1974 : 41; Das, Ms).

In historic times Tibetan hordes are recorded to have invaded Bengal. According to the chronicles of Ladakh (*Cf.* Majumdar, 1971 : 124-125 ; Chanda, 1975 : 132), the Tibetan king Khrisrong-Ide-Btsan (755-797) extended his political suzerainty over some parts of India. It is also known that after him his son Muitig-btsan (804-815) defeated Dharmapala of Bengal, and a subsequent Tibetan king Ral-pa-can (c.817-836) conquered Indian territory as far as "Gangasagara' (mouth of the Ganges) in the south (Majumdar, 1971 : 124-125). These invading Tibetan forces since then began to settle in Bengal, and at times, they curved out a mighty kingdom there spreading over parts of both Bengal and Orissa (Majumdar, 1971 : 124-125; *Cf.* Chanda, 1975 : 10-46; Nath, 1989 : 10-12). Interestingly epigraphic records have mentioned these Tibetan rulers as belonging to the Kamboja family (Chanda, 1913-14 : 35 ; Chanda, 1911 : 618-619). Thus there is no doubt that the term Kamboja was used in India to mean both the country and its people-the Tibetans. Since the Koches of Assam and Bengal are mentioned as Kambojas, they are to be considered as one of the branches of the Tibetan migrants of the land.

It can neither be said for any certainity as to the time of the Kamboja migration to the Brahmaputra valley, nor it can be held whether the Koches of Assam were an extension of the Kamboja invaders of Bengal. Scholars believe that even before the Tibetan invasion of Bengal, there were currents of migration to the North-East from Tibet and central parts of China since long time past which, according to them, dates as far back as the first millenium B.C. (Chatterji, 1974 : 41). S.K. Chatterji appears to have supposed that the Mongoloid Bodos who include the Koches, entered the Brahmaputra valley through its north-eastern passes and trade routes (*e.g.* Robinson. 1975 : 247) and gradually extended towards the west. He, therefore, divides the Bodos of north-east India into two main branches: the eastern and the western. According to him, the eastern branch includes the Chutiyas and the Kacharis and the western one includes the Koches (1974 : 112-114). While there is no positive evidence to show that the Koch kingdom of Assam is an extension of the Kamboja rule in Bengal, the primitive state of their civilization before their formation of a state as known from the early records, rather points to their relationship with the batches of the remote Tibetan immigrants. As earlier mentioned, Minhas-ud-din Siraj has recorded them to have lived amidst the jungles about the thirteenth century (Raverty, 1970 : 566-567) ; and the *Darrang Raj Vamsavali* has recorded Hariya, the father of the founder Koch king Biswa Singha, as a shifting cultivator of the hills along with his calnsmen, (Sarma, 1973 : vv. 51-54). The same reference is found also in some of the early Assamese chronicles in one of which the founder king of the Koch state is said to have been despised by an orthodox Hindu-lord as belonging to the uncivilized tribes (Bhuyan, 1958 : 10 ; Wade, 1927 : 187). All this shows that the Koches in Assam, before their formation of a state, had no record of attaining any high degree of civilisation which fact not only points to their migration as a separate immigrant group but also to the fact that they were living as a tribe since remote past rather than as an advanced group of armed forces coming to invade and conquer the country. Records show that Hariya was the chief of his clan consisting of twelve families. He was accustomed to meat and drink in form of country-liquor called *mad* which his two wives used to supply him at the fields on the hills (Sarma, 1973 : v. 54).

Hariya's son Bisu was a young and energetic boy who by virtue of his organising ability united his tribe and gathered considerable strength. He then attacked the growing feudal chiefs in the neighbourhood called 'Bhuyans' and by subjugating them all, formed the nucleus of a small state centering round the hill Chikana in the Khuntaghat *pargana* of Goalpara district of Assam (Sarma, 1973 : 118-122 ; Nath, 1989 : 20-23). This event had taken place about the year 1515 A.D. (Gait, 1981 : 48 ; Nath, 1989 : 27-28). The state thus formed gradually grew at the cost of the neighbouring chiefs who rose to power in the region after the fall of the old kingdom of Kamarupa, and it extended as far as the river Baranadi in the east on the north of the Brahmaputra and the Karatoya river on the west. On the south bank it extended as far east as the river Kapili in Nagaon (Nath, 1989 : 35). The Koch state thus comprised the lower Himalayan regions, the whole of the present districts of Kamrup, Goalpara and parts of Nagaon district in Assam as well as the district of Rangpur except Ghoraghat in present Bangladesh.

The growing power of the Koches under Bisu was marked by the Brahmanas who soon found him out and Hinduised him and baptised him as Biswa Singha (*i.e.* lion of the world) (Sarma, vv.1973 : 125-131 ; Gait, 1981 : 48-49). Biswa Singha, too, on his part, proportionately responded to enlist the support of the intelligent class for the newly growing state. Thus from the very inception the Brahmans were imported from outside the state and established, Sanskrit was patronised and cultured in the court itself and temples and shrines were built (Sarma, 1973 :vv. 114, 266-68; Giat, 1981 : 50 ; Ghoshal, 1942 : 119-222 ; Barua, 1972 : 41). Thus Hinduisation of the royal household and other members of the Koch aristocracy began. Biswa Singha sent his two sons Malladeva and Sukladhvaj to Benaras for higher education in Sanskrit both of whom, later on, became great Sanskrit scholars (Sarma : 1973: vv.266-280). Vernacular literature in the form of Assamese also became encouraged by way of according patronage to the Vaishnava scholars to get the Sanskrit religious texts translated into vernacular Assames for the understanding of the masses (Sarma, 1973 : vv. 556-560). It should be mentioned that the growth of the Neo-Vaishnavite movement and the Vaishnava Assamese literature in Assam owed its impetus from the founder Koch kings, such as, Biswa Singha and Naranarayan. It is very significant that the Neo-Vaishnavite movement which was a part of the all India Bhakti Movement, linked Assam with the rest of India culturally and thereby largely contributed to the social integration of the country. It was from this period onwards that melting down of the tribal mode of living of the Koches began to be gradually replaced by a caste based socio-economic systems.

The rulers at the foundation stage were concerned about the consolidation of their rule firmly. Chiefs of different clans belonging to the tribe were appointed as ministers (Sarma, 1973 : v.151) in order to obtain their constant support. They took census of the people (Sarma, 1973 : vv. 196-197) in order to ascertain revenue in terms of manpower and arranged them in a systematic way whereby every adult male member was compelled by law to render free services to the state; and by dividing them into certain units placed them under some officers so that quick mobility of the peasants in times of need might be possible. Thus a feudal structure developed; and that was what gradually coming into being almost all over the valley.

Thus the Koches who originally migrated to the Brahmaputra valley from Tibet and the Himalayan regions contiguous to it, contributed largely to the growth of civilisation in the Brahmaputra valley as early as the sixteenth century A.D. As mentioned above, the Chutiyas and the Kacharis, the two other allied Bodo tribes of Assam, also formed immigrant groups from the same region along with the Koches. As a matter of fact, the process of state formation in the land by the Bodo Mongoloids hailing originally from Tibet, may go back even to an earlier date, for the Chutiyas and the Kacharis also formed two durable states in the Brahmaputra valley much earlier to the Koches (Bhuyan, 1962 : 176-182, 193-200 ; Bhuyan, 1951 : for details ; Gait, 1981 : 40-42). Such connections might have led to the growth of economic and cultural relations between the Brahmaputra valley and the Himalayan countries even in very early times. That Assam's relations with Tibet and her neighbouring countries have existed since very early times could be gussed from the fact that hordes of Tibetan and Bhutanese Buddhist pilgrims still visit the Hayagriva - Madhava temple at Hajo in Kamrup district in Assam and consider the image of the temple as that of 'Mahamuni Buddha' (Choudhury, 1966 : 401-402), the padestal of which contains a small inscription in Tibetan language (Choudhury, 1966 : 402). Besides cultural, there were economic relations, and traders from the Brahmaputra valley used to visit Tibet, Nepal and China in remote past (Gogoi (Nath), Ms ; Barua, 1977 : 35-48). Thus S.K. Chatterji's view that "on the whole, the Tibetans remained foreigners so far as India was concerned" and that they "did not anything to the sum total of Indian culture" (1974 : 44), may be put to scrutiny. Indeed, Tibetan influx into Assam considerably added not only to the growth of Tibeto-Indian relations in historic times, but it also largely contributed to the growth of India's culture and civilization.

KEY WORDS AND ABSTRACT

KEY WORDS Social Hierarchy. Neo-Vaishnavite Movement. Kambojas. Epigraphic Records. Tibetan Migrants.

ABSTRACT The Koches of Assam termed in early Sanskrit literature as *Kambojas*, are one of the immigrant groups who came to the Brahmaputra valley from Tibet and its contiguous region in very early times. The terms 'Kamboja' denoting Tibet and/or its people to the early Indians, points, among other evidences - chiefly anthropological, to their Tibetan origin. The Koches formed a state in tne western part of the Brahmaputra valley about the beginning of the sixteenth century. Since then the royal house became Hinduised and a process of detribalisation of the culture of these people began. They soon became staunch Hindu, patronised Sanskrit, settled Brahmanas and accorded all kinds of help for the growth of the Neo-Vaishnative movement of Assam. Thus they cemented the socio-cultural relations betweem the North-East and the rest of India. The Koches developed a system of administration and took census of the people to ascertain amount of revenue to be collected in terms of men's labour. Thus a kind of feudal structure grow. The formation of a state by the Koches in Assam bears testimony to the Tibetan contributions to the growth and development of India's civilization in middle ages.

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Author's Address : **Dr. D. Nath,** Department of History, Dibrugarh Universtiy, Dibrugarh 700 004, Assam, India

Culture of Friendship and Militarism of The Gurkhas of Nepal

Bharat Ch. Kalita

INTRODUCTION

Nepal, a Himalayan country of the Kirat tribe in the Bagmati valley, was under the rule of the Lichchavis from the Ist half of the 4th century to 8th century A.D. During the rule of the Guptas in India, the Lichchavis were reduced to a vassal - Lichchavi Princess Kumaradevi was married to Chandragupta I (AD 320-28) of India. Samudragupta's Pillar inscription of Allahabad describes Nepal as the frontier Kingdom. In early historical period Indian states and Nepal states (Kathmandu, Lalita Pattan, Bhatgoan, Gurkha, Baisi and Choubisi hill states) had sweet and sour relationship. Adi Shankaracharyas - c 788-820 of India set up Matha and made regular arrangements for worship in the temple of Pashupati in the Bagmati valley. Traditions require all priests of Pashupati temple come from South India. The king of Nepal on his part shares with Shankaracharyas the right to worship on the sanctum sanctorium of Puri, Shrirengi, Rameswaram. The Hindu cult and concept got spread in all the states from Kathmandu converting the entire Himalayan region subsequently as Hindu states. The Hindu culture of love and toleration created the culture of friendship, and the protection of self identity and prestigious living created in them military strengh and fighting zeal. This study attempts to support the above contentions going through the historical ages.

In the Indian subcontinent during the tenure of their 200 years of colonial rule, the British power maintained an interesting policy with the Himalayan kingdom of Nepal. The basis of the policy was formulated by the East India Company with the experiences they acquired from the only battle they fought angainst the Gurkha *Sepahees* of Nepal in 1814-16.

GURKHA IN NEPAL

The Gurkhas inhabitated the place of the same name which was one of the four sovereign principalities into which Nepal was divided, namely, Kathamandu, Lalita Patan, Bhatgong and Gurkha.

The unification of the four sovereign principalities was brought about by the kingdom Gurkha under their powerful king Prithvi Narayan (1742-75). The Gurkha ruler originally came from a few families of the Rajput Khatriyas who were driven out of Chitor, India in about 1303 AD by Ala-ud-din Khilji. These homeless warriors wandered about in Nepal until 1559 AD till they settled in Gurkha after overthrowing the existing Gurkha king Khadga Raja. These Rajputs in course of time got absorbed with the locals by inter marrying Gurkha women and imbibing Gurkha manners and customs so much so that the Gurkha nomenclature had become a proud possession of identity for them.

The British kept an eye on the development of the Himalayan kingdoms under the rising power of Prithvi Narayan and perhaps attempted to halt him soaring too high as the company sent one captain. Kinlock with select troops in aid of Raja Jay Prakash Mal of Kathamandu against Prithvi Narayan's advancing force. But Prithvi Narayan succeeded in over-throwing the king of Kathmamandu in 1769 and thereby completed the foundation of the unified new kingdom of Nepal under his monarchy with Kathamandu as capital. The company later on sent a mission under Mr. Lagan to establish a comfortable trade relation with Nepal. But Mr. Lagan following traditional British diplomacy tried to create internal unrest against Prithvi Narayan by helping the forces hostile to Prithvi Narayan. The result was a disastrous failure of this Lagan mission.

TACTFUL HANDLING OF RELATION

From 1772 to 1785 the British Governor General Warren Hastings adopted a tactful non-intervention policy towards Prithvi Narayan and his successors whom the British looked upon with respect for their fighting qualities. King Prithvi Narayan also was quite sensible to realise the power of the mighty British and therefore he played his own card very carefully to keep the British in good humour. When Raja Chait Sing of the Bejoygarah state of India revolted against the Company, to crush the revolt, British desired to secure military help from the Nepal King. Prithvi Narayan readily agreed to extend help but before the Gurkha help came the British had crushed the revolt. This friendly gesture of the Gurkha King made the Company grateful to Nepal. Many a time this example of friendly gesture was quoted by the British power to the subsequent rulers of Nepal to win over favour and support.

In 1801 Lord Wellesley acquired the Gorakhpur district from the Nawab of Oudh. This border district of the Company was exposed to frequent incursions by the Gurkhas claiming to be their own land. The British repeatedly protested this aggression but with no effect on the Gurkhas. Over and above that, the Gurkhas showed their audacity in occupying the Butwal and Sheoraj districts in 1813. An attempt of peaceful solution of the issue having failed, Governor General Lord Hastings sent an army of 3400 against Nepal. Initially the British suffered heavy reverses. General Gillespie, well known here of Java War, got killed along with his 500 men. The Gurkhas proved their toughness and bravery which the British well recorded. Ultimately indeed the British superiority of men, money and weaponry forced the Gurkhas to accent the Treaty of Saugauli in 1816.

This hard-earned victory made the British to consider a different type of dealing with the Gurkhas. The experienced British Generals had never come across a people in any battle field before like the Gurkhas who were full of fighting spirit, highly confident, exceptionally brave, maintaining high stamina under any circumstances. The soldiers of the company were mostly Hindus from India and in action they were no match for the Gurkha. General David Ochterlony who commanded the British army in this war was full of very high respect of the fighting quality of the Gurkhas. He immediately suggested to his Government to recruit the Gurkhas in the British Army to enhance the fighting qualities of the British East India Company and to allay the fear of danger that might have come to the Company from these short statured hard core fighters. The treaty of Saugauli was therefore carefully framed keeping this factor in mind by the British.

AN ESTIMATE ON GURKHAS

Charles Metcalfe, a senior British Indian official wrote at the time - "We have met with an enemy who shows decidedly greater bravery and greater steadiness than our troops possess, and it is impossible to say what may be the end of such a reverse of the order of things. In some instances our troops, European and Native, have been repulsed by inferior number with sticks and stones. In others our troops have been charged by the enemy sword in hand, and driven for miles like a flock of sheep. In short, I, who have always thought our power in precarious, cannot help thinking that our downfall has already commenced. Our power rested solely on our military superiority. With respect to one enemy, that is gone.

Mr. Brian Hodgson who was a long time British Resident in Nepal puts - "In my humble opinion they are, by far the best soldiers in India and if they were made participators of our renowned Army, I conceive that their gallant spirit, emphatic contempt to *madhesias* (people residing in the plain) and unadulterated military habit might be relied on fidelity". Captain H. Ramsay described the Gurkhas as a brave, wild, lazy, ignorant stupid, roving race of men with strong natural love for war and sport. but possessing very small aptitude for intellectual employments which they invariably regard with great dislike." Dr. Oldfield complimented them "there is not a single instance of Nepal chief taking bribes from selling himself for money to the British or any other state". Mr. Ensign John Shipp described them as bravest of the brave — I never saw steadiness or bravery exhibited in my life. Run they would not, and of death they seem to have no fear, though their comrades were falling thick around them for we were so near that every shot told.

RECRUITMENT

The term Gurkha strictly includes only those people who came from India and settled in Gurkha and does not include the Bishts, Burathakis, Thakurs, Magars or Gurungs. But all these tribes also are enlisted in the British Army.

After the war 1814-16 British took a realistic attitude and General Ochterlony started enlisting Gurkhas in the Army of East India Company immediately after the war. The process was followed by other British Generals. Within a short period three Gurkha Regiments were raised named as Melown Regiment, Sirmoor Rifle and Kumaon Regiment.

These three regiments were raised by the British Generals adopting clandestine method of recruitment as no formal approval of the Nepal Durbar was secured till 1886 for the enlistment of Nepalee subjects in British Army.

Maharaja Jung Bahadur, like all his predecessors, was averse to his subjects entering British Military Service. Even he put a restriction to those Nepalee *Sepahees* who had already joined the British service to re-enter Nepal even in their period of leave. He also declared that any person who was detected in his attempt to leave his country for this purpose would be imprisoned and his goods and houses would be confiscated. Despite all these restrictions enlistment of Nepalees in British army continued. The British Government used all their diplomatic skill to pursuade the Nepal Durbar. After the elimination of Maharaja Ranadip Singh by Bir Samsher family, the recruitment of Nepalee subjects in British army eased under certain conditions.

UNIQUE RELATIONSHIP

This Gurkha recruitment factor made the Anglo-Nepal relationship unique compared to the British relationship with the 562 Indian princely states. Nepal's status remained to be higher in British estimation though the kingdom did not enjoy complete sovereign status by the same standard as the other fully sovereign Asian states.

Nepal maintained her diplomatic relation with Tibet and China while the British Indian Government wanted to end Nepal's relation with China, yet it admitted that it had no legal right to do so. She took no action against Nepal. In 1854 Nepal exercised her sovereign right by going to war against Tibet without ever formally informing the Company Government.

In 1877 the Imperial Durbar was held in Delhi to proclaim Queen Victoria as the Empress of India. The British made the attendance of this Durbar compulsory to all heads of the princely states of India. The King of Nepal did not attend this Durbar in person considering that it was beneath his status and dignity and that his attendance would lower the prestige of his Independent country. British could not take any action against him and thereby conformed with the status of Nepal.

In the Anglo-Sikh war of 1845-49 and in the suppression of the great uprising of the Indian people in 1857 the Gurkha Regiment played vital role for the success of the British. This made the Gurkhas a never separated element even to-day of the decadent British power.

KEY WORDS AND ABSTRACT

KEY WORDS Lichchavi Princess. Adi Shankarachayya. Hindu cult. King of Kathmandu, British Power. Gurkhas.

ABSTRACT The Gurkhas of Nepal are well known as the valient and most loyal fighting force in the estimation of the British Imperialist who fought and conquered different parts of the world during their colonial days. Like many other races, the Gurkhas also stood on the way of British imperialism initially. But subsequently this race became close and loyal followers and friends of the British power. Though the imperialism vanished Gorkha Regiment still remained to be the part of the British Royal Guard and Gurkha Regiment still decorates the Indian Armed forces as one of the most valuable parts of the fighting forces. This culture of friendship and militarism of this Himalayan race deserves due attention.

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Author's Address : **Dr. Bharat Ch. Kalita**, Ex Reader and CGO-I, National Defence Academy, Poona, India

Kinship Groups and History in Suru, Ladakh

Nicola Grist

INTRODUCTION

The subject matter for this paper came to my attention through luck rather than good judgement, as the following history will illustrate. In the early 1980s I briefly visited the Suru valley and collected some basic enthnographic data on kinship and other aspects of social organisation. Then, in 1990, I offered to work on a translation of the Purig (which includes Suru) section of the Urdu history of the region written by Hashmatullah Khan, who was the *wazir-i-wazarat* of Ladakh around the beginning of the 20th century. His account is largely based on oral historical accounts which he collected by asking people from different villages to tell him histories. Although they do not provide an accurate or mutually consistent historical account; nevertheless, they provide a fascinating and important record of what people were saying about their past at that time.

In 1993 I got the opportunity to do detailed fieldwork in the Suru valley. I went equipped with a copy of the Purig section of Hashmatullah Khan, expecting to be able to make an interesting comparison between the stories that were told then and those that are told there now. I was therefore quite taken aback to find out that most people did not remember the old stories, and were not very interested in the accounts in the book.

This seems particularly surprising since, apparently, the area had been famous for its folklore in the past. Isfandir Khan, the son of Kacho Sikander Khan, the author of an Urdu history of the area (Khan, K.S. 1987), told me that people said that previously they were said to have had eighteen cycles of songs in the area; and their most famous singer had been Bekar (*beda*) Nasib Ali from Sangra, who was the father of the ill-fated Bekar Bibi, who married Tsewang Namgyal, the king of Ladakh in the middle of the 18th century. Nowadays, although there are a few old people who can tell snippets of village foundation stories, the longer, more detailed ones and the majority of the accounts of the rulers of the area that are in Hashmatullah Khan's book have been forgotten.

Along with this forgetting of the old historical narratives, people have also stopped telling the epic stories of Kesar and Apitso, which by all accounts were previously very popular in the area. In the case of those stories I was told by some people that the stories are unIslamic and deal with untruths, and hence the telling of them was a sin (*nyes-pa*) - and so even if someone knew them they would be unwilling to tell them. Others said that Kesar was to do with Buddhists and their kings, and so not of great interest to them. The disappearance of the historical narratives of the chiefs, can be plausibly explained by an examination of the history of the area from external sources. The rulers of Suru-Kartse have largely been forgotten because their line disappeared in the 18th century, when the area came to be ruled from Phokar (near Mulbekh). Purig itself also ceased to have any independence after 1758, when it was finally joined under a single Ladakhi king ruling from Leh (Petech, 1977 : 116). In the 1840's, the remaining rulers in Purig were severely punished by the Dogras, after rebelling several times against their rule, and those who survived were never given any power or positions in the administration.

Therefore the forgetting of the more chiefly historical narratives can be explained by the disappearance of the chiefs themselves. In neighbouring Baltistan, where the majority of chiefly families continued during Dorga rule, stories of the Suru-Kartse chiefs are still told; for instance, Kazemi's songs from Baltistan (Kazemi, 1985) contains several that tell stories about the chiefly families of Suru-Kartse. In Suru, there are no families at all that claim descent from the old chieftains. The time of chiefships is referred to as having been 'Buddhist times' - a term that is frequently used for everything that came before the Islamic era. In fact, the only bit of the account in Hashmatullah Khan that is in common currency, is the story of Thi Mohmmed Sultan, the last indigenous ruler of the area, and the advent of Shi'a Islam in the valley. The story that is known locally is that Thi Mohammed Sultan married a daughter of the ruler of Skardu, who was already a Shi'a Muslim, and she brought with her a Shi'ite religious teacher called Mir Hashm. He then preached Islam in the area, and hence the people there become orthodox Shi'as before other areas of Purig. Hashmatullah Khan (Khan, 1939:699) says that Thi Mohammed Sultan's father, Thi Namgyal married a princess of Skardu and they brought Mir Hashm as their son's teacher. Mir Hashm's *astana*, which is lower down the Suru valley, by the ruined fortress of Karpokhar, is a popular place of pilgrimage. According to the histories, after Thi Mohammed Sultan's death, the rule of the area passed to Kunga Namgyal from Mulbekh side, and so the line of the Suru-Kartse chiefs ended completely. I would not take this whole account as being historically accurate, rather it shows that in Suru people associate chiefship with the pre-Islamic period.

Nevertheless, the ending of indigenous chiefships and the advent of Islam *per se* did not seem to explain adequately the fact that there appeared to be a general lack of historical narrative in the area compared to the past. Seemingly people had abandoned the old histories and had put nothing in their place. However, gradually I began to realise that the main history-telling events in the area were the speeches at the Shi'te *matam* (mourning) ceremonies, which recount the lives and deaths of the family of the Prophet Mohammed. These are regular occasions in the area, as they are held on most birth and death anniversaries of members of the Prophet's family and on some of the Id days, as well as regularly throughout the month of Muharram. Thus, nowadays, people in the area have a considerable knowledge of the history of Shi'ism centring on the martyrs from the Prophets' family. I realised that narrative has now become part of the history of Suru, and it has replaced the old histories, not by sweeping them away, but merely by its greater relevance to the present.

However, I am not suggesting that the relevance of the new history is simply that people have become Muslims, just as the abandoning of the old histories is not because they are forbidden by Islam. Rather I think that other changes that have occurred in the area have made the new histories more relevant to people's every day lives. To illustrate this, I will show the connection between some of the old histories and the wider kinship groups that were important in the past: and then I will show the connection between Shi'ite history and changes that have taken place in the area.

The Old Paradigm - The Pa and Clan Histories

What I am calling the 'old paradigm' is the organisation of kinship groups that seems to have been in existence at the time when Hashmatullah Khan recorded the oral histories of Purig. As it happens, the government performed the 1911 settlement of the whole of Kargil *tehsil* in the same period. The settlement involved recording and registering the ownership of all land holdings. The combination of these two records allows us to make a tentative reconstruction of the wider kinship groups of the time.

The land records themselves record the land holdings by dividing people up into named clans called *pa* (or sometimes *zat* - particularly by Sunnis), which share a common plot of land. Each of these *pa* has a genealogical diagram, tracing descent from an apical ancestor, and describing how land was divided between the sons - and less often the daughters - of each generation. The names of the *pa* in the land records frequently coincide with those of people, clans or places that occur in origin stories of how Ladakh came to be populated or in stories of historical figures.

For instance, Francke reports that in Khalatse, just after the turn of the century, there was a kinship group (*pha-spun*) called Brushalpa, which is the same as Brukshel-pa, a very common *pa* in Suru. It means people from Gilgit, which is where Helbi and other mythological founders are said to have originated (Francke, 1904:364-5). Helbi itself is also a common *pa* name in Suru. Hashmatullah Khan reports that in those days, a Muslim family in Wakha traced their descent to Helbi, and a Buddhist one in Bodh Kharbu traced theirs to his brother (Khan, 1939:684). In Khalatse and Suru, there is also a *pa* called Gasho, which is the clan name of Tha Tha Khan (Khan, 1939:714). Other *pa* names refer to titles and roles to do with government and service to the king, such as Dragchos-pa, Togoche-pa and Lampa-pa which are also common all over Ladakh, both as house and kin group names.

Thus it would appear that at that time there was some correspondence between these clan histories and actual clans that appeared on the ground, particularly since Hashmatullah Khan reported that a number of people referred directly to these founding ancestors as being their own actual ancestors; such as a man in Bodh Kharbu who said that he was descended from Helbi (Khan, 1939:684).

The New Paradigm - Factions and 'Religious' History

By 1993/4 in Suru people did not refer to any of these old stories. When I asked people about Helbi, who are down in the land records as belonging to the Helbi *pa* or had themselves said that they did, they said that they didn't know anything about him. Some older men still referred to rather brief village foundation stories - although these do not seem to be told any more. It is common for people to say that their ancestors came into the area, from Baltistan, Iran or Kashmir, but these apparent migrations are not linked to any historical narratives in Suru.

The stories do seem still to have some currency as those of great religious figures. For instance, the teacher called Hazrat Zanches or Hazrat Pir, who is the main historical religious figure for the Sunnis in Pranti and Panikhar; and Sayyid Mir Hashm, whom I have already mentioned as being the same for Shi'as. The only people who now commonly trace their descent in the area are the families of *aghas*, who are religious leaders of *Sayyid* status - that is they trace their descent from the Prophet Mohammed's family. Other people show little interest in their own ancestors beyond their grandfather's generation - several people said to me that if I wanted to know about their ancestors then I could go and look in the *patwari's* records. There are words in the local dialect for several generations of ancestors, but these are usually only used to convey people a long way away in the past, rather than any specific ancestors.

This move away from concern about ordinary people's ancestors has paralleled a lessening of the importance of the *pa*, although a smaller kinship group called the *pha-spun*, which is based primarily on patrilineal descent in Suru, is still very important. I noticed particularly that this forgetting of the *pa* has accelerated since the early 1980s, so that nowadays in several villages most people no longer know that name of their *pa*. It is often referred to as merely being something written in the *patwari's* records.

However, there is some variation in the degree to which people still use the *pa*. In Panikhar, the majority of Sunnis still directly refer to their *zat* name, and some even use it rather like an English surname. Interestingly some of the Shi'as in Panikhar also actively refer to their *pa*, although this is very rare for non-*sayyid* Shi'as in most other villages. I do not think this difference among the Sunnis is merely coincidental, but rather it is to do with the fact that the Sunnis in Suru define themselves as being a single large kinship group, and therefore people must be in one of the Sunni *zats* to be a Sunni. They also regard Hazrat Zanchas as being the equivalent of a common ancestor to the whole group, and hence still have a strong notion of common origin based on kinship.

For Shi'as, the focus of their membership of a wider group is now largely to do with religious affiliation. For the last three decades, they have been split into two factions: the *yokma-pa* and the *goma-pa*, which in many respects act as kinship groups. Both these factions - and the Sunnis - are effectively endogamous, since their members do not like to intermarry. This factional split has been in existence at least since the 1960's, at which time the two factions were each led by an *agha*, both of whom are now dead. Each faction has as its leaders a small lineage of *aghas*, and factional activity centres on the village of Taisuru - where they both have their main *masjid* or *imam-barah* in Suru block.

The factions are linked to the history of Shi'ism and the Prophet's family in several ways. Firstly, the *aghas* themselves trace their descent directly to the Prophet's family and are hence a local embodiment of that family. Secondly, the main ritual of Shi'ism in this area, are the *matam* (locally called *orche*) or mourning ceremonies, that are held regularly in Suru, and constitute an extremely absorbing and emotional experience, which vividly and immediately recalls the lives of the Prophets's family. Thirdly, as part of the *matam* and throughout Muharram, the *aghas* and other people who are good *raconteurs*, tell stories about the members of the Prophet's family and their marytrdom.

Thus it would seem that the history of Shi'ism provides an ideological framework for membership of the faction, which acts as a kinship group. At the same time the *pa* and their histories have declined in importance not because people have forgotten their traditions but because they have changed them.

KEY WORDS AND ABSTRACT

KEY WORDS History. Kinship. Change. Ladakh. Shi'ism.

ABSTRACT This study is about the relationship between kinship groups and people's conception of their own history. I am going to argue that what people present as their history is largely a subjective matter, that normally owes more to their present circumstances than to the past *per se*. A statement such as this is a common place in mainstream anthropological theory, but in scholarly works on the Himalayas there has been a tendency to treat local oral historical accounts as being about the past, when in fact they are more to do with the present. As an illustration of my point I am going to look at the relationship between local historical accounts and kinship groups in the Suru area of Ladakh.

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Author's Address : **Nicola Grist,** Goldsmith's College, University of London, 13, Wingmore Road, London SE24 0AS, UK

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Shifting Cultivation and Forest in North East India

Babul Roy and A.N.M. Irshad Ali

INTRODUCTION

Shifting cultivation is one of the most primitive methods of growing cereals. Its history is traced back to about 9,000 years from the present (Sharma, 1990). This method of cultivation was probably the precursor of plough cultivation in the evolution of agricultural technology (Majumdar, 1990; Saha, 1990). Some communities practising shifting cultivation today in north east India (*e.g.* the Garos) are uninterrupted continuations from the prehistoric past (Roy, 1981).

Shifting cultivation is prevalent in most of the tropical zones of the world, where forest cover is excellent and the topography is lashed by too frequent rains. Besides India, this type of cultivation is found in wet tropics of South East Asia, South West China, Africa, Central and South America, etc. (Schilippe, 1956; Conklin, 1957; *c.f.* Prashad et al., 1990). The 'farming' system of West Africa is a typical example of shifting cultivation. The Yao of Southern Nya-shaland follow a kind of slash-and-burn type of cultivation, common in Central Africa, which is nothing but a kind of shifting cultivation. In America, the Boro of Western Amazan forest practise shifting cultivation extensively. Outside India communities practising shifting cultivation are the Bamboos of Rhodesia, hill tribes of Borneo, Indochina and Bruma. In India shifting cultivation is practised by most of the hill dwelling tribal communities such as Juangs, Bhuiya, Godhas of Orissa; Baiga of Madhya Pradesh and most of the hill tribes of North East India (Nag, 1958). According to the report of the SAST Commission (1960-61), Govt. of India, around 25.89 lakh Indian tribes depend on shifting cultivation extended annually over an area of 5.41 lakh hectares (*cited in* Roy Burman, 1994).

In tribal India shifting cultivation is widely prevalent and it is known by different names among different tribes. The Nagas call it *jhum* or *tekongly*; in Tripura it is called *hookuimong*; in Arunachal Pradesh it is known as *adiabik*; in Bihar it is known as *khallu*; in Gujarat shifting cultivation is known as *waler*; in Madhya Pradesh it is referred to as *bewar*; in Tamil Nadu it is called *kumri*; the Bhuyas call it *dahi* or *koman*; the Marias of Baster call it *penda* and the Khond refers to it as *posu*.

According to Conklin "any continuing agricultural system in which impermanent clearences are cropped for shorter period in years than they are followed" constitutes shifting cultivation (*cited in* Roy Burman, 1990). *Jhuming* is practised without using any machanical soil and water conservation measures, fertilizer, insecticide and pesticide. The plot of land selected is used for 2 to 3 years for cultivation and thereafter it is abandoned (Prashad et al., 1990). Shifting cultivation consists of felling trees on a hill side a little before the sowing season. After the felling trees dried up they are set on fire. By the time of the sowing season, the surface of the earth is covered with ashes. The seeds are then scattered and sown in these ashes. After some time the seeds germinate and grow being nourished by an occasional shower of rain. The crops of shifting cultivation are scarce and are of inferior quality. In a few years' time the soil becomes exhaustive. The plot of land cleared for shifting cultivation is generally abandoned after 1 or 2 years of subsequent cultivations and the people shifted to the new site. Hence the qualifying term 'shifting' is added to this typė of cultivation. Indeed, on some occasion shifting cultivation is continued for more than 2 years uninterrupted depending on the nature of soil and the type and maturity of the forest.

Jhuming is a very labour intensive process of growing cereals and at the same time climatically is very detrimental. It affects our ecosystem in many different ways. First and foremost it involves large scale destruction of valuable forests. This consequently affects the local hydrological cycle, local weather (temperature, rainfall, humidity, etc.), broadly the entire local eco-climax. The extensive felling and cutting down of trees from hill slopes spontaneously cause large scale soil erosion threatening the very existence of the green cover. Shifting cultivation is practised particularly in the tropical rain forests - the treasure house of the world's half of the bio-genetic resources (Erwin, 1983; *c.f.* Ghosh, 1990). Therefore, this practice is a great threat to our environment. An internationally acclaimed report (World Resources, 1986) indicates that principal agent in the conversion of tropical forests is the slash-and-burn cultivation. The north east belt, where *jhum* is practised extensively by almost all the forest dwelling communities, is the resource belt of India's bio-genetic wealth. It may be noted that half of the flowering plants so far described in India are found in the north east (Rao, 1974). Out of 10 orders, 36 families, 135 genera, of land mammals found in India, all the orders, 27 families, and 85 genera are available in this region (Kurup, 1974). Any amount of loss of forest wealth may cause extensive damage to such invaluable bio-genetic resources.

However, the biodiversity of any region available around is the result of complex historical interactions among physical, biological and soical forces over the time. All eco-climaxes have been affected by the cultural patterns of human use and interactions. Biodiversity of any region is an outcome of a dynamic ecosystem process of long time interactions between men and nature. This implies that biodiversity conservation efforts may need to give greater attention to ecosystem process than to ecosystem products (McNeely, 1994). The virgin forest of uniform pattern should be far less genetically rich than forest affected by *jhuming*. In the latter case the forest is of composite type: some dense, some less dense, some just bushy and so on. The genetic diversity of Asian forest (most of which are man-effected) has been well established. The biodiversity or the climax community available in the north east is also a product of the long historical interactions between man, his activities (*jhum* cultivation etc.) and nature. On this account the view that *jhuming* has been practised by hill peoples since historical past without endengering the ecosystem appears to be true. As such total restriction to this practice could rather be detrimental to conserve the existing biodiversity, particularly of the *jhum* belt. Nevertheless, it also cannot be overemphasised that enormous explosion of population today greatly contributed huge pressure to the ecosystem. The extensive and too frequent jhum cultivations greatly proved to be lethal to the ecological equilibrium. The deterimental effects of *jhum* or shifting cultivation (when it is practised at very short fallow period), to our ecosystem are well established and cannot be ignored. In the following an attempt has been made to show with the help of some quantitative analysis the probable effects of cyclic *jhuming* on the pattern and composition of forests in North East India.

THEORETICAL CONSTRUCT

(I) Percentage of the Land under Jhuming and Jhum Cycle

Theoretically, if 50% of a forest is under *jhuming* at one time, the concerned forest zone clearly gets divided into two halves - one currently engaged in cultivation while the other half is reserved for the next year's engagement. In this context only one year *jhum* cycle is possible at any maximum limit. Quantitatively the *jhum* cycle is equal to (100% of *jhum* area annually available - 1). Following this : if 20% then 5-1 years cycle; if 10% then 10-1 years cycles ; if 5% then 20-1 years cycle; if 2.5% then 40-1 years cycle are possible.

However, these figures are valid when land is abandoned only after one time of cultivation. The *jhum* cycle will further vary positively depending on another variable that is dependent on cultivation pattern. The whole thing now can be formulated as:

Here 'X' is the variable dependent on cultivation

$$Jhum\ \text{cycle} = \left(\frac{100}{\%\ \text{of}\ jhum\ \text{area annually engaged}} - 1\right) + X$$

pattern. If land is abandoned only after one time cultivation then 'X' = 1; two times 'X' = 2; three times 'X' = 3 and so on.*

(II) Forest Pattern in Jkuming Belt

When 2.5% land of a forest is annually engaged under *jhuming* the average *jhum* cycle available is 39 years. In this case the whole forest so involved is found to be of 40 different types, each covering an area of 2.5% of the forest land. Such as one currently engaged in *jhuming*, one was cultivated last year, one the year before the last year and so on.

* In this study we have considered that a plot of land is abandoned only after one time of cultivation. As such all the estimated *jhum* cycles and the forest ages calculated on that basis, presented throughout this paper, are valid only if one time cultivation is practised. But in actual practice, in average, 2 or 3 times continuous cultivations are done in a plot of land. In which case the forest ages as well as all the *jhum* cycles presented here should be increased by 2 or 3 times.

Table 18.1a : The probable impacts of *jhum* cultivation on forest

When 2.5% area of a forest or an ecosystem is under any one time of *jhum* cultivation, the available *jhum* cycle estimated to be 39 years in average. In this context we can expect 40 different plots, each having 2.5% of the forest land: one of the plots is currently engaged in *jhuming*, one was cultivated last year, one the year before the last year and so on. The probable composition of the forest could be estimated to be as follows (provided that no other factors such as cutting down of forest outside the 2.5% *jhum* land under one time engagement is strictly maintained):

The Composition of the Forest :
Plot no. (1) will bear tress/vegetation of 39 years old (maximum)
Plot no. (2) will bear tress/vegetation of 38 years old (maximum)
Plot no. (3) will bear tress/vegetation of 37 years old (maximum)
Plot no. (4) will bear tress/vegetation of 36 years old (maximum)
Plot no. (5) will bear tress/vegetation of 35 years old (maximum)
Plot no. (6) will bear tress/vegetation of 34 years old (maximum)
Plot no. (7) will bear tress/vegetation of 33 years old (maximum)
Plot no. (8) will bear tress/vegetation of 32 years old (maximum)
Plot no. (9) will bear tress/vegetation of 31 years old (maximum)
Plot no. (10) will bear tress/vegetation of 30 years old (maximum)
Plot no. (11) will bear tress/vegetation of 29 years old (maximum)
Plot no. (12) will bear tress/vegetation of 28 years old (maximum)
Plot no. (13) will bear tress/vegetation of 27 years old (maximum)
Plot no. (14) will bear tress/vegetation of 26 years old (maximum)
Plot no. (15) will bear tress/vegetation of 25 years old (maximum)
Plot no. (16) will bear tress/vegetation of 24 years old (maximum)
Plot no. (17) will bear tress/vegetation of 23 years old (maximum)
Plot no. (18) will bear tress/vegetation of 22 years old (maximum)
Plot no. (19) will bear tress/vegetation of 21 years old (maximum)
Plot no. (20) will bear tress/vegetation of 20 years old (maximum)
Plot no. (21) will bear tress/vegetation of 19 years old (maximum)
Plot no. (22) will bear tress/vegetation of 18 years old (maximum)
Plot no. (23) will bear tress/vegetation of 17 years old (maximum)
Plot no. (24) will bear tress/vegetation of 16 years old (maximum)
Plot no. (25) will bear tress/vegetation of 15 years old (maximum)
Plot no. (26) will bear tress/vegetation of 14 years old (maximum)
Plot no. (27) will bear tress/vegetation of 13 years old (maximum)
Plot no. (28) will bear tress/vegetation of 12 years old (maximum)
Plot no. (29) will bear tress/vegetation of 11 years old (maximum)
Plot no. (30) will bear tress/vegetation of 10 years old (maximum)
Plot no. (31) will bear tress/vegetation of 9 years old (maximum)
Plot no. (32) will bear tress/vegetation of 8 years old (maximum)
Plot no. (33) will bear tress/vegetation of 7 years old (maximum)
Plot no. (34) will bear tress/vegetation of 6 years old (maximum)
Plot no. (35) will bear tress/vegetation of 5 years old (maximum)
Plot no. (36) will bear tress/vegetation of 4 years old (maximum)
Plot no. (37) will bear tress/vegetation of 3 years old (maximum)
Plot no. (38) will bear tress/vegetation of 2 years old (maximum)
Plot no. (39) will bear tress/vegetation of 1years old (maximum)
Plot no. (40) is currently engaged in *jhum* cultivation.

Analysis:

(i) Average age of the forest (under 2.5% *jhuming*) is 19.5 yrs. max.

(ii) Average age of the best of 10% of the forest is 37.5 yrs. max.

(iii) Average age of the best of 25% of the forest is 34.5 yrs. max.

(iv) Average age of the best of 50% of the forest is 29.5 yrs. max.

(v) Average age of the best of 75% of the forest is 24.5 yrs. max.

Similarly, under 5%, 10% and 20% of land engagements (anual engagement in *jhuming*), the expected forest pattens can be analysed. The forest patterns under different percentages of land engagements are shown in Table - 18.1b.

Table 18.1b : Forest patterns under different percentages of annual *jhum* engagements (Theoretical estimates) (in years)

Particulars	*Under 2.5%*	*Under 5%*	*Under 10%*	*Under 20%*
Percentage of the forest	97.5	95.0	90.0	80.0
Average age of the forest	19.5	9.5	4.5	2
Average age of the best 75% of the forest	24.5	12	5.5	2.5
Average age of the bset 50% of the forest	29.5	14.5	7	3
Average age of the best 25% of the forest	34.5	17	8	3.5
Average age of the best 10% of the forest	37.5	18.5	9	4

The pattern of such a *jhum* forest can be discussed as : the average age of the forest is 19.5 years approx., the best 10% of it is of approx 37.5 years in average, the best 50% is of approx. 29.5 years in average and the best 75% is of approx. 24.5 years in average (Table 18.1a and 18.1b). According to McNeely (1994) the *jhum* effect forest is richer in biodiversity than any virgin forest. This statement is perfectly true here. The cyclic *jhuming*, when practised in *jhum* cycle as long as 39 years, gives 40 different zones to shelter 40 different types of eco-systems.

On increasing the percentage of annual land engagement under *jhuming* from 2.5% to 5%, the cycle consequently gets reduced to 19 years. This shift changes the forest pattern in the following ways : the percentage of forest reduces to 95%; the average age of the forest reduces to 9.5 years; and the average age of the best half of the forest now could be maximum 14.5 years. The general impression is that even at this stage the forest looks quite healthy.

Similarly, when the land under *jhum* engagement is increased to 10%, the *jhum* cycle is consequently reduced and comes down to 9 years. The productivity under 9 years *jhum* cycle is not quite dissatisfactory in so far the cultivator's need is concerned. However, the interesting point is that the shape and composition of the forest is considerably affected by *jhuming*. Based on the present estimation it can be stated that under 10% of annual *jhum* engagement the average age of the forest could be just 4.5 years at best. The 4 or 5 years forests are immature, incapable of maintaining their own life cycle processes. Probably the actual process of degradation of an eco-belt effected by *jhum* cultivation begins at this stage. In the case of 20% engagement, we can expect only maximum 4 years cycle at best. The cultivation out-put under this condition is drastically reduced from the optimum production. The average age of the forest can not be more than 2 years at this stage. The depletion of forest may result owing to large scale soil erosion, huge loss of soil fertility and mass destruction of flora and fauna. Beyond 20% of land of a forest system under annual *jhum* engagement is a sign of devastation. Because beyond that stage there will be no more forest that can sustain any such cultivation as a normal practice.

In a nut-shell the whole problem can be summed up as follows : with the percentage wise increase of land engagement under one time *jhuming* (from 2.5% onwards) the visible depletion of forest land does not appear to be dismal. But the forest pattern in all internal details changes remarkably. This is because only a small percentage of *jhum* land is dependent upon a large percentage of forest to maintain the natural equlibrium of the forest. The conceivable relations hip between the reduction of *jhum* cycle and the forest pattern is graphically shown in figure 18.1.

THE EXTENT OF SHIFTING CULTIVATION AND ITS IMPACT ON FOREST IN NORTH EAST INDIA

In North East India which consists of seven states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura), shifting cultivation is extensively practised by almost all the hill dwelling tribal communities. As far as the availability of *jhum* land is concerned the Nagaland leads the table with (608,000 ha.), followed by Mizoram (604,000 ha.), Meghalaya (416,000 ha.), Assam (298,000 ha.), Arunachal Pradesh (248,000 ha.), Tripura (221,000 ha.) and Manipur (100,00 ha.). Among these states though in Manipur the percentage of land for *jhum* cultivation is less than in other states, yet the region exhibits maximum population pressure on agricultural *jhum* land. where as much as 60,000 ha. (exactly 60% of the total available *jhum* land), is engaged annually. Statewise details of annual land engagement in *jhum* cultivation and total land available for *jhuming* can be seen in table 18.2.

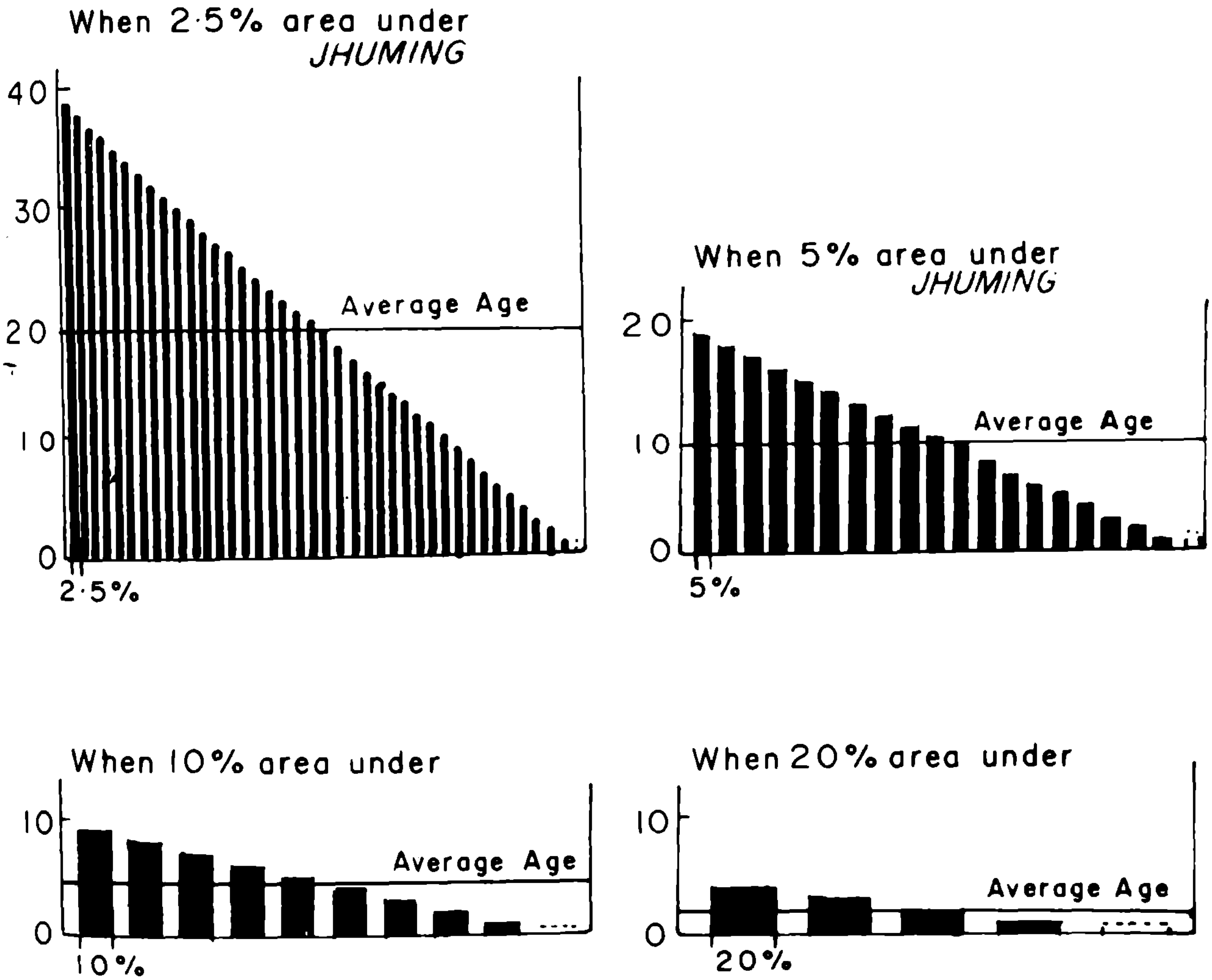

Fig 18.1. Probable forest pattern of *jhum* affected belt

Key : (i) Vertical axis ('Y' axis): Read for the forest age in years

(ii) Horizontal axis ('X' axis): Read for the number of plots

(iii) Percentage figure below the first bar of each graph indicates the percentage of land out of the total land covered by a plot

(iv) Dotted line (......) within the graph: Read for the plot where *jhuming* is currently practised

It appears that the population sustaining capacity of shifting cultivation is very poor. It has been stated earlier that 2.5% to 5% land under any one time *jhum* engagement of an ecosystem is a balanced one. In this case one can expect the average *jhum* cycle as high as 39 years under 2.5% and 19 years under 5%. Such long fallow period in cyclic *jhum* cultivation has many advantages: the natural cycle of forest is maintained, yield is optimum and competitive, and the biodiversity of the forest is rich.

Table 18.2 : Statewise area under shifting cultivation in North East India (Area in Hectare)

State	*Total State geography*	*Total area under jhum cultivation*	*% out of the total states geography*	*Total area annually available for jhum cultivation*	*% out of the total area under jhum cultivation*
Arunachal Pradesh	8,149,000	248,000	3.04	92,000	37.09
Assam*	1,535,000	298,000	19.41	72,000	24.16
Manipur	2,236,000	100,000	4.47	60,000	60,00
Meghalaya	2,253,000	416,000	18.46	76,000	18.26
Mizoram	2,108,000	604,000	28.65	62,000	10.26
Nagaland	1,649,000	608,000	36.87	74,000	12.17
Tripura	1,067,000	221,000	20.71	23,000	10.40
Total	18,997,000	2,495,000	13.13	459,000	18.39

* Only two hills districts of Assam, namely, Karbi Anglong and North Cachar Hills District
Source : NEC Documents; *c.f.* Misra (1990)

The current picture of shifting cultivation in north east region, however, is very gloomy. During the last few decades population has increased enormously inducing loads on forest and natural resources in different ways. Factors like loss of forest by degradation (as mismanagement turns forest into barren shade), loss by human occupation (for purposes other than *jhuming*), and increase in *jhumia* population (those who practise *jhum*) have contributed to the reduction of *jhum* cycle considerably. On an average it is less than 5 years at present, which is very critical so far the forest life is concerned. The statewise *jhum* cycles, calculated as per methods discussed in this paper, are shown in table 18.3.

In North East India total around 2,495,000 ha. of land (almost 13.13% of the total geographical land), is under shifting cultivation. The available *jhum* cycle for the region is just 5 years. On this account, the *jhum* affected forest pattern cannot be more than 2 years old and half of that forest of 3 years old. Apart from all those environmental degradations already referred to above, this situation indicates that the forests at this stage are unable even to sustain the day to day needs of the *jhumia* populations. The forest pattern, effected by *jhuming*, for all the seven states of the north east region is shown in table 18.4 and figure 18.2.

Table 18.3 : States-wise *jhum* cycle (in years) in North East India

State	*Jhum cycle*		
	If land is abandoned only after one time cultivation	*If land is abandoned only after two time cultivation*	*If land is abandoned only after three time cultivation*
Arunachal Pradesh	1.69	1.69 x 2	1.69 x 3
Assam (Hills)	3.13	3.13 x 2	3.13 x 3
Manipur	0.66	0.66 x 2	0.66 x 3
Meghalaya	4.47	4.47 x 2	4.47 x 3
Mizoram	8.74	8.74 x 2	8.74 x 3
Nagaland	7.21	7.21 x 2	7.21 x 3
Tripura	8.61	8.61 x 2	8.61 x 3
Regional	4.43	4.43 x 2	4.43 x 3

Method Used :

(i) % of *Jhum* area annually available $= \dfrac{\text{Total } Jhum \text{ Area Annually Available}}{\text{Total } Jhum \text{ Area Available}} \times 100$

(ii) *Jhum* Cycle $= \left(\dfrac{100}{\% \text{ of } Jhum \text{ Area Annually Available}} - 1 \right) + X$

Where 'X' is the variable dependent on cultivation pattern. *e.g.* if land is abandoned only after one time cultivation. X = 1; if after two, X = 2; if after three times, X = 3; and so on.

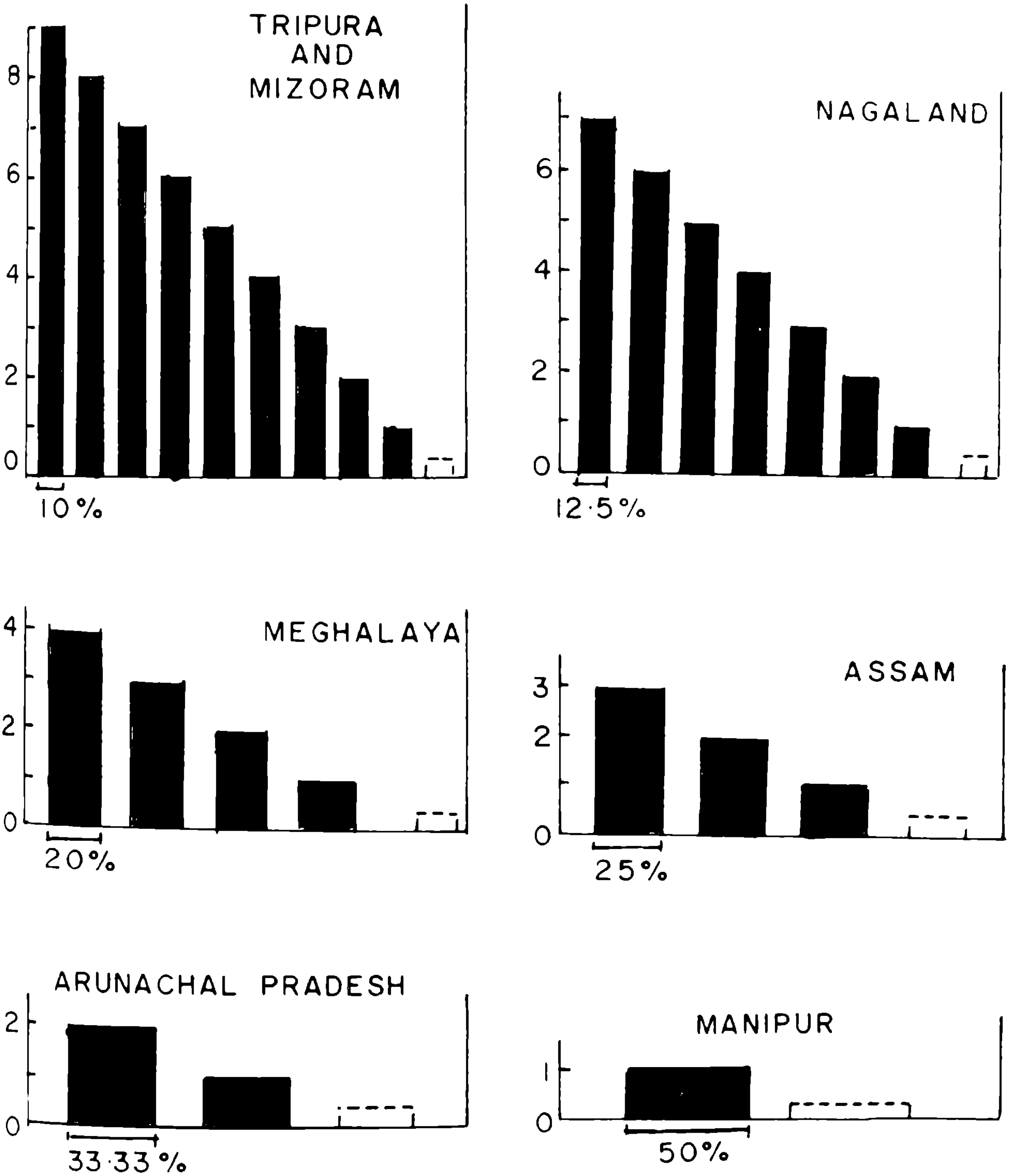

Fig. 18.2. Forest Patterns

Key : (i) Vertical axis ('Y' axis): Read for the forest age in years

(ii) Horizontal axis ('X' axis): Read for the number of plots

(iii) Percentage figure below the first bar of each graph indicates the percentage of land out of the total land covered by a plot

(iv) Dotted line (......) with in the graph: Read for the Plot where jhuming is currently practised

Table 18.4 : State-wise forest pattern as per *jhum* cycle in North-East India (in years)

State	*Jhum cycle*	*Adopted jhum** cycle*	*Average of the forest*	*Average of the best 75% of forest*	*Average of the best 50% of forest*	*Average of the best 25% of forest*	*Average of the best 10% of forest*
Arunachal Pradesh	1.69	2	1.0	1.0	1.5	2	2
Assam (Hills)	3.13	3	1.5	2	2.5	3	3
Manipur	0.66	1	0.5	0.5	1	1	1
Meghalaya	4.47	4	2	2.5	3	3.5	4
Mizoram	8.74	9	4.5	5.5	7	8	9
Nagaland	7.21	7	3.5	4.5	5.5	6.5	7
Tripura	8.61	9	4.5	5.5	7	8	9
Regional Total/Average	4.93	5	2.5	3.07	3.92	4.57	5

* Forest only affected by *jhuming*.
** Only upto natural number counted, any fraction 0.5 or above has been calculated as 1, below that, is excluded. All secondary calculations are based on this figure in this table as well as elsewhere in the text.

DISCUSSION

It has been found that under long fallow period, *jhuming* is not a potential threat to biodiversity. Rather, such practice is a causative agent for rich and diverse flora and fauna of an ecosystem. Man interrupted forest is richer in genetic resources than virgin forests (McNeely, 1994). *Jhum* interruption gives a dynamism to the forest as well as a diverse habitat sheltering different types of living beings. In north east zones the rich biodiversity that we encounter today is perhaps because of the results of interaction between the human activities (*e.g. jhuming*) and nature. However, such a practice which involves large scale destruction of valuable trees is always seen to be a wasteful exercise. And it is more so, at least, when practised extensively, *i.e.* at short fallow period.

The population sustaining capacity of *jhum* cultivation is very low. In a rough estimation a family consisting of six members (two adults and tour-minors) requires a minimum ten to fifteen bighas of land under any one time of cultivation. But since ten years cycle is the least optimum limit (from both sustainability and productivity point of view) the actual land requirements to maintain such a family stands at one hundred (100) to one hundred and fifty (150) bighas. Now a village having thirty such families the total land requirement stands at 3,000 to 4,500 bighas. It can perhaps be stated that any scientific cultivation covering five per cent of that land could be sufficient to maintain such a village. Any other scientific cultivation (*e.g.* timber plantation) is found to be much more profitable than *jhuming* (Roy, 1994).

The reduction of *jhum* cycle affects forest adversely. The forest gets depleted literally in geometric proportion with the arithmetic reduction of the *jhum* cycle. As per present estimation, since only a small percentage of *jhum* land within a forest maintains the natural equilibrium, a little shift in the *jhum* land requirement inevitably could cause major effect to the forest.

Among the seven states of North East India, Arunachal Pradesh and Manipur are the two states where *jhuming* is practised in around one year cycle. But, from our experience in North Cachar Hills it is found that below five years cycle, any form of *jhuming* is not feasible. In north Cachar hill areas in Assam it is found that in case of 30 or 40 years cycle one requires minimum effort in such cultivation. As in such cases the soil is fertile enough to give rich yield and interestingly such cultivations could be done even without any weeding. But as the *jhum* cycle decreases the labour input (especially in weedings) increases progressively and ultimately at one stage cultivation becomes almost impracticable. Below four or five years' cycle *jhuming* necessarily requires to be abandoned: first, because of the low fertility of soil and second, because of the weeding problem.

It could perhaps be stated that the vast area of the unclassed forests where *jhuming* is practised in the north east has already been depleted considerably. Excluding Arunachal Pradesh and Manipur almost 30% land out of the total geographical area comes under *jhum* cultivation. The average *jhum*

Note : 1. *Bigha* is a measure of land in Assam. 1 *bigha* is equivalent to 0.330579 acre.

cycle currently practised in the region is around 5 years. *Jhuming* at this stage is no longer either a well balancing system or a productive venture even to sustain the bare necessities of the people.

Tribal communities are practising *jhum* for hundreds of years without putting any major threat to our ecosystem. Today increase in population owing to the induction of modern medicine among the tribals on the one hand and encroachment of *jhum* areas by non-tribas reducing the area available for *jhuming* on the other have contributed to the reduction of the *jhum* cycle throughout. Thus, at present this age old practice is a potential threat to the whole ecosystem that gets deteriorating with greater and greater involvement of human activity.

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KEY WORDS AND ABSTRACT

KEY WORDS Ecosystem Process. Ecosystem Products. Biogenetic Resources. Biodiversity. *Jhum*.

ABSTRACT Shifting cultivation, one of the most primitive methods of growing cereals, is still being parctised by many tribal communities. According to McNeely (1994), 'ecosystem as a process' instead of 'ecosystem as a product' should be the main concern in ecological conservation. Whatever biodiversity we observe in a particular area effected by shifting cultivation is an evolutionary product of long historical interactions between man and nature. However, the rapid increase of population has generated enormous pressure on ecosystem including the land. The evil affects of shifting cultivation, when it is practised in short fallow period, have been well established. In North East India shifting cultivation (also known as *jhum*), is practised at the cycle of on an average of 5 years, when sustainable limis is found to be 30/40 years. The *jhum* affected forest pattern and composition estimated here is that the entire forest should be just around 2 years old and that half of the forest should be just 3 years old. The short fallow period of *jhuming* is no longer a sustainable practice and the forest even can't sustain the basic needs of the people.

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Authors' Address : **Babul Roy and A.N.M. Irshad Ali**, Department of Anthropology, Guwahati University, Guwahati 781 014, Assam, India

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Shifting Cultivation Among the Adi Tribes of Arunachal Pradesh

Asham Borang

INTRODUCTION

The Arunachal Pradesh with an area of 83,740 sq km is situated between the latitude of 26°28'N - 29°31'N and longitude of 91°30'E - 97°30'E. The state is sparsely populated having a total population of 8,64,558 (1991 Census) consisting of 63% indigenous tribes having about 25 major tribes. Politically the State is divided into 13 districts out of which West Siang, East Siang, Upper Siang, Southern part of Dibang valley and South-East part of Upper Subansiri districts are dominated by the Abor (Adi) tribes. The Adis fall into two main groups (i) The Minyong-Padam group comprising the Ashings, the Boris, the Karkos, the Milangs, the Minyongs, the Padams, the Panggis, the Pasis, the Shimongs and the Tangams and (ii) the Galo or Gallong group comprising the Bokars, the Goals or Gallongs and the Pailibos.

For the present purpose the study has been undertaken among the Minyong-Padam group of East Siang and the lower part of Upper Siang districts during the period from 1991 to 1995. During study select villages were visited, and the observations and results area based on data collected from the field-visits.

THE LAND AND THE PEOPLE

The land under study is situated roughly between the 27°43' - 29°20'N latitude and 95°35' - 94°42'E longitude. Though the land lies in a monsoon region falling within the tropical hot-belt of climatic zone, the climate is modified by a great variation of topography.

From an elevation of 100m in the foot-hill region, the area passes through a series of hills and ranges of mountains and rises upto the height of about 4,000 m. The annual rainfall varies from 100 mm to 5,000 mm spread over 8-9 months. This well distributed precipitation with high humidity rising upto 90% is conducive to the luxuriant growth of the forests.

There are tropical riverine semi-evergreen forests and tropical semi-evergreen forests in the low land and foothill areas. The higher reaches ranging from 1,500m are covered with sub-tropical and temperate broad-leaved forests and above 3,500m of altitude there are the alpine forests.

According to agronomic classification five major soil regions have been identified in this area (Nyori, 1993). There are Diluvial and Sandy loam soils, clayey Aluminu rich organic content valley soils, Shun-land soils, Mid-altitudinal virgin forest soils and High-altitudinal virgin forest soils.

The hills are broken and abruptly precipies forming deep gorges which make it impossible to locate a convenient place for a village and so people settle themselves in the valleys along the course of rivers.

The indigenous tribes constitute about 68% of the total population of 99,643 (1991 Census). The dominant tribes are the Minyong-Padam group. Their cultures and customs are associated with festivals and agriculture. Although wet and terrace cultivations are getting popular, they practise jhumming which continues to be more important as it is closely linked with their ways of life - their economy, social custom and norms, mythology and religion which are interwoven with forest. As they lead an isolated life due to remoteness and inaccessibility, their culture is rich and relatively unpolluted and undisturbed.

MATERIALS AND METHODS

The author visited certain select villages of the Karkos, the Minyongs, the Padams, the Panggis, the Pasis, the Shimongs and the Milangs. The observations and results are based on these subtribes. Elderly people were contacted and interviewed. While gathering information a few jhum fallows and fields under tillage were visited.

The village territories are demarcated by prominent natural features like rivers or mountains which are well known and regarded with reverence. The entire land falling under the jurisdiction of the village belongs to the families inhabiting it. The whole land is divided into three different catagories.

1. Land for residential purpose.
2. Land for games, hunting etc. and
3. Land for the agricultural purpose. However, games and hunting can be done in other catagories also.

Grazing, collection of firewood and housing materials, household uses etc. are not restricted to these catagories of land.

Technology involved for cultivation is slash and burn method. The forest land assigned for jhumming purpose is divided into a number of patches called *Patat*. Each *Patat* is cultivated for two years. The number of *Patats* vary from village to village. When a *Patat* is taken up for cultivation, it is divided into plots, and one plot is allotted to each family of the village. A relatively big or more capable family receives a relatively big size plot or even two plots if the family so desires. In the second year the second *Patat* is taken up, divided and distributed among the families for new *jhum* while the first one is still under tillage. In the third year while the third *Patat* is divided and distributed, the second *Patat* is kept under tillage and the first *Patat* is abandoned till it is recultivated with the beginning of the fresh cycle after the abandonment of the last *Patat*. In the fourth year, the fourth *Patat* is taken up, while the third *Patat* is under tillage and the second *Patat* is kept fallow. The process rolls on till the last *Patat* is taken up and cultivated when the process reverts to the first *Patat* with the beginning of a fresh cycle.

For example, supposing a village 'X' has ten families and there are 5 *Patat* namely A, B, C, D and E. If *Patat* - A is taken up in 1991, it is divided into ten plots and one plot is assigned to each of the ten families. In 1992, *Patat*-B is taken up for new jhumming and *Patat*-A is kept under tillage. In 1993 *Patat*-C is taken up, *Patat*-B is kept under tillage and *Patat*-A is abanoned till it is recultivated in 1996. In 1994, *Patat*-D is taken up, *Patat*-C is kept under tillage and *Patat*-B is abandoned till it is recultivated in 1997. This sequence goes in a cyclic manner cultivating each *Patat* for two years and every *patat* is recultivated after every three years. Thus there are three-four year cycles in village 'X'. The illustration is given in table 19.1 taking the *Patats* of village 'X'.

In this way the sequence continues and in 2001, *Patat*-A is taken up again. Thus after a *Patat* has been used for two years, it is abandoned and will be recultivated when it attains the corresponding next phase of cycle. In a fallow land no individual or a group is allowed for cultivation or clearing jungle till the land attains the next corresponding phase of cycle and the clearing can be done only at the time of clearing for cultivation. The offender is find a methon (*Bos frontalis*) or more by the *Kebang* (Village Council).

In practice the people clear the jungle uprooting under-growth creepers and cutting down the small trees (*Rikpa*) followed by felling of the big ones (*Esing benam*). The felled trees and branches are cut to pieces so that the logs and branches are kept lying north-south-ward, that is in the direction of wind as far as possible so that during the clearing of unburnt debries, there be no impediments. In the hilly areas branches and logs are kept horizontal to the slope in order to prevent the soil from being washed away by the rain water. The Shimongs do not fell trees but simply prune them at the crown. The arduous task of tree felling is done by men.

After the debris, small branches etc. are dried up, the elderly members of the family go to the field. There they examine if the debris, small branches have dried to the required extent. They determine the wind direction by floating some dust into the open air. Accordingly the people take their position and set fire at a time towards the direction of wind. They take precaution that the fire does not spread to the adjoining virgin forests.

Table 19.1 : Illustration is given taking the *Patats* of village 'X'

1991	*1992*	*1993*	*1994*	*1995*	*1996*	*1997*	*1998*	*1999*	*2000*
B-Fallow	C-Fallow	D-Fallow	E-Fallow	A-Fallow	B-Fallow	C-Fallow	D-Fallow	E-Fallow	A-Fallow
C-Fallow	D-Fallow	E-Fallow	A-Fallow	B-Fallow	C-Fallow	D-Fallow	E-Fallow	A-Fallow	B-Fallow
D-Fallow	E-Fallow	A-Fallow	B-Fallow	C-Fallow	D-Fallow	E-Fallow	A-Fallow	B-Fallow	C-Fallow
E-Under-tillage	A-Under-tillage	B-Under-tillage	C-Under-tillage	D-Under-tillage	E-Under-tillage	A-Under-tillage	B-Under-tillage	C-Under-tillage	D-Under-tillage
A-New-*jhum*	B-New-*jhum*	C-New-*jhum*	D-New-*jhum*	E-New-*jhum*	A-New-*jhum*	B-New-*jhum*	C-New-*jhum*	D-New-*jhum*	E-New-*jhum*

The following day the clearing of the half-burnt debris (*Arik romnam*) is started. All the half-burnt, useless pieces of branches or logs and debris are piled up at suitable sites and later burnt. The big branches or logs are kept for fencing or for use as firewood. Varieties of seeds are sown in the *jhum* fields. Millets, lettuce, teel etc. are sown broadcast, while paddy, maize, job's tear, bean, pea, chilly, gourd etc. are sown by dibbling. In the same field arum, topioca, ginger etc. are put in holes made with digging sticks. In the mean time fencing is constructed on community or individual basis. Weeding is done two to three times, mostly by women of the family. However, if men are free from other activities, they also help in weeding. The early crops are harvested by August/September and late crops by October/November or December.

The harvested crops are kept in granary (*Kumsung*) in baskets. The *Kumsungs* are constructed in the yard of the village somewhat away from the dwelling house in order to prevent the granary from accidental fire.

Jhum Cycle

It has been observed that the *jhum* cycle in the study area has got twelve to 'eighteen *jhum* fields and hence cycles are ten to sixteen years' duration. In some villages a few *jhum* lands have beem left abandoned since long. For instances the cultivators of Silluk village have abandoned recultivation of the Koyo *patat*, Rokmi *patat*, Ebung *patat*, Sine *patat*, Tekpom *patat* and Goyeng *patat* and they maintain thirteen jhum lands (Eleven year cycle).

For case-study the *jhum* cycle of Damroh village (Population : 1747; 1991 Census) has been taken up. The village has two blocks-*Gidum* (comprising Borang, Yirang, Perme and Lingging Lego clans) and *Gingkong* (comprising Sokko Lego, Pertin, Ratan and Tayeng clans). There are some jhum lands which the two blocks cultivate separately or often jointly. The cycle is as given in figure 19.1.

The cycle is fixed and every cultivator knows the corresponding year of cycles. Since the settlement in *Damroh Kumting* (Damroh settlement) in the middle part of 17th century, the villagers are still maintaining the same cycle though this village is one of the richest and largest villages among the Adis till today, without any ecological disturbances. Inspite of increase of population, they have left

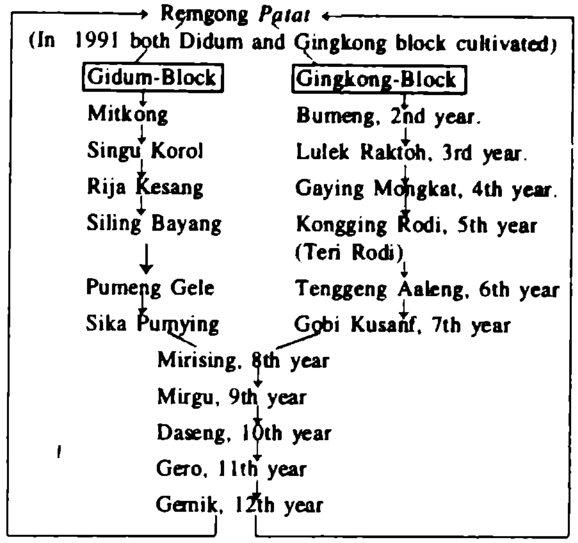

Fig. 19.1. *Jhum* cycle of Damroh village (As recorded in 1991)

abandoned few old *jhum* lands located in Kesing hills.

Some large villages may also be mentioned as follows. The pattern of cultivations is identical (Table 19.2).

Table 19.2 : The pattern of cultivation in some large villages

S. No.	*Name of village*	*No.of house holds**	*Population**	*Jhum patch*	*Cycle*
1.	Pareng	81	386	18 Patats	16 years
2.	Geku	241	1,349	15 Patats	13 years
3.	Komkar	178	1,102	14 Patats	12 years
4.	Shimong	232	915	15 Patats	13 years
5.	Riga	352	1,908	14 Patats	12 years

* *Source* : Census of India 1991, Series-3 Part-XII - A & B

Agricultural Calender

The cultural behaviour of the people is directly related to the course of nature. The advent of certain activities of agricultural seasons are calculated from the songs or call of particular birds or insects or following certain natural phenomena, such as:

1. The blooming of *Kompi/Kombong* (*Prunus persica*) in *Kombong* month (February).
2. The mournful wailing call of Pengu (*Megalaima virens*) in *Kombong* to *Kijir* (February to April)

Accordingly the Adis' agricultural year has four seasons, namely, *Donggup*, *Lobo*, *Todi* and *Digin* and is divided into twelve months. The detailed activities during the seasons can be summarised as given in table 19.3.

Table 19.3 : Adis activities during a Calender year

Seasons	*Months*	*Coresponding English month*	*Agricultural operations*
Donggup	Gitmur	January	Harvesting of job's tear, finger millet completed; collection of housing materials, firewood; trapping, hunting, weaving etc.
	Kombong	February	Construction of house, merry-making, firewood collection, weaving, preparation for sowing of early paddy, maize, millets, arum etc.
	Galling	March	House construction completed, *Aran* or *Unying* festival, *Aran Mopum* festival followed by preparation of next *Patat* (Cycle).
Lobo	Luking or Kijir	April	*Rikpa* (clearing of jungle) in next cycle in new *Patat*, minor jhumming for cotton, vegetable etc.
	Lobo	May	Burning of *Rigang* (2nd year tillage of last cycle); preparation of new cycle completed; sowing of winter and autum highland paddy, fencing etc.
	Yilo or Lokam	June	Sowing of jobe's tear, Foxtail millet completed, weeding; Followed by *Lutor* festival ; *Lutormopum* festival, ploughing in wet and terrace fields.
Todi	Tanno	July	Wet cultivation continues, *Lune-Solung* festival, weeding in *Ringang*, transplantation in wet cultivation etc. Harvesting of maize.
	Iyo or Yo	August	Weeding in *Rikpa*.
	Yiite	September	Harvesting of Foxtail millet, weeding in *Rikpa*, minor jhumming for vegetables (lettuce, coriender etc.)
Digin	Dishang	October	Weeding, firewood collection, merry making, *Dishang sanam* (Community collection of Arrow poison-*Aconite* spp. called *Emoh*) Harvest of early paddy started.
	Terem	November	Early paddy harvest completed, Harvest of winter highland paddy.
	Bishing	December	Harvest of winter highland paddy completed, harvest of finger millet, jobe's tear started.

All these seasons or months are calculated by the advent of some natural phenomenon or other. All the community activities are structurally related. The people need not plan their activities again and again over the year; these all follow one after another as season's cycles roll on.

DISCUSSION

Jhumming has always been a matter of controversy. This is because :-

(a) It is destructive of forest and environment
(b) It causes loss of fertility in soil
(c) It causes soil erosion
(d) It is wasteful of time and energy.

The tribal people have learned over the centuries how to utilize the forests in a sustainable manner. No other person understands and loves forests as they do. Their life totally depends upon forests. As the study reveals the jhumias of the study area maintain 10-16 years' cycle, the cycle is immutable. All cultivators are aware of the corresponding year of cycles. The *jhum* clearing is started during the dry season and seeds are sown prior to the outbread of monsoon. And as the monsoon commences, the *jhum* field is already covered with crops or other vegetation which inhibit the soil erosion or runoff. Immediately after an area goes fallow at the close of cropping period the land is covered with vegetations of different species which also checks erosion and runoff of rain water. When the field is left fallow for a full cycle period, regeneration is uninterrupted due to regulations by the local community. The shifting cultivation especially in a country of heavy rainfall is not a permanent denudation of land as it immediately re-vegetates. It is more important in the failure of forest generation than craving for crop growing. The very grazing of cattle in parkland forest margin, *jhum* fallows, where animals discriminately graze on new tree seedlings and recurrent regrowth parts of shurbs and trees, tends to prevent the re-establishment of forest growth. The annual burning of grassland, careless *jhum* burning, urbanization, industrialization, mining, human settlement, hydro-power projets, etc. are significantly causing denudation. It also has been found that invasion of *Mikania scandens, Ageratum conyzoides, Eupatorium odoratum, Solanum torvum* and *Spilathus paniculata* takes place in fallow lands at the time of re-establishement - an inhibiting factor of forest regeneration in the area. These species are exotic to Arunchal Pradesh. These entered this land along with seeds or food materials, package etc. when the Britishers explored the region during the period from 1825 till Independance.

Perhaps, A.P. Percival was correct when he declared that "the importance of the whole matter had been exaggerated, that in time the forest recovered, and that in areas where there was no possibility of exploiting the timber commercially, shifting cultivation caused less harm to the forest than its prohibition would have caused to the forest people" (Elwin, 1957).

Many authors (Borthakur et al., 1979; Deori, 1992; Mohan, 1991; Prasad et al., 1981; Singh, 1991 etc.) have reported the effect of fire upon the soil. The *jhum* burning is a disadvantageous practice in view of the destruction of humus and consequent decrease in nitrification. Valuable microflora and fauna are destroyed and organic matter is oxidised.

But the authors are silent about the advantages of the burning. Burning leads to an accumulation of potash and valuable phosphate. These are released immediately prior to plantation of crops that will need them. It also remarkably reduces the potential acidity which is important in the more saline lateritic soils. It is also found that at the site where debris are piled up and burnt there is more luxuriant growth of crops and more productive. This is a practice the jhumias resort to constantly from experience and observation. Hence, it may be noted that burning is not only a part of *jhum* technology but also leads to an improvement in the properties of soils and productivity.

Jhumias are well aware of the danger of soil erosion. They are also aware of the danger of wanton destruction of forests. All tribes of Arunachal Pradesh believe in forest gods or devils. Out of fear of these gods or devils they do not destroy forests recklessly and unnecessarily. They abuse the timber contractors who are responsible for the forest destruction and erosion. The percentage of annual net jhumming is only 2.25 (Borang, 1996)

This is a very negligible per cent of land coming under annual jhumming, and entertaining ideas of blaming the jhumias are an exaggeration and bias. In fact burning of grasslands, extraction of timbers, the process of urbanization and industrialization and hydro-electric project erection etc. are the prime factors to be blamed for environmental malady. In these processes there is hardly any attempt to integrate the other factors-soil, economic and environmental viability.

The indegenous tribes have such un-written systems of land management which are really democratic and effective in land control. The people's traditional leadership and community-based social structure is the best way of administrative system. Spencer (1966) stated "No state is southern and eastern Asia today possesses a clear and ordered conceptual system of land control which will fit present-day administrative problem".

Another controversy is based on the wastage of time and energy. It is reported that energy efficiency (Energy output : Input ratio) of *jhum* with long cycles is more than that of Terrace Rice Cultivation (TRC). Mishra and Ramakrishnan (1981) reported the benefit cost analysis of jhumming system that a 15-years cycle had the highest benefit : Cost ratio (5.4), followed by 10 years cycle (3.7), 5 years cycle (2.3) and terrace cultivation (1.9). It indicates that the system practised for cycle of 10 years or more, has both protective and productive benefit although the technology is of low grade. It is also observed that no history of famine or starvation is ever reported in the study area. *Jhum* also provides year round pre-occupation as depicted in the calender for those inhabiting remote rural areas. Thus it can not be considered as a wastage of time.

Now-a-days the indigenous communities are absorbed into main-stream societies and thus alien cultures have invaded indigenous cultures due to intrusion of strangers and market forces resulting in gradual fading of indigenous knowledge. The alien culture groups have invaded indigenous territorial ranges restricting the original occupants' cropland ranges too small in total area to be benefically cultivated. Presently the traditional practice is no longer in vogue in full scale in the recently established townships and the vicinity as the traditional system of village organisation is in the state of disintegration. The government have taken over large areas of land for forest reserves thereby curtailing the traditional rights and freedom of the original occupying population over their traditional forest ranges. Here it will be apt to recall Tewari's (1991) remark, "The problem of forest conservation and protection cannot be separated from the lives of forest dwellers and local population. A new and healthier relationship between forest department and the masses must be evolved to avoid tribal movement. The local tribal community which has symbiotic relations with the forest should be accepted as partner in the local forestry development efforts in each area." In other words the tribals are "Ecosystem-People".

CONCLUSION

The *jhum* cultivation is a long-range rotation of land-use suited to hilly terrains. It is only confined to *jhum* forests earmarked for the purpose by the people with fixed cycles and corresponding year for tillage. The Minyong-Padam group of Abor tribes maintain the *jhum* cycle for 10-16 years which is both ecologically and economically viable.

However, viability may be lost when :

i) Population increases beyond the carrying capacity.

ii) When alien culture-groups invade the territorial ranges restricting indigenous occupants to relatively small *jhum* lands compelling jhumias to shorten their traditional jhum-cycle duration.

iii) Government take over the traditional lands for forest reserves without providing alternative lands.

Presently the indigenous communities are inclined to come closer to main-stream societies. Thus alien cultures have invaded indigenous cultures resulting in gradual fading of inigenous knowledge, and thus the traditional practice is no longer in vogue in full scaie. Though jhumming practices are very old and traditional, they are currently not understood fully with respect to their bio-physical and socio-economic aspects. The elements of complexity of jhumming has not been understood by the silviculturists, pedologists, agronomists, ecologists and geographers. They are biased in their out look. It is necessary to understand the indigenous customes, cultures and other anthropogenic practices related to traditional agriculture. If we critically examine available research results we find they are not actual *jhum*-field oriented nor are they indigenous knowledge and technology based but are more of laboratory-field oriented. The silviculturists, pedologists, agronomists, ecologists and geographers collectively need to have a good deal of co-ordination with sociologists for proper understanding. A synthesis of traditional knowledge and mordern scientific outlook is necessary to evolve a method for improvement of jhumming. It can fairly conform to Pei Shengji's (1994) remark that 'Understanding of mountain people's indigenous knowledge of biodiversity resource management is a key to sustainable development in the Himalayan Region".

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KEY WORDS AND ABSTRACT

KEY WORDS Arunachal Pradesh. Abor Tribes. Shifting Cultivation. Jhumming. Semi-Evergreen Forests Jhum Fallows.

ABSTRACT The indigenous people of Arunachal Pradesh are tribals who constitute over 63% of the total population. They practise jhumming, hunting, fishing or trapping, for their day to day needs. Such activities are associated with festival, mythology, rites and other anthropogenic activities. Their cultural activities are directly related to the course of nature. The present study highlights the jhumming system of the Abor tribes (Now-a-days they recognise themselves as "Adi" - the Hillmen") of the

East Siang and Upper Siang districts. It is a case-study of Damroh village - one of the largest villages of the districts.

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Author's Address : **Asham Borang, Scientist-'SD'**, State Forest Research Institute, Van Vihar, P. B. No. 159, Itanagar 791 111, Arunachal Pradesh, India

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The Human Settlements and Health Status in Sikkim

Veena Bhasin

INTRODUCTION

In ecosystems human beings, including human settlements are a part that is human cultural components are taken into account. It is nevertheless useful to depict culture as a separate set of components of the system. "Human Settlements" get formed and organised due to the interdependence of individuals. It offers them opportunities and amenities which makes life more comfortable by providing better means of livelihood, mutual support, *inter alia* the privileges that community living provides. These are the primary factors of a settlement, big or small, be it a small village, a nomadic encampment or a larger urban metropolis. Each settlement is a nucleus which grows over a span of time and becomes more elaborate and complex as it encampasses within its circle larger and higher issues that come its way. Each settlement evolves its own "personality", as human needs are "general" to a certain extent and still are "particular" too, as each settlement has its Ecology - the relevant surroundings, the cultural, the economic, to name just a few. Thus a whole settlement is a separate unit. To understand it more meaningfully as a component part of the larger system.

The evolution of human settlements takes place in space and time and is always in a continuous process of evolution as it is always in a flux. These human settlements, which are concentrations of information exchange and flows, are crucial to the organisation of all other processes and flows.

Although it is generally understood that human well-being in a settlement is essential, yet there is no commonly accepted criterion of it. It may be vague or ambiguous and hence elude definition. Well-being has physical, mental, ethical, socio-economic, political and ecological dimensions. What constitues "health" or "welfare" or "pathology" changes according to cultural setting, environmental conditions and ecological relationships.

"Health" in the broad sense is "quality of life" rather than only the absence of disease. The health situation is often reduced to the extent of registered disease and available health resources. Such elements as the death rates, manpower in the field of health, incidence of a particular disesase etc. are presented which leads to a narrow and sometimes misleading interpretation of the causal variables. Health situation is a complex dynamic equilibrium which stems from the entire socio-economic condition. Health is not a component but is an expression of development, so that the health of a community at a given moment is in the very situation of the whole social system seen from a health view point, which is defined as a combination of physiological development associated with reduced mortality-morbidity trends, and the capacity of both mentally and physically creative work.

The following are the main groups of variables which determine the health situation : external or indirect factors and internal or direct ones; the former characterizing the social frame of development, the latter its health focus.

Indirect factors in the health situation include the overall environment conditions and the social organisation of the population, with economic production and economic distribution of products.

Direct factors in the health situation are the status of health services, which includes organisation, rsources and output of the health services; delivery system and the status of the system of sanitation. However, the most important direct factor is the health status, rooted in a good nutritional status of the people. Personal health is directly measured through morbidity, mortality and physiological development of the individuals of a given community.

Over-all conclusions on health assessment must be drawn from an analysis of the direct factors in connection with the indirect factors.

The health of a population depends on various constraints. A brief review of the factors influencing the health of the population are specified below:

Resource endowment of the "environment" affects the health status of the community. The relationships are extremely complex and may work through long causal chains which are not immediately apparent. For instance, soil degradation may lead to a scarcity of fuel-wood or safe-water and thus compel a mother to spend several hours a day away from home, putting the small toddlers in the custody of other siblings. The repercussions in terms of morbidity, infant mortality to just sensorial retardation may never be singled out. In addition greater maternal fatigue, superimposed on already low caloric intake may lead to a low weight at birth of progeny and thus to increased infant mortality.

The physical environment of a population is not just a natural resources, but also a source of constraints to a population. It first affects the individual by influencing growth, sexual maturity, fecundity, then influences fertility and mortality and thereby the population as a whole. Spatial distribution of a population is a result of climate, rainfall, altitude, terrain and the carrying capacity of land. The stability between a population and the physical environment is reached after a prolonged exposure of a population to a particular environment and the stresses therein.

Safe water and sanitation are two basic components of hygiene which have a strong cultural determination and key influence on people's health, perhaps comparable only to food. 74 per cent of India's urban area is served by piped water to households and only 31 per cent of the rural area has easy access to safe water. While in case of sanitation, 47 per cent of urban area is served with installed sanitation facilities and only 2 per cent of rural area has any access to sanitation facilities.

Despite the over-all resource constraints, the success of the water supply programme largely depends on public acceptance and appropriate utilisation of the new facilities. For instance, the evaluation of the UNICEF/WHO-assisted Rural Water Supply Programme in India in 1976 noted that spot studies showed nearly 70 per cent of the pumps as not functioning at any given time. There is a necessity to design and introduce a water supply and sanitation technology suited to local conditions which the villagers themselves can operate and maintain without external assistance. This technology must be cheap enough so that village communities can afford to buy it if they cannot build it themselves.

The correlation between "educational level" and health status is now widely recognised. Health and education are inter-related. A child's ability to take full advantage of schooling provided him depends on his health, and later on, his ability to apply the knowledge and skills he has acquired depends on his mental and physical fitness.

Perhaps the most important factor in determining the health status of a population though affected by cultural patterns is food intake. In this study an attempt has been made to obtain the integrated picture of health status among the people of Sikkim in relation to existing medical and sanitary facilities, so as to find out the main health problems and necessary measures to imrpove the health status.

SIKKIM STATE

Sikkim, a small mountainous state in the Eastern Himalayas with an area of 7299 sq km, has witnessed great changes in its political system, social structure, economic life and cultural values during the past hundred years. The process of change was quickened by currents from four different directions, resulting in a multiform ethnic mix. It lies between 27° and 28°N latitude and 88°E longitude (Fig. 20.1). To its north lies the Tibetan plateau; to the west, the kingdom of Nepal; to the east, the kingdom of Bhutan and the Chumbi valley of Tibet and to the south, the Darjeeling District of West Bengal. The State is almost rectangular in shape, being 113 kilometres long and 64 kilometres wide and the elevation varies from 300 to 8400 metres above mean sea-level. Sikkim has been strongly influenced by Tibet in its religious and cultural life. By virtue of being a protectorate of India until 26 April, 1975, it has been politically and economically influenced by India and became the twenty-second State of India after that.

Before its assimilation into the Indian Union, Sikkim was an independent kingdom ruled by a hereditary Maharajah, who was assisted by large landowners, the *Kajis*, in the administration of the State. The *Kajis* were hereditary ministers. During the British rule, the Maharajah was also assisted by British Political Officers along with the hereditary *Kajis*. The Maharajah was a Buddhist and Buddhism flourished greatly because of the encouragement to the Lamas and the setting up of monasteries. There were no Christian missionaries in the State at that time and Europeans could not enter Sikkim without a legal permit. The State was closed to outsiders because of its strategic position between Nepal, Tibet and Bhutan.

Sikkim, by virtue of being in the direct path of

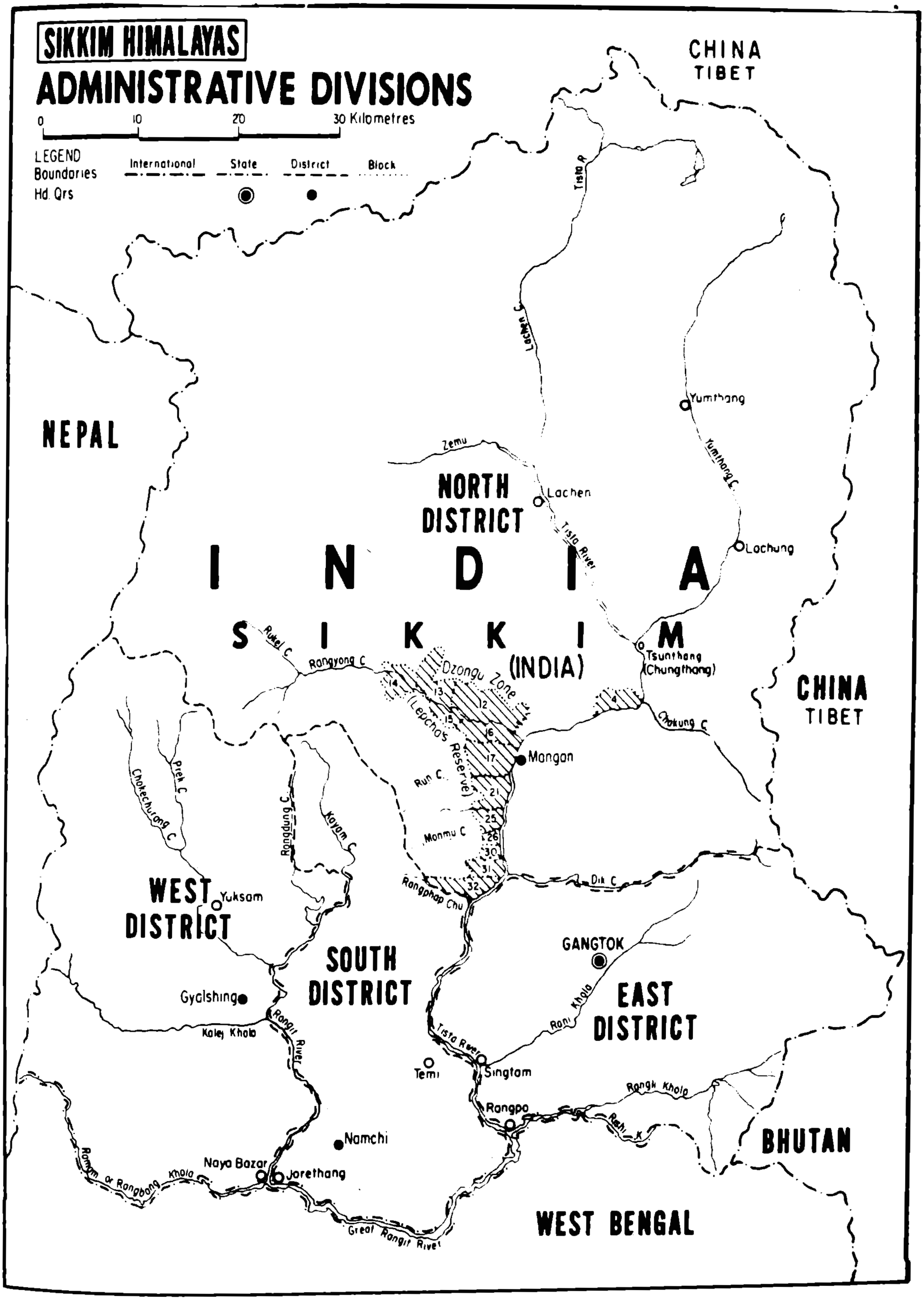
SIKKIM HIMALAYAS
ADMINISTRATIVE DIVISIONS
0 10 20 30 Kilometres
LEGEND
Boundaries
Hd. Qrs
International
State
District
Block
CHINA
TIBET
NEPAL
INDIA
SIKKIM
(INDIA)
NORTH DISTRICT
WEST DISTRICT
SOUTH DISTRICT
EAST DISTRICT
BHUTAN
WEST BENGAL
Dzongu Zone
(Lepchas Reserve)
Lachen
Lachung
Yumthang
Tsunthang (Chungthang)
Mangan
Yuksam
Gyalshing
GANGTOK
Singtam
Rangpo
Temi
Namchi
Naya Bazar
Jorethang
Tista R
Lachen C
Zemu
Tista River
Yumthang C
Rukel C
Rangyong C
Chokung C
Run C.
Monmu C
Rangphap Chu
Dik C
Prek C
Chokechurong C
Rangdung C
Kayam C
Kolej Khola
Rangit River
Roni Khola
Rongli Khola
Rathi K
Great Rangit River

Fig. 20.1

the monsoon, is the wettest part of the north eastern region, the climate varying from the sub-tropical to the Alpine depending upon the altitude (Sub-Tropical up to 1500 metres; Temperate - 1500-2000 metres; Alpine - 4000 metres; perpetual snow line at 5000 metres and above). Sikkim has an annual rainfall of about 1250 mm even in the dry upper valleys of Lachung and Lachen, increasing to about 2500 mm in other districts. There are two maximum rainfall areas *viz.* (i) in South-East which includes Mangan, Singhik, Drikchu, Gangtok, Kerporang, Rongli, Gnathang etc. and (ii) in South-West corner including Hilley. In between these two regions, there is a low rainfall region *e.g.* at Namchi, where the rainfall is about half of the former areas. There is an area in the North-West Sikkim which gets very little rainfall (even less thatn 4.9 mm) as this area has mainly snow-covered mountains.

The relative humidity is above 70 per cent throughout the year at most places. The temperature varies with altitude and the slope (generally 6°C to 10°C). The mean monthly temperature (maximum and minimum) and the relative humidity at Gangtok (1818 m), Lachen (2697 m) and Gyalshing (1534 m) is given in table 20.1.

Table 20.1 : Annual temperature and relative humidity from three stations in Sikkim state

Station	*Annual*		*Relative humidity*	
	Mean daily maximum temperature °C	*Mean daily maximum temperature °C*	*0930*	*1730*
Gangtok	19.9	11.4	83	82
Lachen	13.1	2.3	76	-
Gyalshing	22.8	12.9	-	-

Its climatic conditions of high humidity accompained by warm temperature favour proliferation of diseases and pests both in endemic and epidemic forms. Sikkim can be considered the breeding ground for all kinds of diseases and pests both on standing crops and in storage.

Sikkim is primarily a catchment area of the Tista drainage system. The Tista, the largest river of the State, divides it into two parts while flowing essentially north-south. Every centimetre of run off from precipitation of snow-melt in the state is carried by the Tista river and its tributaries. The other major river is Rangit and there are smaller stream flowing in East and North Districts of the State. These streams include (1) Rani Khola; (2) Rangpo Khola; (3) Sethi Khola in East District while the North District is travessed by Lachen chu and Lachung chu. Quite a few of the streams are perennial; fed by storing of snow melt. Besides these, there are number of glacial lakes in the higher reaches. These are sacred lakes. Both the visible and the less obvious national lakes identified by religious visionaries are said to have presiding deities, representing good and evil. Propitiating these deities, through various religious ceremonies is considered important for the welfare of the people.

The cultivated area in the State is essentially located at an elevation ranging from a few hundred metres to 2000 metres. The terrain being hilly, with frequent occurrence of land-slides, major irrigation projects cannot be undertaken.

Land Use

The whole of Sikkim from the view of land utilization can be divided into three zones - the crop growing zone, the forest zone and alpine pasture. Maize and rice are cultivated up to 2000 metres. At higher elevations wheat, barley and potato are grown. Hardy crops like buckwheat and barley, are grown up to 3000 metres by the transhumant population. With the increase in altitude and decrease in temperature, the crop yield becomes less and so do cultivated plots.

Land Use in Sikkim

1. Total Area of Sikkim - 7299 sq km
2. Area Under Forest - 2650 sq km *i.e.* 36 per cent of the total geographical area
3. Area Under Snow and Alpine Pasture - 2850 sq km *i.e.* 39 per cent of the total geographical area
4. Area Under Cultivation - 880 sq km
5. Area Under Towns and Others - 999 sq km

The total area of Sikkim is 7299 sq km as given above. Out of this, 36 per cent is under forest and 39 per cent under snow and alpine pastures. The State is endowed with luxuriant vegetation of different types. Forest recources include not only timber, but bamboo, fuel wood, fodder, minor forest produce, medicinal plants and wild life. Forest vegetation consists of mixed evergreen trees, grasses and bushes.

Ecological Zones in Sikkim

Sikkim contains within its borders a variety of non-tropical and geographic environments from the low snow-free outer hills to the high peaks with permanent snow and glaciers. Within its habitable portions, different social, religious, linguistic and ethnic groups co-exist practising different types of agriculture and pastoral activities. As one moves north wards, valley floors and mountain peaks increase in altitude, the terrain becomes more rugged and the climate drier and cooler. The vegetation changes from sal forests to rhododendrons and conifers and finally to grass above the timber line. Such a transition can sometimes be seen even on a single mountain side in any of the ecological zones.

Sikkim is divided into numerous small valleys with an uneven distribution of population, and with indadequate communication facilities. Agricultural land is limited to mountain valleys. The settlement pattern consists of dispersed hamlets on the lower slopes above the agricultural lands. The lower Himalayan region is more thickly populated as compared to the higher areas. The high hills are inhabited by a self-sufficient transhumant population. The lower hills, bordering the plains, have more diverse economic activities. Environment and ecological adaptations have been shown in table 20.2.

The villages in all the zones are small, few having a population of more than a thousand. The development and extension of motorable roads has facilitated the growth and development of some of these villages as markets and administrative centres. The fields are invariably terraced in all the ecological zones. The principal crops of Sikkim are maize, cardamum, paddy, wheat, barley and potato. Paddy is an irrigated crops, the only irrigation source being spring channels. The Kodo crop is not taken up as an independent crop, but is raised along with maize. Other crops like soyabean, oranges, apples, ginger and beans are raised in small areas.

The economy of Sikkim is overwhelmingly rural and agricultural. Industry, whether small or large scale, is insignificant. The state of Sikkim is practically self-sufficient in rice and other foodgrains, but finds it necessary to import rice in order to feed the large 'transient population', including traders, tourists and the army. The major export commodity is cardamum, which is exported

Table 20.2 : Ecological zones in Sikkim state, environment and ecological adaptation

Area	*Climate*	*Altitude (Metres)*	*Ecological Adaptation*	*Crops*	
				Agriculture	*Horticulture*
Lower Hills	Tropical Sub-Tropical	300-500 500-1500	Wet and Dry Agriculture, Sedentary Farming Domestication of Live-stock, Horticulture	Rice, Maize, Millet, Wheat and Mustard Pulses, Soyabean, Vegetables, Potato.	Guava, Lime Lemon and Ginger Oranges
Mid Hills	Temperate	1500-200	Wet and Dry Agriculture, Slash and Burn Agriculture or Rotational Dry cultivation, Hunting and collection of Minor Forest Product, Horticulture	Paddy, Maize, Millet, Wheat, Soyabean, Potato, Vetetables, Ginger	Mandarin (Oranges) Large Cardamum, Plum, Peach, Peas
High Hills	Temperate	2000-2700	Dry Agriculture, Pastoralism and Bhutias Transhumance	Maize, Barley, Vegetable Seed Potato	Apple, Plum, Peach, Peas
High Hills	Sub-Alpine Alpine	2700-4000 4000-5000	Yak Herding, Pastoral Economy, Horticulture, Cheese, Butter, Hides, Wool, Apple and Potato are Commercial Commodities		
Very High Hills	Alpine	Above 5000	Lachenpa and Lachungpa Transhumant Groups visit the Area. Lachenpa grow vegetable and potato at higher elevation	Mainly used for Seed Potato, Vegetables	Pasturage

in large quantities to Arab and Middle-Eastern countries. In addition, apples and potatoes are grown in the north for export to other parts of the country. Sikkim is also well-known as producer of alcoholic beverages. It has very limited industrial potential - copper mines at Rangpo and Dikchu, fruit processing, jewels and distillery are the important industries at Singtam.

According to the Census of 1981, the population of Sikkim is 316385 out of which 265301 are rural and 51084 are urban *i.e.* 84 per cent of the total population is rural (Census of India 1981, Series 19,

Table 20.3 : District-wise distribution of total population of Sikkim State

S. No.	*State/District/ Town*	*Total (T) Rural (R) Urban (U)*	*Area in sq km*	*Total population (including) institutional and houseless population*			*Density per sq km*	*Females per 1000 Males*	*Percentage growth rate of population 1971-81*
				Total	*Male*	*Female*			
	Sikkim	T	7096	316385	172440	143945	45	835	50.77
		R		265301	142341	122960		864	39.50
		U		51084	30099	20985		697	159.73
1.	North District (Mangan Town)	T	4226	24445	14784	11671	6	789	103.28
		R		25675	14272	11403		799	102.44
		U		780	512	268		523	135.65
2.	East District (Gangtok, Singtam, Rangpo Towns)	T	954	138762	77232	61530	145	797	62.07
		R		95520	51845	43675		842	39.24
		U		43242	25387	17855		703	154.08
3.	South District (Namchi, Jorethang Towns)	T	750	75976	40980	34996	101	854	42.85
		R		70611	37787	32824		869	35.89
		U		5365	3193	2172		680	39.03
4.	West District (Gyalshing, Nayabazar Towns)	T	1166	75192	39444	35748	64	906	28.59
		R		73495	38437	35058		912	29.10
		U		1697	1007	690		685	54.84

Table 20.4 : District-wise distribution of Scheduled Castes and Scheduled Tribes of Sikkim State

S. No.	*State/District/ Town*	*Total (T) Rural (R) Urban (U)*	*Scheduled Tribe (Percentage)*			*Scheduled Caste (Percantage)*		
			Total	*Male*	*Female*	*Total*	*Male*	*Female*
	Sikkim	T	23.27	22.16	24.60	5.78	5.54	6.06
		R	23.60	22.75	24.59	5.41	5.28	5.57
		U	21.54	19.35	24.67	7.87	6.76	8.96
1.	North District (Mangan Town)	T	55.57	51.08	61.27	3.02	2.98	3.08
		R	56.32	51.98	61.75	2.91	2.86	2.97
		U	31.15	25.98	41.84	6.79	6.25	7.84
2.	East District (Gangtok, Singtam, Rangpo Towns)	T	22.01	20.76	23.57	7.02	6.63	7.51
		R	21.35	20.59	22.24	6.87	6.66	7.13
		U	23.47	21.12	26.82	7.34	6.57	8.45
3.	South District (Namchi, Jorethang Towns)	T	17.52	16.65	18.53	5.54	5.29	5.83
		R	18.31	17.52	19.22	5.19	5.02	5.38
		U	7.10	6.36	8.20	10.14	8.52	12.52
4.	West District (Gyalshing, Nayabazar Towns)	T	20.04	19.77	20.34	4.70	6.64	4.76
		R	20.20	19.97	0.45	4.61	4.60	4.63
		U	13.38	11.51	14.65	8.49	6.45	11.45

Scheduled Tribes : Butia, Lepcha, Sherpa and Doptapas
Scheduled Castes : Damai, Kami, Lohar, Majhi, Sarki
Others : Tamang, Brahman, Chhetri, Pradhan (Newars), Rai, Limboo or Limbu (Subba), Gurung, Mangar, Other Trading Communities

Part II A and Part II B). The density of population is low and varies from region to region. The average density of population per sq. km. is 45 (Table 20.3). There are fourteen ethnic groups inhabiting Sikkim. The Lepchas, Bhutias, Sherpas and Tamangs are Buddhists, while other groups are Hindus. Among the Hindu groups there is a major clevage between the touchables and untouchables. The Brahmans and Chhetris are at the top of the social ladder. The Pradhans, Mangars, Gurungs, Limboos and Rais belong to the touchable groups and the Kami (metal workers), Sarki (leather workers), Damai (tailors), Lohar (Blacksmiths) and Majhi (fishermen) are Scheduled Castes. The Sherpas, the Tamangs, Lepchas and Bhutias as non-Hindu groups are fitted into the system in ranks below the touchables. In June, 1978, the Bhutias, Lepchas, Sherpas and Doptapas were notified as Scheduled Tribes. The Kami, Damai, Lohar, Majhi and Sarki have been classified as Scheduled Castes which constitute 5.8 per cent of the total population of Sikkim (Table 20.4). They are smaller in number in North District though evenly distributed in the other three districts.

The decennial growth of population since 1901 (Table 20.5) shows a massive increase, the reason being not only the increase in birth rate but the Nepali migration which was initiated by the British and has been a continuous process up to the present day. Nepali migration has altered the ethnic scene in Sikkim. The Census of 1931 registered 25790 Lepchas, but this number also included the Lepchas of Darjeeling. It is generally estimated that the number of Lepchas in Sikkim in 1931 amount to about 13000 out of 110000. Today the balance is still more to the disadvantage of the Lepchas, even though their number may have increased.

In order to prevent the Nepalese from completely taking over the land from the Lepchas, the Sikkim Government-reserved a particular area, Dzongu, in the central and northern part of the country for the Lepchas.

Some of the major groups in Sikkim are found throughout the state, while Scheduled Tribes like the Lepchas, Bhutias, Sherpas and Doptapas are found in limited areas. All these groups are characterized by specific ecological adaptations, as well as by the social organization of the region where they live. Most groups are culturally adapted to certain altitudes which has been a barrier to overall population mixture.

Many languages and dialects are spoken in Sikkim. The three main languages of the State are Nepali spoken by amout 90 per cent of population;

Table 20.5 : Decennial growth of population (1981 Census) of Sikkim State

Year	*Population*			*Decennial*	*Percentage*	*Density*
	Total	*Male*	*Female*	*Variation*	*Decinnial Variation*	*per sq km*
1901	59014	30795	28219	-	-	8
1911	87920	45059	42861	+ 28906	48.98	12
1921	81721	41492	40229	- 6199	- 7.05	12
1931	109808	55825	53973	+ 28087	+34.37	15
1941	121520	63289	58231	+ 11712	+10.67	17
1951	137925	72210	65515	+ 16205	+13.34	19
1961	162189	85193	76996	+ 24464	+17.76	23
1971	209843	112662	97181	+ 47654	+29.38	30
1981	316385	172440	143945	+106542	+50.77	45

Table 20.6 : District-wise area and population (1981 Census) of Sikkim

S. No.	*District*	*District Headquarters*	*Area (sq km)*	*Population*	*Density per sq km*	*Male*	*Female*
1.	North	Mangan	4226	26455	6	14784	11671
2.	East	Gangtok	954	138762	145	77232	61530
3.	South	Namchi	750	75976	101	40980	34996
4.	West	Gyalshing	1166	75192	64	39444	35748
	Sikkim		7096	316385	45	172440	143945

Bhutias by about 28 per cent and Lepcha by about 10 per cent. Various other dialects of ancient Nepali tribes which are in use are Gurung, Limbu, Kharabu, Mangari and Murmi. Hindi is generally understood by a majority of the people. English is the official language of the State and is used for both external and internal communication.

Lamaism, Hinduism and Animism are practised by different ethnic groups, but it is very difficult to classify them accurately. Sikkim has a long tradition of Buddhist religion. Since the rule of the Chogyal dynasty when the first *Chogyal* (king) of Sikkim was crowned in 1642, in Yuksom, Buddhist traditions have become deeply ingrained into the psyche of the Sikkimese people. Yet in proportional terms, Buddhism is practised by about 25 per cent of the local population, while majority religion is Hinduism (70 per cent). However, Buddhism is evident in all walks of life; in rituals and festivals; in Sikkimese architecture and in large number of monasterics and *Maneys* dotting the landscape throughout the state. Of the four Buddhist sects, the Nyngmepa, Kagupa, Gelugpa and Sakypa, reprsented in Sikkim, the Nyngmepa sect, initiated by the Buddha incarnate, Maha Guru Padmasambhava, is the most significant.

Population Distribution

The population of Sikkim is unevenly distributed over the state's land area (Table 20.6). This spatial distribution is influenced by a host of environmental, historical, socio-cultural, economic, demographic and developmental factors.

Sikkim is divided into two zones - North and South. The southern zone starts from the Chakung and the Tista river subdivides it into eash and west zones. Administratively, Sikkim is divided into four districts - Mangan (North), Gangtok (East), Namchi (South) and Gyalshing (West), the dividing line being based on the dividing line of the two rivers, Tista and Rangit.

The East District has the highest density of 145 persons per sq km. As against this, the North District has only 6 persons per sq km. The density of the East District increased from 90 persons per sq km in 1971 to 145 persons sq km in 1981. East District is followed by the South District where density has increased from 70 persons per sq km in 1971 to 101 persons per sq km in 1981 (Table 20.6).

For administrative purposes, Sikkim is divided into 447 revenue blocks (Table 20.7). Till the 1961 Census, the primary enumeration block was co-terminus with the revenue collection block in charge of a *Mandal*. However, the purpose of the 1971 Census, the primary enumeration block was enlarged to a Panchayat area. There are 215 Panchayat blocks in Sikkim (excluding the towns). The average population of a block is 885.

The field work for the study was conducted between the September 1981 to December 1983 in Sikkim State. The data were collected through observation and interviews. Informations regarding 779 family units of different ethnic groups in the four districts were gathered. In Sikkim the types of families that predominate the social scene are either nuclear or joint, supplemented by relatives or seasonal labour. The average size of the family is around five.

HUMAN SETTLEMENTS AND AMENITIES

The human settlement pattern in Sikkim state can be considered in relation to three factors the physical features, climate and seasonal variations. As the vast majority of the people rely heavily on local building materials for house construction, the climate has influenced both the design and material used in human settlements.

Compared to other parts of the country, the con-

Table 20.7 : Distribution of Revenue and Panchayat Blocks in Sikkim State (Census 1981)

S. No.	*District*	*District Head-quarters*	*No. of Panchayats*	*Total No. of Revenue Blocks Revenue Blocks*	*No. un-inhabited*	*No. of Town*
1.	North	Mangan	21	54	3	1
2.	East	Gangtok	68	128	2	3
3.	South	Namchi	66	145	1	2
4.	West	Gyalthing	60	120	1	2
	Sikkim		215	447	7	8

cept of a village is different in Sikkim. There are small clusters of houses clotted along the hill slopes called *Busties*. For revenue collection certain number of *Busties* are put in charge of a *Mandal* who works as an agent of the revenue collecting authorities on a commission basis. The unit of analysis is the revenue block consisting of several *Busties*.

In Sikkim, *Busties* apparently seem to be neat and clean, as they are sparsely populated and are situated on the slope of the hills. The houses are all scattered homesteads except in the Bazars which are inhabited by the Pradhans (Newars) and traders from other parts of India, who live in their shops. Only in the Lachen and Lachung Valleys in North Sikkim villages are compact, with no proper lanes. The houses here are clustered but not adjoining, Lachung village is muddy, filthy and intersected by small streams whose beds are make-shift roads and at the same time the common sewers for the people. Dirt and debris that remain in the villages situated on hill slopes are washed out by rain water. The roaming domesticated pigs and dogs often act as scavengers eating away the food debris and human excreta. There is no provision for sewerage in most of the villages. Many houses do not have separate kitchen, bathroom, latrine and cattleshed.

The settlements in Sikkim are characterized by *Gompa*, (Monastry) at the highest point of *Busti*, normally situated with forest at the back at about 1500 and 2000 meters overlooking the valley. *Gompas* are generally surrounded by the houses of the Lamas. Farther below is the *Busti* (hamlet) of the peasants, who have agricultural lands in the settlement. Around and below the residential areas are rice fields, irrigated terrace (*Pani-khet*) and Pastures (*Gorucharan*). Dry terraces (*Sukha Bari*) are at higher altitude. The moist and scattered land at the bottom of valley, close to the river, is used for cardamum (*Eliachi*) cultivation.

The houses of Lamas and peasants are segregated only in the settlements where there are large *Gompas*. In Sikkim, most settlements are dominated by one or other of three ethnic groups *i.e.* Lepcha, Bhutia or Nepali. Few settlements have both Lepchas and Bhutias in equal numbers, but rarely a settlement has a balanced proportion of the all three ethnic groups. In settlements where both Lepchas and Bhutias reside, the houses next to *Gompas* are of Bhutias, surrounded by hamlets of Lepchas or houses of both Lepchas and Bhutias are at equal distance from Gompa, though in different directions. In settlements, where inhabitants belong to three ethnic groups, the Lepchas the original inhabitants occupy the best part, followed by Bhutias who occupy the next best. On the outskirts of Lepcha, Bhutia *Busties*, the Nepalis who are recent settlers are scattered here and there.

Though houses of different ethnic groups tended to form clusters, the residential separation of different ethnic groups is by no means absolute. Furthermore, the houses of the high landowing groups, usually *Kazis*, *Mandal* etc. and those of the low landless groups are so situated that one side of *Busti* is inhabited by the former and the other by the latter. The principal residential division of settlements reflect the history of landownership.

Housing

In the Sikkim State the houses have hardly any arrangements for light and air, though both are available in abundance. Poor lighting during night, absence of suitable exists for smoke and ill-ventilated houses may be the cause of prevailing eye troubles. Non-availability of fresh air during night causes respiratory troubles. The traditional way of life, ignorance and poverty on the one hand, and the cold climate on the other are responsible for such settlements.

In Sikkim, most of the houses in rural areas are made of mud, concrete or a combination of wood and bamboo with thatched roofs, usually built on a stone plinth. They are either single or double-storeyed having wooden floors. Each house has a courtyard of its own. The Bhutias generally live in double-storeyed houses, the upper floor providing the kitchen, the bed room and a combined prayer and guest room. All except the poor live upstairs. Cattle, pigs, poultry and agricultural products are kept downstairs.

Among Transhumant Bhutias of Lachen and Lachung in North Sikkim, the settlements are situated in dispersed and functionally independent local environments. There are (i) winter villages at 2700 metres, occupied from February to March; (ii) Small compsites at an altitude of 4000 meters along the different tributaries of Lachenchu and Lachungchu; and (iii) Summer quarters in the Thanggu region at an altitude of 4500 meters. All these places are characterised by scarcity of cultivable land and availability of pastures. In the winter villages, the houses are three to six metres high and twelve to twenty four metres long. They are built of upright strong pine-planks, the interstices between which are filled with Yak-dung. The only window is a slit closed by a shutter. On account of damp climate, they are raised above the ground, and are tied with shingles. Previously, the roofs were either of wood or bark, hold down by large stones, but now people have started using corrugated sheets.

The houses at the camp sites are built of stones without any mud or mortar. It is single storeyed, roofed with shingles, and consists of only one room. The whole structure is built on a raised platform. It is usually entered by stairs. The resulting space beneath the house serves as a storing place for fodder and potatoes. Some of the houses are plastered with mud and all have a wooden door and shutter windows, which are tied up and sealed when not occupied (Bhasin, 1990).

The summer houses are small - about two metres high. They are made of stone with low-pitched shingle roofs, over which a covering of pine-bark is laid, the whole being held down by rows of stones. The interior of the houses corresponds in wretchedness with their exterior.The people sleep all huddled together on the planks laid on the ground.

A typical Lepcha house consists of at least two moderately sized rooms, one of which is used as kitchen and living room and the second is ceremonial room where *rites de passage* are performed. The whole structure is built on a raised platform about two metres high. It is entered by means of a ladder made from a roughly notched bamboo. The resulting space beneath the house serves as a cattleshed.

In Dzongu, as the climate is extremely wet, there is a wide overhanging hood, which often projects as much as four and a half metres beyond the wall. It keeps the walls completely dry throughout the rainy season. The walls are made of bamboo lath plastered with mud and cowdung. The roofs are generally thatched. In recent houses, the bamboo and mud-plastered walls and floors have been replaced by corrugated sheets. The new houses are *pucca* wooden structures. There are no washing and toilet facilities in the house, these are done outside. Each household owns some poultry which finds place in the house or near the cattle-shed in a bamboo basket. The cattleshed beneath the living room is usually kept in unhygenic condition with cowdung piling high. This cowdung is a constant source of *Bhusnu* (a small insect) menace, as the *Bhusnu* bite causes skin irritation.

The Nepalese on the other hand prefer to live downstairs with their animals around and store their agricultural products upstairs. Some of the houses are only huts with thatched and tinned or tiled roofs with not much of either light or ventilation. The courtyard and the ground floor in some houses remain dirty and unclean due to the keeping of pigs, cattles, poultry and goats. Such conditions in the lower altitudes facilitate breeding of sandflies, harbour mosquitoes and other insects which not only cause annoyance but also propagate diseases like malaria, kalazar etc.

Residential Facilities Available : Table 20.8 depicts the residential facilities available in the study area in Sikkim State. In North District of Sikkim, the highest percentage (87.4) of people are residing in single storey houses followed by East District (66.9 per cent). In the South District 63.4 per cent are living in single storey and 36.6 per cent in double-storey houses. 54.4 per cent of the population in West District are residing in double-storey and 43.9 per cent in single-storey houses. Only 3.4 per cent in East District and 1.8 in the West District are residing in houses more than two storeys. 38.1 per cent population in West District is residing in houses with more than six rooms followed by the South District population of 25.0 per cent (Table 20.8). In the North District 36.2 per cent are living in two-roomed houses. 27.6 per cent in three-

Table 20.8 : Types of residential facilities available in the study area of Sikkim State, district-wise

S. No.	District	No. of storeys			Number of rooms					
		Single	Double	More	1	2	3	4	5	6 and Above
1.	North	87.4	12.6	0.0	7.7	36.2	27.6	16.8	7.1	4.6
2.	East	66.9	29.7	3.4	19.5	23.9	18.3	14.2	9.6	14.5
3.	South	63.4	36.6	0.0	6.3	28.1	15.6	15.6	9.4	25.0
4.	West	43.9	54.4	1.8	2.4	2.4	11.9	23.8	21.4	38.1
	Sikkim	71.2	26.8	2.1	14.4	26.8	21.2	15.5	9.2	12.8

roomed houses and only 4.6 per cent in houses with more than six rooms. In the West district the housing condition is better with 23.8 percent and 21.4 per cent residing in houses with four and five rooms, respectively.

Among the Buddhists of Sikkim 11.5 per cent live in household having one room, 32.4 per cent are living in two roomed households, 25.1 per cent in three-roomed households. The population living in four and five roomed households accounts for 14.1 percent and 85. percent respectively. Only 8.4 percent of Buddhists inhabit households with more than five rooms (Table 20.9).

Among the Hindus of Sikkim the situation is slightly better. The population in households living in four, five and more rooms is 17.1 percent. 10.1 per cent and 18.0 per cent, respectively. The population in households living in one, two and three rooms accounts for 17.4 per cent, 20.6 per cent and 16.5 per cent, respectively.

Table 20.10 depicts the percentage of house having separate kitchen, bathroom, latrine and cattleshed in the study area in all the four districts of Sikkim.

Kitchen : In Sikkim, 93.0 per cent houses in West District have separate kitchen, followed by houses in the East District with 68.9 per cent. In the North District the number of houses with separate kitchen is only 38.2 per cent, while in the South District the houses with separate kitchen amounted

Table 20.9 : Residental facilities available in the study area of Sikkim State

Religion/	*No. of storeys*			*Number of rooms*					
Population	*Single*	*Double*	*More*	*1*	*2*	*3*	*4*	*5*	*6 & Above*
I. BUDDHISTS									
Lepchas N. Dist.	90.1	9.9	0.0	8.9	33.7	24.8	20.8	7.9	4.0
Lepchas E.S.W. Dist.	87.2	12.8	0.0	5.4	45.9	13.5	10.8	10.8	13.5
Lepchas (Total)	89.3	10.7	0.0	8.0	37.0	21.7	18.1	8.7	6.5
Bhutias N. Dist.	80.7	19.3	0.0	1.6	28.1	35.9	17.2	9.4	7.8
Bhutias E.S.W. Dist.	72.9	26.0	1.0	10.3	29.5	32.1	10.3	6.4	11.5
Bhutias (Total)	76.5	22.9	0.6	6.3	28.9	33.8	13.4	7.7	9.9
Sherpas	97.3	2.7	0.0	34.3	42.9	11.4	5.7	2.9	2.9
Tamangs	71.4	26.2	2.4	22.5	20.0	17.5	10.0	15.0	15.0
Buddhists (Total)	83.0	16.5	0.5	11.5	32.4	25.1	14.1	8.5	8.4
II. HINDUS									
Brahmans	42.3	46.2	11.5	13.3	20.0	17.8	22.2	15.6	11.1
Chhetris	64.6	32.3	5.1	15.8	15.8	22.8	12.3	15.8	17.5
Pradhans (Newars)	32.8	60.3	6.9	2.3	22.7	6.8	20.5	9.1	38.6
Rais	66.1	33.9	0.0	17.4	19.6	15.2	21.7	2.2	23.9
Limboos	63.2	36.8	0.0	16.7	33.3	23.3	10.0	6.7	9.9
Gurungs	44.4	55.6	0.0	16.7	23.3	10.0	20.0	10.0	19.9
Mangars	80.0	20.0	0.0	36.0	24.0	12.0	12.0	8.0	8.0
Scheduled Castes	82.6	10.9	6.5	33.3	12.8	23.1	15.4	10.3	5.2
Hindus (Total	57.9	38.2	3.9	17.4	20.6	16.8	17.1	9.2	18.0
Sikkim (Total)	71.2	26.8	2.1	14.4	26.8	21.2	15.5	9.2	12.8

Table 20.10 : Kitchen, bathroom, latrine and cattleshed facilites available in the study area of Sikkim State, District-wise

S.	*Districts*	*Kitchen*		*Bathroom*		*Latrine*		*Cattleshed*	
No.		*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*
1.	North	38.2	61.8	10.7	89.3	18.2	81.8	64.9	35.1
2.	East	68.9	31.1	26.3	73.7	45.6	54.4	32.3	67.7
3.	South	64.5	35.5	29.0	71.0	45.2	54.8	29.0	71.1
4.	West	93.0	7.0	39.5	60.5	51.1	48.8	58.1	41.9
	Sikkim	62.0	38.0	23.1	76.9	38.5	61.5	47.9	57.1

to 64.5 per cent.

It can be seen from the table 20.11 that 48.7 per cent of Buddhist households have a separate kitchen while 62.1 per cent of Hindu households have similar facility.

Bathroom and Latrine : In Sikkim, the percentage of houses with separate bathroom and latrine is not high. Only 23.3 per cent of houses have separate bathrooms and 38.9 per cent have separate latrines. The West District with 39.5 per cent of houses with separate bathroom and 51.1 per cent with separate latrines tops the list followed by South and East Districts with 29.0 per cent with separate bathrooms, 45.2 per cent seprate laterines 26.3 per cent with separate bathroom and 45.6 per cent with seperate latrines, respectively. In North District 89.3 per cent houses have no separate bathrooms and 81.8 per cent with no separate latrines (Table 20.10).

The Hindus of Sikkim are comparatively particular about separate bathrooms and latrines, but even their frequency is low (Table 20.11). Only 15.0 per cent of Buddhists households have separate bathrooms and 29.0 per cent of Buddhists have separate latrines. Among Hindus 31.5 per cent household have spearate bathrooms and 48.7 per cent of houses have separate latrines.

Cattleshed : In Sikkim 42.9 per cent of the houses in the study area responded with separate cattleshed (Table 20.10). In regard to separate cattleshed it is the North District which has the highest percentage (64.9) and the South District has only 29.0 pęr cent of houses with separate cattleshed. 44.6 per cent of the Buddhists and 42.5 per cent of Hindus have separate cattlesheds (Table 20.11).

People are not aware of the fact that certain diseases may be caused by or carried to man through animals and they keep some of their animals inside the house. These animals play a role in perpetuating an insanitary environment and certain infectious diseases are transmitted through animal's urine, faeces, wool, hair, saliva etc. Certain intestinal parasites like tapeworms and ascaris complete their life-cycle in two stages (one within cattle and other animals and the other in man).

Drainage System : This is not satisfactory in most of the Busties in Sikkim. It is fair among 50.0

Table 20.11 : Kitchen, bathroom, latrine and cattleshed facilites available in the study area of Sikkim State

Religion/	*Kitchen*		*Bathroom*		*Latrine*		*Cattleshed*	
Population	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*	*Yes*	*No*
I. BUDDHISTS								
Lepcha N. Dist	43.2	56.8	10.2	89.8	20.5	79.5	87.6	12.4
Lepcha E.S.W. Dist.	88.0	12.0	48.0	52.0	68.0	32.0	32.0	68.0
Lepchas (Total)	53.1	46.9	18.6	81.0	31.0	69.0	75.4	24.6
Bhutias N. Dist.	40.0	60.0	14.3	85.7	20.0	80.0	54.0	46.0
Bhutias E.S.W. Dist.	51.3	48.7	7.7	92.3	29.5	70.5	17.9	82.1
Bhutias (Total)	46.9	53.1	10.2	89.8	25.8	74.2	32.0	68.0
Sherpas	25.7	74.3	2.9	97.1	11.4	88.6	5.7	94.3
Tamangs	62.5	37.5	31.6	68.4	50.0	50.0	30.8	69.2
Buddhists (Total)	48.7	51.3	15.0	85.0	29.0	71.0	44.6	55.4
II. HINDUS								
Brahmans	72.3	27.7	46.8	53.2	48.9	51.1	66.0	34.0
Chhetris	86.0	14.0	20.0	80.0	68.0	32.0	40.0	60.0
Pradhans (Newar)	84.1	15.9	22.7	77.3	34.1	65.9	63.6	36.4
Rais	76.6	23.4	19.1	80.9	53.2	46.8	19.1	80.9
Limboos	67.7	32.3	32.3	67.7	29.0	71.0	51.6	48.4
Gurungs	73.3	26.7	40.0	60.0	50.0	50.0	36.7	63.3
Mangars	61.5	38.5	34.6	65.4	42.3	57.7	34.6	65.4
Scheduled Castes	71.8	28.2	43.6	56.4	53.8	46.2	10.3	89.7
Hindus (Total)	75.5	24.5	31.5	68.5	48.7	51.3	40.8	59.2
Sikkim (Total)	62.1	37.9	23.3	76.7	38.9	61.1	42.5	57.5

per cent of the Buddhists households, (that too because of the slope of the house site) with poor or with no drainage among 47.1 per cent of houses. Only among 2.9 per cent of well-to-do Buddhist households have a good drainage system. Among the Hindus, drainage system is fair among 70.1 percent households and poor among 28.0 percent households (Table 20.12), 83.7 per cent households with fair drainage are in the West District followed by 81.3 per cent households in the South District (Table 20.12). Absence of efficient drainage system help in proliferating bacterial diseases *e.g.* diarrhoea, dysentery etc. Flies breed in the dirty water which helps in spreading diseases. The people are not able to correlate the transmission of diseases with the flies and insects. Villages are approachable either directly by jeepable road or through bridle paths.

Ventilation : Houses are poorly venilated in Sikkim. Only among 46.3 per cent of Buddhist households and 60.2 per cent of Hindu households, the ventilation is proper (fair). It is good among 25.0 per cent of Buddhist and 20.4 per cent of Hindu households (Table 20.13). Nonavailability of fresh air during night favours respiratory troubles.

Drinking Water

There is enough water in Sikkim. The source of water in th State is either surface water from rivers or ground water from springs. The water for drink-

Table 20.12 : Ventilation, drainage facilities and general sanitary conditions in the study area of Sikkim State, district-wise

S. No.	Districts	Ventilation			Drainage			General sanitary condition		
		Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
1.	North	20.5	47.9	31.6	0.0	29.3	70.7	3.7	44.7	51.6
2.	East	26.1	51.4	22.5	3.6	69.7	26.7	11.9	65.4	22.8
3.	South	12.5	56.3	31.3	0.0	81.3	18.8	0.0	68.8	31.3
4.	West	12.6	81.4	7.0	4.6	83.7	11.8	7.0	79.0	1.0
	Sikkim	22.9	52.6	24.5	2.5	59.5	38.1	8.8	60.5	30.6

Table 20.13 : Ventilation, drainage facilities and general sanitary conditions in the study area of Sikkim State

Religion/ Population	Ventilation			Drainage			General sanitary condition		
	Good	Fair	Poor	Good	Fair	Poor	Good	Fair	Poor
I. BUDDHISTS									
Lepchas N. Dist.	17.5	52.6	29.9	0.0	4.1	95.9	3.1	36.5	60.4
Lepchas E.S.W. Dist.	29.4	50.0	20.6	8.8	85.3	5.9	14.7	76.5	8.8
Lepchas (Total)	20.6	51.9	27.5	2.3	25.2	72.5	6.2	46.9	46.9
Bhutias N. Dist.	16.1	37.1	46.8	0.0	38.7	61.3	4.8	33.9	61.3
Bhutias E.S.W. Dist.	31.3	35.0	33.8	5.0	67.5	27.5	7.5	55.0	37.5
Bhutias (Total)	24.6	35.9	39.4	2.8	54.9	42.3	6.3	45.8	47.9
Sherpas	51.4	48.6	0.0	0.0	100.0	0.0	2.8	97.2	0.0
Tamangs	17.5	60.0	22.5	7.5	70.0	22.5	2.5	75.0	22.5
Buddhists (Total)	25.0	46.3	28.7	2.9	50.0	47.1	5.5	54.9	39.7
II. HINDUS									
Brahmans	32.6	58.7	6.7	2.2	47.8	50.0	23.9	69.6	6.5
Chhetris	22.8	64.9	12.3	0.0	76.4	23.6	17.5	68.4	34.0
Pradhans (Newars)	0.0	63.6	36.4	0.0	79.5	20.5	0.0	70.5	29.5
Rais	25.5	59.6	12.8	4.2	80.9	14.9	12.7	70.2	17.0
Limboos	10.0	76.7	13.3	0.0	71.0	29.0	10.0	70.0	20.0
Gurungs	28.1	53.1	18.8	9.4	46.9	43.8	18.8	53.1	28.1
Mangars	15.4	26.9	57.7	0.0	69.2	30.8	0.0	46.2	53.8
Scheduled castes	21.6	67.6	10.8	0.0	83.8	16.2	10.8	75.7	13.5
Hindus (Total)	20.4	60.2	19.4	1.9	70.1	28.0	12.5	66.8	20.7
Sikkim (total)	22.7	52.9	24.3	2.5	59.6	38.0	18.8	60.5	30.6

ing is not treated or filtered in any way. It is directly led from its source either in galvanised or bamboo pipes to the reservoirs or taps. The availability of drinking water is much better in summer than in other seasons. As a matter of fact, all the 440 villages (440 inhabited and 7 uninhabited, Total = 447) of the State have been considered as problem villages because of the scattered nature of the households. While distance is one of the factors contributing to the difficulties of water supply for drinking purposes, even the quality of the available water is questionable. Laboratory tests have revealed that the water, though generally free from bacterial infestation, has a high quantity of mica and certain type of impurities which have adverse effects on general health. As a matter of fact, the contamination of surface water with impurities like mica, iron, flouride and iodine is the major contributory factor for diseases like dysentery, diarrhoea and cholera which are quite common.

In the summer season, out of 215 Panchayat units, 163 have drinking water facilities within one km of the Panchayat unit against 137 in other seasons. Springs are the main source of water and the second place is occupied by some kind of piped or tap water. However, there are 52 Panchayat units in Summer and 78 in other seasons, where the inhabitants have to go out of their Panchayat unit for water (Economic Census, Sikkim, 1979).

The tables 20.14 and 20.15 show the drinking water facilities in summer and other seasons in the four Districts of the State. The government has already complëted a project to supply piped water to 107 villages. During the Sixth Plan, 125 more villages are expected to receive piped water. In addition six existing schemes are being implemented. In the villages where water supply is at some distance, particularly during dry months, there is a considerable wastage of time and effort on the part of women and children who normally fetch water.

It can be seen from the table 20.16 that water supply in the study area of Sikkim is mostly through iron or rubber pipes, 78.2 per cent of Buddhists households are supplied with iron or rubber pipes. Only 18.7 per cent of Buddhist households have to fetch water from the springs. Among Hindus of Sikkim 80.1 per cent of the households are connected through iron or rubber pipes. 16.4 per cent of the Hindu population has to fetch water from springs. The condition of water supply in different districts can be seen in table 20.17. The survey of sources of water revealed that people of Sikkim suffer from lack of clean water to drink, although water as cleaning agent and for domestic purposes is obtainable and not far from their reach. The same water sources are used for all purposes.

Educational Facilities

In 1981 the literacy rate in Sikkim was 34.05 lower than the Indian rate of 36.07 per cent. Liter-

Table 20.14 : Drinking water facilities in summer in Sikkim State

S. No.	*District*	*Number of Panchayats units having main source*										
		Within 1 km					*Within 1-2 km*			*Beyond 2 km*		
		Tap	*Pond*	*Stream*	*Spring*	*Other*	*Tap*	*Stream*	*Spring*	*Tap*	*Stream*	*Spring*
1.	North	13	0	0	2	0	6	0	0	0	0	0
2.	East	9	6	1	42	2	2	0	6	0	0	0
3.	South	28	6	1	12	0	3	1	3	4	2	6
4.	West	13	7	0	20	1	3	0	15	0	0	1
	Sikkim	63	19	2	76	3	14	1	24	4	2	7

Table 20.15 : Drinking water facilities in other seasons in Sikkim State

S. No.	*District*	*Number of Panchayats units having main source*										
		Within 1 km					*Within 1-2 km*			*Beyond 2 km*		
		Tap	*Pond*	*Stream*	*Spring*	*Other*	*Tap*	*Stream*	*Spring*	*Tap*	*Stream*	*Spring*
1.	North	0	1	0	2	0	5	0	0	1	0	0
2.	East	6	3	2	28	2	2	2	19	0	0	3
3.	South	23	4	2	12	2	0	1	6	2	2	10
4.	West	12	6	0	23	0	1	3	14	0	0	2
	Sikkim	14	14	4	65	4	8	6	39	3	2	15

Table 20.16 :Sources of water supply in the study area of Sikkim State

Place/Religion Population	*Sources of water supply*			
	Pipe (Rubber/Iron)	*Spring*	*Stream*	*Pipe/Spring*
I. BUDDHISTS				
Lepchas N. Dist.	98.9	1.1	0.0	0.0
Lepchas E.S.W. Dist.	68.3	31.7	0.0	0.0
Lepchas (Total)	89.3	10.7	0.0	0.0
Bhutias N. Dist.	47.7	47.7	0.0	4.6
Bhutias E.S.W. Dist.	78.5	13.9	1.3	6.3
Bhutias (Total)	64.6	29.2	0.7	5.6
Sherpas	88.6	5.7	0.0	5.7
Tamangs	81.6	18.4	0.0	0.0
Buddhists (Total)	78.2	18.7	0.3	2.9
II. HINDUS				
Brahamans	85.7	14.3	0.0	0.0
Chhetris	85.7	14.3	0.0	0.0
Pradhans (Newars)	84.1	4.5	0.0	11.4
Rais	80.5	13.0	0.0	6.5
Limboos	81.3	12.5	0.0	6.3
Gurungs	83.3	10.0	0.0	6.7
Mangars	65.4	34.6	0.0	0.0
Scheduled castes	84.2	15.8	0.0	0.0
Hindus (Total)	82.2	14.0	0.0	3.8
Sikkim (Total)	80.1	16.4	0.1	3.3

Table 20.17: Sources of water supply in the study area of Sikkim State, District-wise

S. No.	*District*	*Sources of water supply*			
		Pipe (Rubber/Iron)	*Spring*	*Stream*	*Pipe/Spring*
1.	North	79.8	17.0	0.0	3.2
2.	East	81.7	15.0	0.3	3.1
3.	South	68.8	18.8	0.0	12.5
4.	West	76.7	23.3	0.0	0.0
	Total	80.3	16.3	0.2	3.3

acy rate is shown in table 20.18.

There are 400 schools in Sikkim, of which 80 are High Schools and the rest Primary. Enrolement in the schools is 52000 but still 18000 do not go to school. There are schools at almost every 2 km from place to place. Incentives for poor children are proposed, as well as construction of hostels in areas where the dropout rate is high because of the distance of the residence from the schools. Text books are subsidized to the extent of 50 per cent.

Primary School : Out of 215 Panchayat units, as many as 183 have primary schools within a distance of 1 km (Economic Census Sikkim, 1979). Other 11 Panchayat units have primary schools within a distance of 1-2 km. Only in 21 Panchayat units students have to walk more than 2 km to avail of educational facilities. In the north District all the 21 primary schools are within 1 km distance (Table 20.19).

Middle School : The facilities are not satisfactory for the whole State. Out of 215 Panchayat units, 51 units are within 1 km distance. For another 57 Panchayat units the pupils have to walk between 1 and 5 km. In 107 Panchayat units, to avail of educational facilities, students have to walk more than 5 km.

High/Higher School : The table 20.21 shows the position of secondary education facilities in the State, District-wise.

High school facilities are also not satisfactory. Students have to walk long distances to avail of them. Out of 215 Panchayat units, only 17 have high schools within 1 km distance. Schools in other 38 Panchayat units are within 1 to 5 km range. Students from 40 Panchayat units have to walk between 6 to 10 km. The majority of the Panchayat units *i.e.* 120 are at more than 10 km. The majority of the Panchayat units, *i.e.* 120 are at more than 10 km distance from the high school (Economic Census Sikkim, 1979).

The impact of modern education outside the towns and neighbouring areas has nevertheless been small. Even now, people whose main occupation is farming cannot see any relationship between literacy and farming. In fact, sending children to school is regarded as counter-productive. For the hours when they are in school, they cannot help their parents in agricultural and pastoral activities.

It can be seen from table 20.22 that there are 81 primarty, 23 middle, seven high and 14 higher secondary schools in 60 Revenue villages of study area in all the Four Districts. There are no Adult Education Centres in the East and South District, while the West and North Districts have eleven each. There are two Industrial Training Centres in the West and one in the North Districts in the study area (Table 20.22).

Transport and Communication

In Sikkim State, village communities are fairly closely-nit and insulated despite caste and ethnic differences. To give them better access to the nearest town and/or market centres, villages are being

Table 20.18 : Literacy rate in Sikkim State 1981

S.No.	District		Literate and educated persons			Percentage of literacy		
			Total	Male	Female	Total	Male	Female
1.	North	Total	7867	5909	1958	29.74	39.97	16.78
		Rural	7444	5605	1839	28.99	39.37	16.06
		Urban	423	304	119	34.23	59.38	44.40
2.	East	Total	57430	39113	18317	41.00	50.64	29.77
		Rural	33142	23433	9979	34.98	45.20	22.85
		Urban	24018	15680	8338	33.34	61.76	46.70
3.	South	Total	24681	17660	7021	32.49	43.09	20.06
		Rural	21924	15731	6193	31.05	41.63	18.87
		Urban	2757	1929	823	51.39	60.41	38.12
4.	West	Total	17760	13097	4663	23.62	33.20	13.04
		Rural	16934	12518	4416	21,04	32.57	12.60
		Urban	126	579	247	48.67	57.50	35.80
	Sikkim	Total	107738	75779	31939	34.05	43.95	22.20
		Rural	79714	37287	22427	30.05	40.25	18.24
		Urban	28024	18492	9532	54.86	61.44	45.42

Table 20.19 : Primary Schools in Sikkim State

S. No.	District	No. of Panchayat Units having Primary School		
		With in 1 km	With in 1-2 km	Beyond 2 km
1.	North	21	0	0
2.	East	55	5	8
3.	South	60	2	4
4.	West	47	4	9
	Sikkim	183	11	21

Table 20.20 : Middle Schools in Sikkim State

S. No.	District	No. of Panchayat Units having Middle School			
		With in 1 km	With in 1-2 km	With in 3-5 km	Beyond 5 km
1.	North	9	1	3	8
2.	East	17	5	16	30
3.	South	14	2	9	41
4.	West	11	4	17	28
	Sikkim	51	12	45	107

Table 20.21 : High/Higher Schools in Sikkim State

S. No.	District	No. of Panchayat Units having Secondary School				
		With in 1 km	With in 1-2 km	With in 1-5 km	Within 6-10 km	Beyond 10 km
1.	North	2	1	1	3	14
2.	East	8	3	6	17	35
3.	South	4	2	12	10	38
4.	West	3	1	13	10	33
	Sikkim	17	7	31	40	120

Table 20.22 : Educational facilities available in study area in Sikkim State

S. No.	District	Educational institutes					
		Primary	Middle	High	Higher Secondary	Adult Education center	Industrial Training Center
1.	North	12	3	1	1	11	1
2.	East	43	8	6	6	0	0
3.	South	13	5	0	3	0	0
4.	West	13	7	0	4	11	2
	Sikkim	81	23	7	14	22	3

provided with roads, linking them with district roads and state highways. This development has opened up the rural society to increased associations with neighbouring regions and the formerly

Table 20.23: Bus transport in the study area of Sikkim State

S. No.	District	No. of Revenue Villages having a bus stop at a distance of			
		With in 1 km	Less than 5 km	With in 6-10 km	Beyond 10 km
1.	North	9	-	-	1
2.	East	10	9	3	1
3.	South	3	2	-	6
4.	West	12	2	2	-
	Sikkim	34	13	5	8

Table 20.24: Distance of Revenue Villges from *Pucca* Roads in the Study Area of Sikkim State

S. No.	District	No. of Revenue Villages having a bus stop at a distance of			
		With in 1 km	With in 1-5 km	With in 6-10 km	Beyond 10 km
1.	North	9	-	-	1
2.	East	13	5	3	2
3.	South	3	2	-	6
4.	West	12	2	3	-
	Sikkim	37	9	6	9

Table 20.25 : Marketing facilities in the study area in Sikkim State

S. No.	District	No. of Revenue Villages having Markets/Hats			
		With in 1 km	With in 5 km	With in 5-10 km	Beyond 10 km
1.	North	1	1	-	1
2.	East	2	8	6	7
3.	South	2	2	-	7
4.	West	3	3	7	3
	Sikkim	9	14	13	25

closed economic system has given way to increased trading and marketing. Transport and communication are essential ingredients for the economic development of a region and its importance can hardly be overemphasized in the context of a land-locked State like Sikkim. Road building is a difficult task in Sikkim because of its topography. Roads are built along turbulent rivers and connect mountains of different altitudes, the altitudes varying from a few hundred metres to above 5000 metres with extreme variations in climatic conditions. In spite of all these hardships, 480 kms of surfaced road per lakh (0.1 million) of population and 1300 kms of unsurfaced road per lakh (0.1 million) of population has been constructed in the State. The feeder and district roads are substandard. A large number of villages lack road links with market towns and with one another.

Bus Transport : Out of the sample revenue villages, ten in the East District, nine of the North District, three in the Sough and 12 in the West District are connected by bus transport. Residents of another nine revenue villages in East District have to walk less than five kms to catch a bus, between six to 10 kms in 3 revenue villages and in one revenue village beyond ten kms. Similarly in the South and West Districts, residents of two revenue villages have to walk between six and ten kilometers to catch a bus (Table 20.23).

Nearness of the revenue village to a metalled or *pucca* road is of great help in getting some means of transportation, where private transport is not available. Out of the 60 revenue villages studied, only 37 revenue villages have a mettaled road within a distance of one km. Another nine revenue villages are within a distance of five kms to a metalled road. Out of the remaining 14 revenue villages, five are within six to ten kms and the remaining nine are beyond ten kms (Table 20.24).

Marketing

It can be seen that in the study area about 23 per cent of the revenue villages do not have a market or 'Hat' within five kms and in 25 per cent population of the revenue villages, people have to go beyond ten kms to avail of market facilities (Table 20.25).

Postal Facilities

In modern times, availability of postal facilities is one of the essential amenities required. The spread of these facilities in Sikkim is given in table 20.26.

Table 20.26 shows the 74 Panchayat unts have a post office within one km distance. Another 82 Panchayat units have a post office within a radius of five kms. 41 Panchayat units have a post office between six to ten kms. 18 Panchayat units can availa of postal facilities only after walking a distance of ten kms (Economic Census Sikkim, 1979).

In the study area, 60.2 per cent revenue blocks in North District, 64.4 per cent in East District and 55.4 per cent revenue blocks in West District are provid:d with post office facilities. In the South District the maximum number (81.6 per cent) of

Table 20.26 : Postal facilities in Sikkim State

S. No.	*District*	*No. of Panchayat Units having Postal facilities at a distance of*				
		With in 1 km	*With in 1-2 km*	*With in 3-5 km*	*Within 6-10 km*	*Beyond 10 km*
1.	North	13	1	3	3	1
2.	East	20	9	22	15	2
3.	South	22	7	16	14	7
4.	West	19	5	19	9	4
	Sikkim	74	22	60	41	18

Table 20.27: Revenue Blocks with post office facilities in the study area of Sikkim State

S.No.	*District*	*Revenue Block has Post Office*	
		Yes	*No*
1.	North	60.2	38.8
2.	East	64.4	35.6
3.	South	81.6	18.4
4.	West	55.4	44.6
	Sikkim	63.3	36.7

revenue blocks are provided with post office (Table 20.27).

Electricity Supply

As mentioned earlier, the villages in Sikkim lie in the remote inaccessible areas and since the general infrastructure is poor, electrification of villages has been proceeding sluggishly.

With the commissioning of the first unit of the Lagyap Hydel Project in September 1979, the position of electricity has improved to some extent. It is hoped that with the completion of the entire Lagyap Project in another 1-2 years and renovation of the Lalli House at Sankhola, Sikkim will have sufficient electricity to boost up the economic development programme. The current status of the use of electricity is shown in the table 20.28.

From the table 20.28 it can be seen that out of 215 Panchayat units only 45 units are electrified. Only 7 industries and 4 pump sets are working on electricity (Economic Census Sikkim, 1979).

Table 20.28 : Electricity facility in Sikkim State

S. No.	*District*	*No. of Panchayat Units having*		
		Any pump set using electricity	*Any mill/ industry using electricity*	*Any house using electricity*
1.	North	0	0	4
2.	East	3	4	15
3.	South	1	3	13
4.	West	0	0	13
	Sikkim	4	7	45

The settlement pattern and socio-cultural conditions of people in a community have a strong impact of health. Health systems do not operate in isolation, and so they should not be evaluated as such. It is clear that preventive and curative efforts will be more effective, while other social and economic factors are supportive. Literacy, food production, transport, trade pattern, employment opportunities, and the like can all be conducive to better health if properly adjusted to and properly articulated. These factors affect mortality through nutrition, sanitation and pure water supply. The socio-economic conditions of the people does create differentials in access to these basic items. During the study it was only possible to assess the economic conditions roughly, as people were reluctant to furnish the desired information. Statistical sources of information were rather limited and unreliable.

DISEASE INCIDENCE AND HEALTH CARE

A cooler climate, rugged conditions, and a relatively higher level of nutrition (among some ethnic groups) have influenced health conditions in Sikkim. Epidemic diseases are relatively uncommon, due both to the climate and the widely dispersed population. Among the endemic diseases, malaria and small pox used to be common in the lower altitudes, but following the effort to eradicate it, its incidence has been greatly reduced. Because of the wide range of temperature, rainfall and altitudes, diseases of tropical as well as temperate climates are common in Sikkim. In addition, certain diseases such as helminthiasis and goitre, common to the Himalayan region as a whole, are also found in Sikkim.

Certain ecological factors and human settlement patterns have paved the way for the outbreak of some diseases, socio-cultural and economic factors have stimulated their incidence and the seasonal factor has heightened their incubations and complications and reinforced their virulence. If rain bring in the gastro-intestinal disorders, summer harbingers the cough and the phelgm and the cold winter affects the people with infection of pneumonia, bronchitis and bronchial asthama.

Disease Incidence

The common diseases in order of their prevalence in the State are (1) Hookworm, (2) Scabies, Warts and other skin diseases (3) Malaria, (4) Goitre, (5) Tuberculosis, (6) Tapeworms, (7) Venereal diseases, (8) Roundworms, (9) Other Fevers, (10) Epilepsy and other Nervous Disorders (11) Throat Infections and (12) Tropical Ulcers (Table 20.29). The largest number of patients are listed under the heading 'Other Diseases' in the medical registers of various hospitals and dispensaries, which includes a variety of diseases from the common cold to pneumonia.

Table 20.29 : The incidence of disease in Sikkim State

S. No.	*Disease*	*Frequency (in per cent)*
1.	Diarrhoea and Dysentery	4.7
2.	Worms (Hook, Round, Tape)	24.4
3.	Digestive Disorders, other	10.2
4.	Malaria	15.2
5.	Pneuomonia, Pleurisy and Bronchitis	9.8
6.	Tuberculosis	0.4
7.	Tropical Ulcer	7.6
8.	Skin Disease	2.9
9.	Disease of Nose, Ear and Eye	2.3
10.	Gastro-urinary (non V.D.)	0.7
11.	Venerreal Disease (V.D.)	0.6
12.	Fevers (Typhoid etc.)	2.2
13.	Goitre	1.8
14.	Anaemia (Severe)	1.4
15.	Diabetes	0.02
16.	Epilepsy and other Nervous Diseases	3.3
17.	Mental Distress	0.02
18.	Heart Disease	0.10
19.	Liver Disease	0.2
20.	Rheumatic condition	0.7
21.	Rickets	0.02
22.	Ill-defined causes, other infectious diseases and miscellaneous	6.5

The incidence of tuberculosis, goitre, pneumonia, kalazar and malaria were on the rise for a few years after 1954 and then declined (Table 34). This decline was due to the increase in medical facilities in the 1960s which brought medical care within reach of more people. It also reflects the degree of control achieved on the incidence of the disease through preventive and curative measures. In this group of diseases, malaria and smallpox are good examples. From a peak of 12310 patients in 1956, the incidence declained to 343 in 1963. This was clearly the result of the malaria eradication scheme which was undertakne in the First Plan (1954-61) and continued through the Second (1961-66). The surveillance work for small pox was also carried by the NMEP (National Malaria Eradication Programme).

Till September 1975 smallpox vaccination (both primary and re-vaccination) were carried out with the aim of achieving 100 per cent vaccination. In April 1976, one survelliance team consisting of a team leader and one paramedical assistant carried out surveillance activities with the assistance of a vaccinator attached to the districts and PHSC. The incidence of kalazar and V.D. had reduced substantialy by the late 1960s. The incidence of diseases such as dysentery, diarrohoea and goitre steadily increased in the 1960s and 1970s. Most of the diseases result from poor hygienic conditions and unprotected, ill-kept water supplies. Without education in sanitation and hygiene, it is unlikely that a marked decline in these diseases will occur. A reduction in the duration and degree of illness seems to be the main benefit of the improved medical facilities.

The incidence of these disases varies from one zone to another. The main problems in the Southern zone are malaria, hookworm and tropical ulcers; in the Eastern zone - hookworm, malaria, venereal diseases, skin diseases and nervous disorders; in the Western zone - hookworm, tuberculosis, venereal diseases and skin diseases : and in Northern zone - helminthic diseases, specially tape and hookworm and venereal diseases.

Diarrhoea and dysentery are the two diseases with a high incidence. These are largely waterborne infections which bear a close relationship with the hygienic conditions prevailing in a settlement. In hill areas, streams and rivulets provide the principal source of water supply. The water comes down from higher altitudes either from melting snow or from moisture retained during monsoon. At the upper reaches of streams, the water is usually uncontaminated but as it flows down through various settlements it losses this quality. The possibility of pollution in drinking water from human waste is high. The unprotected waste sources are contaminated in the rainy season of the hills with the night soil, garbage and other human and animal waste. The water sources turns into a veritable source of the carrier of a good number of diseases, parasites and bacterias, infecting the disgestive system.

The prevalence of goitre in Sikkim is not surprising since this diseases appears to be common in the Himalayan tract and is attributed to the lack of iodine in water. The deficiency could be overcome through treating water at its source, but since the water supply for most villages and towns comes directly from running water, this would in practice be very difficult. In view of this, the alternative of using iodized salt should be adopted.

As already mentioned, scabies, warts and other skin diseases are common. Because of the cold climate and scarcity of water, the people are insanitary about their personal hygiene. They take bath irregularly. Even while taking bath, oil is rarely used on the body or the hair. As a result, hair gets matted and becomes good breeding ground for lice. Disregard of personal hygiene and cleaniliness leads to these various infections and skin diseases.

Of the diseases caused by worms, that by hookworm is the most common. The parasitic diseases are also caused by the intake of preserved raw meat and semi-boiled meat. The Lepchas of North Sikkim relish the carrions of pork, beef, preserved by hanging them over the fire for a long stretch of time. The dishes prepared from the semi-decomposed carrions, not fully boiled, cause enteric disorders and worm infections. Pigs who live on excreta and garbage are a major factor in the wide prevalance of this disease.

Of the blood diseases, anaemia deserves mention. The high incidence of hill-diarrhoea and hill dysentery and chronic ailment from these diseases lead to anaemia, which is also caused by a malnutritional diet and chronic diseases of infection from worms. Anaemia has not yet assumed a severe form because of natural physiological advantages of the metabolism of accelerated formation of haemolgobin in high altitudes.

Cardiac diseases are also fairly common, being caused by the ardous strain from movement up and down the hill. If the heart is weak among some people. lungs too are not healthy in all. Wasting diseases like pulmonary tuberculosis, accentuated by chronic malnutrition, hard labour, absence of proper ventilation, the smoking habit and absence of facilities of segregation, are therefore, common. Bronchial asthma is also common. Rheumatism is also present among people. It is said to be caused by the cold climate.

The prevalence of venereal diseases is also not surprising, since people are not particular about personal hygiene. They are generally not aware of the hygienic precautions that should be taken to avoid infection.

Representative population samples have been analyzed in regard to the distribution genetic markers of the blood, anthropometric variables, dermatoglyphic traits, colour blindness, ear-lobe attachment, mid-phalangeal hair and some behavioural traits. In various population groups of Sikkim frequency of haemolgobin E has been observed among the Lepchas, Bhutias, Gurungs and Rais (Bhasin, 1984; Bhasin et al., 1986) Dekha (1981) has reported no significant differences in fertility of women and mortality of children for different genotypes of haemologbin E.

Health Care System

In Sikkim, greater importance is given to curative measures instead of preventive ones. Most of Sikkim's health problems are related to insanitary conditions and lack of education. They are preventable by public health measures. The difficulty in making progress in preventive medicine is compounded by a number of cultural and traditional habits and beliefs surrounding dietary practice, childbirth, illness and hygiene.

In 1981, there were five hospitals in Sikkim - at Gangtok, Singtam, Namchi, Mangan and Gyalshing. From among these, the hospital at Gangtok is the largest and best equipped. There are dispensaries or health centres in Rinchenpong, Daramdin, Dentam, Soreng, Kowzing, Melli, Pakyong, Simick, Limgzey, Rangil, Samdong and Song. In 1979-80 these hospitals and dispensaries were attended to by 66 doctors. There was thus one doctor for every 4800 persons.

Hospital facilities are not at all satisfactory in the whole State. Only seven Panchayat units out of 215 are lucky enough to be in the one km range of a hospital. Out of 215, 150 panchayat units are more than ten kms. away from any hospital, 11 Panchayat units are within one to two kms range (Table 20.30). The rest of the 47 Panchayat units are between three to ten kms (Economic Census Sikkim, 1979).

Table 20.30 : Number of Hospitals in Sikkim State

S. No.	District	No. of Panchayat Units having a Hospital				
		Within 1 km	Within 1-2 km	Within 3-5 km	Within 6-10 km	Beyond 10 km
1.	North	1	2	2	1	15
2.	East	4	5	5	7	47
3.	South	–	2	7	9	40
4.	West	2	2	6	10	40
	Sikkim	7	11	20	27	150

Table 20.31 : Number of Dispensaries (allopathic, including Primary Health Sub-centres) in Sikkim State

S.No.	District	No. of Panchayat Units having a Allopathic Dispensary				
		Within 1 km	Within 1-2 km	Within 3-5 km	Within 6-10 km	Beyond 10 km
1.	North	9	1	4	4	3
2.	East	16	4	14	12	12
3.	South	11	2	15	23	15
4.	West	18	2	13	15	12
	Sikkim	54	9	46	64	42

Table 20.32 : Primary Health Centres in Sikkim State

S. No.	District	No. of Panchayat Units having a Primary Health Centres				
		Within 1 km	Within 1-2 km	Within 3-5 km	Within 6-10 km	Beyond 10 km
1.	North	4	1	3	4	9
2.	East	10	4	8	23	23
3.	South	6	2	10	19	29
4.	West	6	3	13	16	22
	Sikkim	26	10	34	62	83

The position in respect of dispensaries is found to be a little better than for hospitals (Table 20.31). Out of 215 Panchayat units 54 units are within the one km distance. Another 55 units are between two to five kms range. The rest 108 are between six to ten kms range. It may be pointed out that the national norm for the opening of a Primary Health Subcentre is one for 5000 population. This has been more or less achieved in Sikkim. Because the areas are sparsely populated, people have to walk long distances. The terrain being hilly, it becomes more irksome for sick people to travel such long distances. So they ultimately resort to their own folk medicine. There are Ayurvedic but not Homeopathic or Unani Dispensaries in the State. Tibetan medicine is very popular in this State and is quite effective (Economic Census Sikkim, 1979).

The national norm of having a Primary Health Centre for a population of 20000 has been achieved in Sikkim (Table 20.32). The terrain is hilly, and the distribution of people at far off places creates difficultires for the sick. 26 out of 215 Panchayat units are within one km. distance, ten are within one to two kms distance, 34 units are between three to five kms. People from 62 units have to travel between six to ten kms to avail of the PHC facilities. Still, 83 Panchayat units are beyond ten kms of any PHC (Economic Census Sikkim, 1979).

Primary Health Centre facilities are available to only 7.3 per cent of total population in study area in Sikkim (Table 20.33). Out of which only 3.1 per cent in the North District and 7.1 per cent in East District. 22.9 per cent of population in the South District have PHC facility in the study area followed by– 17.9 per cent in the West District. Primary Health sub-centre facilities are availed by 32.9 per cent population in the study area. Only 8.9 per cent of the population can avail of the hospital facility. The rest 51.0 per cent of the population has no medical facilities. Though these facilities are

Table 20.33 : Medical facilities available in the Study Area of Sikkim State, District-wise

Medical facility available	*District*				
	North	*East*	*South*	*West*	*Total*
Primary Health centre	3.1	7.1	22.9	17.9	7.3
Primary Health Sub-centre/ Dispensary	50.4	25.5	17.1	26.8	32.9
Hospital	0.0	13.6	14.3	5.4	8.9
None	46.5	53.9	45.7	50.0	51.0
Total	100.0	100.1	100.0	100.1	100.1

Table 20.34 : Number of patients treated in hospitals and dispensaries in Sikkim State (1954-63, 1973 and 1980)

Year	*Others*	*Malaria*	*Kalazar*	*Dysentery*	*Diarrohea*	*Helminthiasis (Hookworm, Tapeworm, Roundworm)*	*T.B.*	*Goitre*	*V.D.*	*Smallpox*	*Total*
1954	79055	9261	1106	4107	2841	13992	561	3803	354	86	115060
1955	83075	10802	993	3842	1123	15398	266	3810	328	65	120637
1956	119308	12310	1410	3357	3257	23085	497	4693	384	142	168300
1957	124037	10982	971	3496	4192	27115	620	4666	316	7	176395
1958	113994	4988	428	4518	5158	27817	913	4919	348	4	173083
1959	126544	2270	402	4879	5304	29851	699	6612	398	8	176968
1960	135051	1503	170	6250	7995	26304	869	7233	734	1	186089
1961	127179	851	136	1442	7559	22540	606	7175	161	5	167649
1962	121660	556	82	4140	7176	23491	511	6758	121	–	164496
1963	141185	343	107	5584	8400	24725	412	7709	61	2	188526
1973	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	45	-
1980	N.A.	4	2	N.A.	N.A.	19762	1038	7763	10	N.A.	N.A.

N.A. = Not Available, V.D. = Venereal Disease, T.B. = Tuberculosis. The data for 1980 is incomplete district-wise smallpox incidence in 1973 : East district (cases = 34, Death = 11), South District (Cases = 11, Death = 4)

available in all the Districts, they are being utilised by 66.1 per cent in the North District, 53.9 per cent in East District, 60.0 per cent in West and 85.3 per cent in South District (Table 20.36).

Both Buddhist and Hindus are utilising these facilities if it is convenient and within their reach. PHC facilities are available to 7.6 per cent of the Buddhist population and 7.8 per cent of the Hindu population in the study area (Table 20.35). Primary Health Sub-centre/Dispensary facilities are available to 31.1 per cent Buddhists and 34.4 per cent Hindus. Hospital facilities are available to 5.8 per cent Buddhists and 12.1 percent Hindus. The rest 55.5 per cent Buddhists and 50.8 per cent Hindus are without any government sponsored medical facilities.

Though these facilities are available, they are not being utilised fully as only 67.0 per cent of the Buddhist population and 50.0 per cent of the Hindus are availing these facilities. Private practitioner facility is being utilised by only 0.2 per cent Buddhists and 1.2 percent Hindus. In areas where Government sponsored facilities are available along with folk medicine, both the Buddhists and Hindus are utilising government as well as folk medicine facilities.

Among the Hindus of Sikkim, more number of persons are aware of these facilities than the Buddhists. Each respondent was asked to list the various sources from where this information could be obtained. It is to be noted that relatives, friends, medicos, mass-media and extension workers are mentioned. Among the Buddhists and Hindus the role of medicos and extension workers is very promising as an important source of information. This might be due to their contact with the public due to their frequent visits to the villages.

The role of mass media is not very encouraging. 6.2 per cent among the Buddhists and 15.0 per cent among the Hindus came to know about medical facilities through the mass media. In rural areas, most of the people prefer to listen to only film songs and news. In these circumstances the mass media cannot be an effective instrument to popularise health measures.

The human population residing in isolated vil-

Table 20.35 : Medical facilities available to the various population groups in the study area in Sikkim State

Religion/ population	*Medical Facilities*			
	Primary Health Centre	*Primary Health Sub-centre/ Dispensary*	*Hospital*	*None*
I. BUDDHISTS				
Lepchas N. Dist.	0.8	50.4	0.0	48.8
Lepchas E.S.W. Dist.	4.2	6.3	6.3	83.3
Lepchas (Total)	1.8	37.9	1.8	58.6
Bhutias N. Dist.	7.1	66.7	0.0	26.3
Bhutias E.S.W. Dist.	19.3	0.0	9.1	71.6
Bhutias (Total)	12.8	35.3	4.3	47.6
Sherpas	0.0	5.4	2.7	91.9
Tamanga	15.8	5.3	34.2	44.7
Buddhists (Total)	7.6	31.1	5.8	55.5
II. HINDUS				
Brahmans	3.8	67.9	1.9	26.4
Chhetris	21.1	28.2	11.3	39.4
Pradhans (Newras)	3.4	81.0	0.0	15.5
Rais	3.5	22.8	14.0	59.6
Limboos	10.3	20.5	15.4	53.8
Gurungs	9.1	2.3	11.4	77.8
Mangars	3.3	3.3	23.3	70.0
Scheduled Castes	2.2	23.9	28.3	45.7
Hindus (Total)	7.8	34.4	12.1	45.7
Sikkim (Total)	7.7	32.7	8.8	50.8

Table 20.36: Medical facilities availed in the study area of Sikkim State, District-wise

Medical facilities availed	*District*				
	North	*East*	*South*	*West*	*Sikkim*
Government	66.1	53.9	65.3	62.0	59.7
Private	0.4	0.7	0.0	2.9	0.6
Folk Medicine	0.0	0.4	0.0	0.0	0.3
Government and Folk Medicine	33.5	44.9	14.7	37.1	39.4
	100.0	99.9	100.0	100.0	100.0

lages on hill tops and slopes of Sikkim depends mostly on natural remedies for their body ailments. Sikkim is rich in valuable medicinal plants, nurtured by the Buddhist Gompas for the traditional Tibetan pharmacopoeia. Conserving these plants and cultivation have ensured the survival of one of the oldest systems of medicine, stretching back more than 2,500 years. Recent attempts to revive traditional medicine have opened new possibilities in health care arena. Because of the difficult terrain with varying altitudes and meagre medical facilities, people go to herbal doctors and medico-religious men. The medico-religious men in these regions are called by different local names - *Bonthing, Mun, Pau* and *Jhankris*. The people have a thorough knowledge of the abundant flora of their country and since time immemorial they have known how to use this knowledge in the treatment of diseases. However, the treatments are usually accompanied by large rituals and ceremonies.

The health care system of a community comprises a composite use of cures and healing practices deriving from folk-medicine. With their age-old fold medical system, people have been able to survive and maintain the ecological balance. With the advent of western medicine, a new system has been introduced and people always react differently to this transplanted system. This type of system, which does not allow any scientific exploration, is obviously based on myths and powers that are not within human control *i.e.* for such things a supernatural element may be responsible. Consequently the treatment of the ailment also reflects appeasement of the supernatural powers which are extraneous to the individual (patient). In such a society adoption of a new medical therapy obviously will be challenged by the existing system and hence, unless the new system is capable of replacing the traditional values by its efficacy and acceptability, it will not be a success.

In view of the extremely difficult means of communication and distance of dispensaries from the villages in Sikkim medical aid is not availed of by the people except in serious cases. The use of traditional herbs for curing diseases is most common in the area.

The environment in which the people live is dirty and unhygienic. There was no proper drainage system in the villages. Water from springs, Bowlies and in some cases Nallahs or *Kholas* was used for drinking purposes. In all the villages surveyed drinking water facilities were found to be inadequate, no proper washing arrangements existed. Washing was done near the sources of drinking water, resulting in the pollution of water. Although health education formed a part of the Community Development Programme, not enough attention is paid by the people to sanitation and cleanliness.

The area being difficult, the sanctioned posts in most cases remain vacant. Thus, medical facilities are not sufficient to cater to the needs of people. Those who want to avail of these facilities often have to travel long distance. This, combined with shortage of medicine, results in most of the patients remaining unattended to. So the people in interior areas have to depend on their own medical treatment.

In general, the health problems in Sikkim can be grouped into five main categories : a high rate of infections and water borne diseases; poor environmental sanitation and hygiene; unsatisfactory nutritional status; ignorance about health; and an unsatisfactory health care delivery system. The belief in the interference of a supernatural agency is strong in the context of health and disease. It was seen from the data that when both the facilities (namely modern and traditional) were available in the area people often accpeted and availed of western medicine (Table 20.36). It can be seen from the table that medical facilities available in the study area among the Buddhists and Hindus of Sikkim are meagre; 7.6 per cent of the Buddhisht and 7.7 per cent of the Hindus can avail of the facilities of the Primary Health Centre; 31.1 per cent of Buddhists and 34.4 per cent of Hindus can avail of the Primary Health Sub-centre facilities; only 5.8 per cent of the Buddhists and 12.1 per cent of the Hindus can avail of hospital facilities (Table 20.35). Out of these, 67.0 per cent of the Buddhists and 50.1 per cent of the Hindus are utilising these health facility provided by the Government. As such these two medical systems (the government and folk) can be compartmentalised because people are using both at a time. Though they may claim that they go to the Health centre, it was seen that side by side other rituals were also being practised. For the Sikkim data, by applying unilateral correlation, it was found that if the revenue block is connected by the road, more people avail of government medical facilities. Unfortunately, adequate modern facilities are not available in many of these areas, and people are accused of not accpeting these non-existing medical facilities. In areas where these facilities are not available, people depend on traditional medical care; herbs are used as medicines along with long rituals and animal sacrifices to cure different diseases. The dependence and confidence on traditional medicine men or magician and the Shaman are the result of the faith and confidence among the patients. As the traditional practitioners share the common cultural traditions of the patients, naturally the patients have more faith in them.

HEALTH AND POPULATION

Sikkim's population is increasing as observed that 40.03 per cent is under 15 years of age. The proportion of population in 0-14 is 42.80 per cent among the Buddhists and 37.10 among the Hindus. The sex-ratio (the number of females per 1000 males) shows a varied picture, among Buddhists it is 921 and for the Hindus 1051 and for Sikkim (Total) 980. As opposed to the population in the 0-14 age groups, that in 65 and above is very low in Sikkim. The mean age of females of Sikkim is 25.0 as compared to the male age of 27.8. For the Sikkim (Total) it is 25.8. Because of young population structure the Young Age Dependency among Buddhists is 78.42, Hindus 61.43 and Sikkim (Total) 69.74. The Old Age Dependency Ratio among the Buddhists of Sikkim is 4.80, among the Hindus it is 4.16 and for Sikkim (Total) it is 4.47. The Total Dependency Ratio for the Buddhists of Sikkim is high as being 83.22 but is less 65.59 among the Hindus of Sikkim. For the Sikkim it is 74.21. The Index of Aging is 6.42 for Sikkim as compared to Kerala's 21.51, India's 16.41 and Bhutan's 11.26.

Among the Buddhists of Sikkim, the percentage of married women in the reproductive age group is 62.35, among Hindus it is 60.75. The figures are comparable to the rates of Kerala which has a percentage of 60.65. It is interesting to note that in Sikkim though the percentage of married women in only 61.52 the percentage in the 0-14 age group is as high as 40.03, indicating high fertility.

The age at marriage is slightly higher among the Buddhists (18.46) than among the Hindus (17.04). The Sikkim (Total) sample has a lower age at marriage 17.71 than India's 18.32 and Kerala's 21.85.

Age at menarche and menopause among the Buddhists of Sikkim is 15.50 and 44.33, respectively among the Hindus it is 14.62 and 45.71, for Sikkim (Total) it is 15.09 and 44.99.

The Crude Activity Rate (CAR) and the General Activity Rates are quite low among population groups of Sikkim. The CAR among the Buddhists and the Hindus is 24.38 and 22.17, respectively. The CAR for the two groups is 46.67 and 36.70, respectively. The reason for the activity rates being higher among the Buddhists is that they are owner-cultivators.

Economically, half of the families were either poor or very poor in Sikkim. 50.2 per cent come under the bracket of less than Rs. 5000. The percentage in the less than 10000 and less than 15000 rupees is 32.9 and 11.2 per cent, respectively. Very few households have an income beyond 15,000 per annum.

Among the Buddhists of Sikkim the literacy rate 36.83 per cent, the male and female literacy rate is 51.94 and 21.92, respectively. Among the Hindus the literacy rate is 54.77, while male and female literacy is 64.40 and 45.53 per cent, respectively. The level of education is not high. They generally discontinue studies after the middle school. The literacy rate for Sikkim (Total) in the sample study is 46.04 as compared to Sikkim's Census 1981 rate of 34.05.

Maize and rice and the chief cereals. The poorer classes take millets and buckwheat. *Kalo-dal, Muruura Ka Bhat* or *Moong Dal* also form important items of diets. All except the Brahmans take meat, but Nepali Hindus avoid pork, against which other groups have no prejudice. In fact, pork is a more favourite dish with them than beef or mutton. A pig is a universal item of gift in a marriage. Their habit of pork eating is responsible for the helimenthic diseases, because pigs eats refuse and human excreta. Milk is taken only with tea and sparingly as it is.

A local drink prepared from fermented millet and buckwheat is used as an almost universal drink by the people of Sikkim. The Lepchas call it *Tumba, Chi* (Stronger than *Tumba*); the Bhutias call it *Chhang* and the Nepalese call it *Rakshi*. Next to alcohol the common addiction is tabacco. The consumption of tabacoo is equal among both the sexes. Even among children, 15 per cent indulge in tabacco.

The diet of a good protion of the population is inadequate by accepted standards. The deficiencies in the diet are both qualitative and quantitative. The basic caloric requirements are not met. The intake of proteins is also marginal while vitamins and minerals fall far short of the desirable level. Malnutrition being a reflection of unfulfilled dietary demands, occurs during the three most demanding periods in human life (i) growing age, (ii) pregnancy and (iii) the periods of lactation.

The per capita consumption of food grains among people of Sikkim is 0.52 kg per day as against Indian average of 0.50 kg. When skinfold data was analysed for centiles in the population, it was found that a sizable portion of the population lies below the 50th centiles showing lower energy stores, thus indicating a poor socio-economic status, leading to lower nutritional status. It is difficult to assess the exact nutritional status from skinfold measurements due to unavailability of normal fat standards for both the populations. However, the lower nutritional status is further supported by the absence of a single peaked and clear cut adolescent spurt for most of the variables in all the population groups. Malnutrition and chronic diseases are important environmental factors which disturb the normal growth especially the adolescent spurt as the extra-nutritional demand of the rapidly growing is not met adequately.

It was seen from the pattern of body growth and physiological variables among population groups of Sikkim inhabiting the Outer, Middle and Inner Himalayan Zones that although all the Morpho-physiological variables exhibit normal growth, the rate of growth especially during adolescence is affected leading to a disturbed velocity curve or adolescent spurt. The chest dimensions of the subjects were found to be more developed as compared to the boys from the plains, thus indicating the morphological adaptation to increased oxygen tension at higher elevations (Bhasin, 1985).

Initiation to breast feeding is universal in Sikkim. Breast milk contributes substantially to the infants and pre-school children's diet. The majority of mothers in Sikkim usually select and consume some special foods during pregnancy and lactation. The food items are usually home-made and from locally available materials. Besides they believe in various superstitions and misconceptions regarding food. Pregnant women usually do not take nutrition and fatty substances in the fear that this will abnormally increase the size of the baby to be born. Certain fruits, animal meats are taboo. Certain vegetables are not eaten as it is thought that it will give stomach troubles to the child.

Pregnant and lactating women of Sikkim do not regularly eat food rich enough in Vitamin A (milk, eggs, green leafy vegetables, carrots, fruits; Vitamin C (oranges, lemon, tomatoes, guava, papaya, mango); and Vitamin D (liver, milk, egg-yolk, fish liver oils) and calcium. The food provided to them is poor for their nutritional requirements. They do not get the required amount of calories, proteins and vitamins in food. Traditional food habits and poverty are the main causes for their lack of nutritional requirements.

The general status of health of Sikkim can be seen in the table 20.37.

General poverty, low family income, a high rate of illiteracy and various socio-cultural factors contribute to this type of health structure. At present the Crude Birth Rate (CBR) among the Buddhists of Sikkim is 21.8, among the Hindus of Sikkim it is 29.3. For Sikkim (Total) (Study area) the CBR is 25.4, whereas the Census CBR for Sikkim is 34.5. The most probable reason for this difference in CBR could be that in such small samples it is left to chance as to how many births have occured in that year.

In Sikkim the decennial growth of population since 1901 (Table 20.5) shows an exponential increase. The CBR for Sikkim (Total) is 25.4, Census CBR is 34.5 which is higher than Kerala (22.9) Himachal Pradesh (30.8), and India (33.9).

Most of the people in Sikkim are not using family planning methods. Only around 50 to 60 per cent of the people are aware of them and only 16.7 per cent of them practice it. The higher percentage of users are female 15.1. The number of users lie in the age group 35-39 among the Buddhists (24.4) while in the Hindu community the highest percentage of 29.3 is found in 25-29 age group (Bhasin, 1990).

The health status of Sikkim State is poor. The critically low economic status of the people and the related poor level of nutrition, sanitation, housing etc. explain the prevailing pattern of disease and death. Of particular concern are high infant and child deaths, and high incidence of diseases. The infant-mortality rate (IMR) among the Buddhists of Sikkim is high (177.8); among the Hindus of Sikkim it is 70.2. The Sikkim (Total) IMR of 117.7 is highere than Burma, Pakistan and Sri Lanka. The child health situation in both the communities is both a consequence and cause of their less developed state. The rate of infant and child mortality is high. Yet the child population constitutes the growing bulk of their population. Here children die of diseases usually not considered lethal elsewhere. Diarrhoea, complicated or brought on by malnutrition, causes about a third of all child and infant deaths: Pneumonia vies with diarrhoeal diseases as the leading taker of young life. Measles, one of the most infectious diseases known, makes children more susceptible to pneumonia, though it is preventable by vaccination. Tetanus, whooping cough, diptheria, and tuberculosis, also preventable by vaccinations, continue to take a heavy toll.

Low death rates have been achieved in parts of India, where Primary Health care procedures midwifery, maternal education on breast feeding and

Table 20.37 : General population trends for Buddhists, Hindus and Sikkim (Total), Sikkim State, Gaddis, Himanchal Pradesh, Kerala and India

S. No.	*Population Trends*	*Sikkim* *Buddhists*	*Hindus*	*Total*	*Sikkim State*	*Gaddis H.P.*	*Himanchal Pradesh*	*Kerala*	*India*
1.	Total Population	2063	1949	4012	316385	2854	4280818	2545000	685185000
2.	Sex Ratio	921	1051	982	835	870	973	1032	933
3.	Density per sq km	–	–	–	45	–	77	655	215
4.	Growth Rate (1971-81)	–	–	–	50.77	–	23.71	1924	25.0
5.	Per cent Growth Rate	–	–	–	2.87	–	2.15	1.77	2.25
6.	Crude Birth Rate (CBR)	21.8	29.3	25.4	34.5	28.4	30.8	22.9	33.9
7.	Crude Death Rate (CDR)	19.8	17.8	18.8	10.9	14.0	10.3	6.4	12.6
8.	Infant Mortality Rate	177.8	70.2	117.7	–	170.1	90.0	29.0	104.0
9.	Neonatal Mortality Rate	66.7	35.1	49.0	–	80.2	52.6	21.0	65.8
10.	Postnatal Mortality Rate	111.1	35.1	68.6	–	45.3	37.5	7.7	38.2
11.	Perinatal Mortality Rate	88.9	–	58.8	–	62.1	42.9	22.9	53.8
12.	Foetal Death Rate (FDR)	22.2	–	9.8	–	13.0	–	6.4	–

Sources : Census of India 1981. Series I. India Paper 2 of 1983. Sample Registration System, 1984. Vital Statistics Division. Registrar General of India, Ministry of Home Affairs, New Delhi (1987).
Sample Registration Bulletin 1985., Registrar General of India, Ministry of Home Affairs, New Delhi.

weaning, vaccinations, oral dehydration of victims of diarhoea, and antibiotics against respiratory infection have been implemented.

Parents in areas with high infant mortality rates typically produce more children than they desire because they want to ensure the survival of a minimum number as observed among the cultivators. Subjected to repeated pregnancies these women suffer from an almost continuous nutritional drain which exposes both mother and child to high mortality risks that show a definite increase from one pregnancy to the next. The pressure of the population growth is felt more by the large families at low income levels. It has been shown by various studies that the larger the family size, the greater is the occurrence of common illness in the family. The health of the family is affected by number of deficiencies. The health of the mother in a large family with limited income is affected by the low nutritional level and also by the physical and material pressures associated with child-bearing and child-rearing. The larger families, moreover find it difficult to provide adquate medical facilities which result in the neglect of their members. Their ailments are noted only when they become serious. Women and children usually lack the most basic advantages.

If the child survives birth, it faces dangerous years. The major threat includes malnutrition due to poor weaning practices, diarrhoeal infection from contaminated water, faecal contamination, and infectious diseases that prosper in malnourished children. Repeated episodes of diarrhoea, which are common where clean drinking water is unavailable, lead to further malnutrition, infection and even death. Dehydration followed by advanced diarrhoea, is also a high risk factor.

The leading diseases among the children of Sikkim may be summed up as follows: (i) respiratory tract infection, (ii) skin infection, (iii) diarrhoea (iv) bronchitis and pneumonia, (v) measles, (vi) eye infection, (vii) intestinal worms, (viii) ear infection, (ix) tuberculosis. The leading cause of death among infants and children under five of Sikkim are : tetanus, birth injuries, pneumonia, diarrhoea and others.

During the last century in the United Sates and Great Britain, cholera and diarrhoea rates dropped sharply, mainly because of improvements in sanitary conditions. Studies in California and Kentucky have shown that compared to diseases rates for children with both indoor water and toilets, diarrhoea occured twice as often in children who had outside toilets, and four times as often in chileren who had neither. In twenty American cities, the average reduction in typhoid fever following installation of water filtration was 65 per cent (Rosenberg, 1962). A Chilean study concluded that, the availability of drinking water ... cut the incidence of acute diarrhoea by about 74 per cent" (Department of Rural Water Supply, National Sanitary Work, Chile). According to the World Bank' privy construction in Costa Rica, helped cut the death rate in half for diarrhoea and related diseases between 1942 to 1954.

In India high costs and cultural barriers have blocked sanitation development. Villagers want water, but convenience is more important than quality. Food, housing and fuel take precedence over water purity, and toilets are seen as a luxury and not a necessity (Chauhan, 1983). In Sikkim also, the other development programmes have takne precedence over water purity and toilets. The majority of the people are ignorant about the causation and prevention of diseases, being demonistic and deistic in out-look on health matters. People do not relate diseases to water supply and waste disposal.

Most of Sikkim's health problems are related to insanitary conditions and lack of education. They are preventable by public health measures. In Sikkim greater importance is given to curative measures instead of preventive ones. In 1980, there were five hospitals in Sikkim and 12 health centres. There was one doctor for every 4800 persons. The internationally accepted norm for doctor/population ratio is 1:2000 which means that Sikkim would need to have more than double the number of doctors to reach international standards. The population is dispersed over an area which does not have easy transportation. The effectiveness of a dispensary or a hospital in such conditions is reduced in terms of both area and the population covered. If medical facilities are located at fixed places, the doctor or nurse/population ratio would be considerably lower than the accepted international norm. The National norm of having a Primary Health Centre for a population of 20000 has been achieved in Sikkim (Table 20.31). But the hilly terrain and distribution of people at far off places creates difficulties for the sick.

Certain ecological factors and human settlement patterns have paved the way for the outbreak of some diseases; socio-cultural and economic factors have stimulated their incidence and seasonal factors have heightened their incubations and complications and reinforced their virulence. If rain brings in the gastro-intestinal disorder, summer harbingers and cough and the phelgm and the cold winter affects the people with infections and pneumonia, bronchitis and the respiratory diseases.

The factors affecting the health of these population groups can be divided into two categories:- those factors which affects the health of the people in an indirect way (attitudes and customs of the people and the demographic structure). Factors responsible for producing disease are (i) Settlement pattern and state of cleanliness; (ii) personal hygiene; (iii) consumption pattern; and (iv) addiction.

Factors which affect health indirectly are (i) religion and family outlook on health; and (ii) health care system.

Illness and misfortunes are distributed to a variety of supernatural forces such as attacks by witches, sorcerers, forest divinities, spirits of diseased individuals and angry gods or goddesses. According to the beliefs of the population groups of Sikkim Buddhists as well as Hindus, the causes of illness can be calssified into two categories:

(i) Diseases caused by supernatural beings-deities, spirits, ghosts and other non-material entities; and

(ii) Diseases caused by magical means - witchcraft and sorcery.

These people have been used to a way of life which has continued for a long time without any major disruption *i.e.*, most of the activities are primarily based on the experience of the past, which may be termed as traditions having the power of coercing the people into a continuation of their life style without any reflection. The values and the attitudes of the people are also made to follow or conform to set patterns. The beliefs pertaining to various diseases and their cure are also based on the past experiences and traditional logic. The system of cause, effect and cure, is thus a circular and enclosed system of knowledege. The cause is a spirit, the effect is spirit possession, and the cause of controlled spirit possession. This system of knowledege provides the manifest of explanation and control in the face of disorders, chaos and inexplicable circumstances.

A health care system is concerned with the ways and means in which people organise themselves to take care of the patient. These different categories of illness are treated with worship and devotion accompanied by animal sacrifice. Diseases caused by magical means are treated by exorcism. Despite the availability of rural health centres to villagers, other systems co-exist and are widely used as alternatives. The Sikkim situation, in which different health care systems co-exist but do not usually cooperate is similar to that of most other countries and is a clear example of medical plularism. Two regional traditional health care systems : Tibetan and the local Sikkimese, folk medical system are flourishing beside the national health care system and private western medicine. The names and activities of the traditional healers are highly diverse-but the role of the sacred is prominent in all. Sacred not only includes all gods and goddesses but also the spirits of ancestors and forests, the beings and demons present every where. It is the sacred that links the malaise of the spirit of the Shaman treating illness due to machinations of the spirits. These system involve rituals, the medicinemen or exorcist and the patient. Most folk healers (*Pau, Bonthing, Jhankris*) have an extensive knowledege of herbal cures and majority use Buddhistic and other incantations (*Mantra*) as part of their healing ceremonies. These folk healers are considered a combination of Shaman, herbalist, diviner, curer and psychiatrist.

There is a prevaling supernatural basis of folk healer treatment. Even when the chief means of treatment seems to be herbal, there is a spiritual or supernatural basis. It is claimed by most folk healers that unless a medicinal concoction has been empowered by a special benediction, it will have little effect. Communicaton between helping spirits and god is necessary.

For the Lepchas, illness is something that may be caused by spirits of envy, hatred and quarreling. Illness may be prevented by leading a good clean life and not causing trouble for others. The Bhutias, on the other hand, believe in witchcraft and sorcery. Their belief in witchcraft and sorcery offers a possible contrast between the scientific and the cultural reality. They believe they have at least partially solved the problem, and their partial solution contributes a great deal towards the shape of the Bhutia cultural system.

According to Lepchas the world is peopled by good spirits *Rum*; and evil spirits - *Mung*. Sometimes it is not possible to decide whether the spirit is good or bad, if a *Rum* is angered it appears in malicious guise and may be then referred to as a demon. All catastrophes occurring in the area are believed to be the actions of spirits. *Mung* may cause sickness, bad harvests, hailstrom and other misfortunes. Illness and death are attributed to a number of malignant spirits who have to be propitiated by various ceremonies. If these spirits are not propitiated through proper sacrifice and rituals. Many writers have described the Lepchas as animists, but this does not seem to be correct. Animism implies the attribution of a living soul to inanimate objects and natural phenomenon, but the Lepchas believe that trees, rivers, rocks and other natural objects are the homes of these spirits. So only the spirits are propitiated and not the natural objects. The air, soil, water and biota are still sacred to people, because of the interconnections that are perceived to exist between them. Any human-induced perturbation is considered to spell disaster, as a whole, because distrubance will have been caused to ruling deities. Propitiating these deities, through various religious ceremonies, is considred important for the welfare of the people.

However, it is impossible for an ordinary man to deal directly with the spirit world and to know the exact cause of their trouble. They may know about minor illnesses, but will not know the exact way of appeasing the evil-causig devil. Diagnosis and propitiation are carried out by special parctitioners, the *Bon-thing* or *Muns*. Prior to the introduction of Buddhism in Sikkim, these sacerdotal functions were carried out by the Lepcha *Bon-thing* or *Muns*. Now, these services are performed by the Yukman or the Lamas as well. The Lamas work in close conjunction with the *Muns*, though beliefs underlying both these systems are connected with agricultural activities. These ceremonies are performed only by the *Muns*. When a man is ill, a *Bon-thing* is called who burns incense to know whether it is *Rum* or the *Kung* who are troubling the sick person. Then by counting the rosary and throwing the dice he discovers what is troubling the patient and sacrifices. In case of a sick women a *Mun* is called. *Mun* is a women who sings and calls up the *Rum*.

The Bhutias place great emphasis on coercive rites of exercising and destroying demons. Like the Lepchas, the execution of religion is in the hands of trained specialists the *Pau*, *Najohum* and *Lamas*. The *Pau* is a male and the *Nejohum* is female.

The *Pau's* primary function is to cure illness. He goes into a trance, and communicates with spirits in order to discover why they have afficted the patients with illness and how to appease them. Sometimes he performs *Motapshe* (diagnosis) with the help of a *Lide* (plate) full of *Chum* (rice). He goes on shaking the rice place till the symbol of the evil spirit appears in the place. The *Pau* performs *Phuphi* by offering money, eggs and clothes which have been circulated thrice over the patient's head to the malignant spirit. These things are thrown out and only the clothes are brought back. It is believed that the persons will get cured within three days. Only if he is not cured he will go to the Lama or the Primary Health Centre. This rite is not accompained by any sacrifice. If the *Pau* wants to capture the evil spirit, he will do so by trying the *Phetho* (thread) round the patient's arm.

In the patient's house, the *Pau* and the patient sit in separate rooms. The *Pau* performs *Motapshe* and after identifying the evil spirit, walks to the patient's room with *Khee* (knife). Then the *Pau* performs *Dakche* (the knife is heated red hot and licked by the *Pau*) and then he carries this heated knife to the patient and performs *Photopashe* (blowing off he hot air near the patient's body with the knife). Then he drinks *Chhang*. The whole process takes about half to one hour.

In case of *Shinde's* (old man spirit) mischief, stomachache, miscarriage, etc., happen. The Lamas help in this by performing *Ginse* (Havan) for three consecutive days in the patient's house. Big Lamas charge three hundred rupees for this and the small Lamas take less.

Shamanism in the greater Tibetan culture has a long and complex history. Many of its distinctive ritual forms and basic functions continued to be appropriated by the Lamas, however they could manage it or by the local Shamans (*Pau*). Over a period of centuries, Shamanism itself also underwent much change, but it has recognisably survived into the present among the Bhutias, as a marginal but tenacious institution. However with a introduction of western medicine, it seem to have gone into rather serious decline. There are two *Paus*, 40 Lamas and 35 *Nejahum* in Lachung (Sherchu *Pau-Pau* Sonam, 59 years and Bichchu *Pau-Pan* Tensing, 60 years old). Tensing's father was also a *Pau* and was believed to possessed of many powers. A *Nejohum* can treat sterile woman and perform Pooja during the complicated deliveries. The *Pau* cannnot enter the delivery room though he can provide holy water (*Naama*) or Ghee (*Neschu*) for an easy and relatively uncomplicated delivery.

Like the Bhutias, Sherpas are adherents of Mahayana Buddhism. Though there are few written records of early links with the Tibetan religious centre, their Tibetan root links are established by oral tradition. Like other adherents of Mahayana Buddism, the Sherpas believe in a great number of malignant spirits, known by the generic term-*Shrindi*. The Sherpas perform rituals to appease these spirits with the aid of two types of ritual practitioners - the Lamas and the Spirit media. Illness and other misfortunes are caused by the activities of witches-*Pem* or *Sondim*, and usually only women are attibuted with the urge and power to harm other villagers. Apart from *Shrindi* and *Pem*, are the *Norpa*-ghosts of dead men whose evil nature is ascribed to the manner of their death. The variety of malicious, aggressive, and violent beings in the Sherpas world is overwhelming. The Sherpa's rituals are concerned with combating the various evil beings by diverse methods. The rituals of offering and rituals of exorcism are both classed as *Kurim* by the Sherpas. In the broadest sense, these *Kurim* are 'rites of protection'. *Kurim* also include a variety of recitations, without either offerings to the Gods or confrontations with the demons for the protection of households and curing of sick people. The Shamans, village Lamas and monks all do exorcistic rituals-that is rituals involving direct confrontation and struggle with evil forces. The Shamans and Lamas do similar curing rituals with similar structure, but Shaman work is not considered religious work and Shaman exorcism, no matter how similar it is to the Lama's work is never considered as *Kurim*. The Shaman's primary function is to cure illness. He goes into a trance, and communicates with spirits in order to discover why they have afflicted the patient with illness and what they require for leaving the patient. Generally, what they require is food, just like every other natural and supernatural being in the Sherpa world. The significance of food in Sherpa life is of tremendous value. The transforming effects of food are both positive and negative. On the positive side food sustains the health of the physiological organism and provides pleasurable stimulation of senses, affects one's physical well-being but also one's psychic energies and one's moral and spiritual welfare. On the negative side, food pollutes the energies of one's total system and contributes to one's moral corruption. Health and pleasure on the one hand, pollution and corruption on the other - there are the meanings of food in Sherpa thought and the mode of operation of its power (Ortner, 1979 : 70).

The Tamangs also adhere to Mahayana Buddhism and like other Buddhist groups believe in numerous evil spirits. These spirits are considered the cause of illness among humans. Buddhism among these people is not very refined. They practice *Jhankrism*. *Jhankrism* in its original form is a kind of Shamanistic cult. The Tamangs call their *Jhankri* (Shaman) priest their *Bompo*. He conducts *Kyon gyalsi* the driving away of the spirits when people fall ill. He worships and sacrifices animals at the *Shipda than*, a shrine for worshipping and offering sacrifies to the earth deity at the time of *Bhumi-Puja*. The *Bompo* propitiates gods and spirits whenever necessary.

The Newars are both Hindus and Buddhists. In Sikkim all Newars call themselves Pradhans and are Hindus. As far as religious practices and the worship of the Hindu and Buddhist deities are concerned, neither group can be strictly placed in one category. Both parties visit and worship the same deities in Hindu and Buddhist temples. Only domestic ceremonies and rites can be said to be peculiar to one or the other religious group. The *Gurju* are the family priests of Buddhist Newars and the *Juju* are the Hindu priests. They also practise *Jhankrism*. The *Jhankris* are called in case of illness and spirits and demons are considered the cause of illness.

All Nepali groups, the Brahmans, chhetris, Rais, Limboos/Limbus (Subba), Mangars, Gurungs and Scheduled Castes are Hindus. *Jhankrism* is not peculiar to anyone Nepali group but is found among all of them. All Brahmans and Chhetris are Hindus and as such they follow the religious practices and observe the religious festivals of Hinduism. Their religious leaders are the Damis (*Jhankri*).

Among the Rais, the religious leader who presides over ceremonies is called *Ngopa*. He becomes possessed by spirits and annouces the verdicts of the Gods. The *Ngopa* also acts as a physician and treats the people by propitiating gods and spirits during an illness.

The Limboo (Subba) religion is closely allied to the Rai religion in that it has a number of local deities of mountain and rivers to worship. It has also adopted some religious practices of the Hindus. The Limboos have two different kinds of religious leaders or priests to ward off evil spirits and treat their clients when they fall ill.

The Mangars are Hindus and have Brahman priests who lead them in the same pattern of religion as practised by the Brahman-Chhetris. Like the Mangars, the Gurungs have *Ghyabre* priests to ward off evils and perform purificatory rites. The religion of the Scheduled Castes is uncertain but their beliefs regarding health, illness and spirits possession are like other Nepali groups. they believe in the *Jhankris* and sent for their help in case of illness etc.

Magic and mysticism enter largely into Lamaic rituals and especially into the priestly ministration for the layman. Charms against sickness and accidents of sorts, ill-luck, and the printed charms for luck which form the 'prayer flags and tufts of rags affixed to trees, bridges etc. are more prominent magic rites.

Various talisman and amulet-charms are made for nearly every kind of disease, accident or misfortune. Eating of the paper on which a charm has been written is an ordinary form of combating disease. The letters used in such cases are called *Za-zig* or "Eatable letters" and are magic sentences printed or written on a piece of paper.

All Sikkimese have one or more of these charms usually folded up into small cloth-covered packets tied around with coloured threads in geometrical pattern and worn around the neck. Others are kept in small metallica cases callled "*Ka-o*" fastened to the gridle or sash, and others are affixed overhead in the house or tent to ward off lightening, hail. For cattle special charms are read and sometimes pasted on the walls of the stalls. Apart from charms for self protection against diseases, misfortunes and badluck, there are charms for killing one's enemy.

All Sikkimese settlements are adroned with prayer flags, or *Da-cho*, which are supposed to carry the luck of the individual through the air in every direction. These flags are of four types - The *Lung-ta*, which is in square form, about 10 to 15 cms long and contains a horse with the mystic figure on its back in the centre. It is hung upon the ridges of the houses and in the vicinity of the settlements; the *Chonpen*, long, narrow, oblong shape, about 20 to 25 cms in length, tied to twigs of trees or to bridges, or to sticks for planting on the tops of hills; the *Gyal-tsen dse-mo*, it is like *Lungta*, but contains a larger holy text; and the vast luck charm, which is pasted on the walls of the houses or folded up and worn around the neck as a charm for good luck.

There is a regular form of Lamaic worship for the planting of the Luck-flags. Lamas advice about this whenever one feels unhappy and down in luck though illness, injury by the earth-demons. Poor people, who cannot afford the expanse of the printed charms, merely write on a short slip of paper the name of the birth year of the individual and the prayers "May his *Lung-ta* prosper". One *Lung-ta* for each member of a household must be planted on the 3rd day of every month (lunar) on the top of any hill nearby, or on the branch of a tree near a spring, or tied to the sides of a bridge; and no offering the flag a stick of incense is burned.

Apart from worshipping gods and good spirits, Sikkimese also worship demons. In every nook and corner, path, big trees rock, spring, water fall and lake there lurks a devil, hence there are few persons who will venture out alone after dark. The sky, the earth, the house, the field, the water source, have each their special demons, and sickness is always due to malign demonical influence. These demons are worshipped seasonally either by an individual or by the *Busti*.

There are frequent services in *Busti* Gompas, conduced by local Lamas on a variety of ritual occasions at specified times throughout the year. In addition to public *Gompa* events, village religion also consists of privately sponsored services, usually held in the sponsor's home, on the occasion of birth, marriage, illness and death. A household may sponsor the performance of cermonies in the absence of any life crisis, simply for the purpose of gaining merit, good luck, protection or all three for the household. All religious services have a broadly common base, centering on offerings and petitions to the gods, and offerings and threats to the demons, and closing with a distribution of ritual foods to all present.

The concept of health and hygiene among the people of Sikkim is not a very high order. As already mentioned the villages are devoid of any specific dumping place for refuse. The drainage system is extremely poor and at places animals and human beings live side by side. There are no preventive health care measures as such which are taken by population groups to avoid illness. The only preventive measures being taken by them are periodic village and family rituals to ward off evil spirits.

The majority of the people in Sikkim have no idea about the causation or prevention of disease. The belief in the interference of a supernatural agency is very strong in the context of health and disease. Different spirits and deities are believed to be connected with different types of diseases. All deities have their own respective departments and area of influence, effect and control as well as nature of actions. However, they have started to realise the efficacy of scientific methods of treatment and prevention as evidenced by their ready acceptance of the small-pox vaccination.

Though Sikkimese employ supernatural methods as well as avail Governmental Public Health Services, the mortality rates are high, especially Infant Mortality. Infant mortality among the Buddhists is very high, 177.77. In contrast to this, among the Hindus of Sikkim, the IMR is 70.18, the Neonatal mortality is 35.09 and the Post-neonatal 35.09 (Table 20.37). There is no perinatal mortality or foetal death. Among Buddhists perinatal mortality and foetal mortality could have been more because of the high altitude; where people depend mainly on subsistence economy, there is little time or resources for them to improve their living standards.

The socio-economic conditions of people in the community have a strong impact on mortality. These factors affect mortality through the level of nutrition, sanitation and pure water supply. The socio-economic condition of the people does create differentials in access to these basic amenties. It was observed that the high mortality of developing countries is associated with, among other factors, poverty, ignorance, malnutrition, inadequate quality of housing, a lack of personal and environmental hygiene and low level of immunity. It is a circular relation that socio-economic development affects the mortality level and in turn in mortality level affects the socio-economic and demographic structure of the community. Therefore, unless and until there is an intensive programme launched for the betterment of these people there can be no early decline in mortality or fertility.

It has been observed that, with the decline in mortality, the pattern of the causes of death also undergoes changes. In a standard population with a 'young' age structure, with a risk in the average expectation of life at birth from 50 to 70 years, the proportion of deaths due to infectious parasitic and respiratory diseases has declined from 34 per cent to 11 per cent, while the percentage of deaths from cancer has increased from 5.6 to 15.2. Infant mortality is a very great indirect inducer of higher fertility.

During the last three or four decades, the mortality level of many developing countries has declined. This decline has resulted from wide spread use of modern medicine and medical technologies. Still the mortality level of these countries appears to be much higher than that of developed countries. This variation in mortality between the developed and developing countries largely depends on the variation in the accessibility of medical facilities.

In areas where mortality rates have declined, this may be concieved as an impact of several socio-economic factors such as an improved communication system, no shortage of food supply, improvement of public health, treatment of epidemics and availability of health facilities. People of different regions are not equally exposed to modern medical and other developmental facilities.

A reliable assessment of the situation in mortality and morbidity is a difficult task. In most developing countires, an adequate system of data collection in mortality and morbidity has not yet been well developed (Ruzicka, 1982). Particularly, information on morbidity is rarely available.

The deaths occurring in the first year of life are a significant demographic and biological variable influencing the fertility behaviour socially and psychologically. In the present-day world, the rate of infant mortality ranges from 181 per 1000 in many African countries to 18 per 1000 in most European and North American Countries, according to the analysis of Population by the Council Data Bank System (1978) and the World Development Report of 1980 of the World Bank (Lerious and Remy, 1980).

In India, though the rates have fallen considerably through the years, they are still high. Deaths of children before their fifth birthday account for almost 47 per cent of all deaths. Almost one third (30 per cent) of all deaths are those of infants (before the first birth day) as reported by Padmanabha (1982). In 1978, the average in Uttar Pradesh was a staggering figure of 167, while Kerala had only 39 per 1000. In the rural areas it was still higher (172 for Uttar Pradesh and 42 in Kerala). In the last fifty years, infant mortality has not responded well to community measures, while general mortality has. In 1910, the crude death rate was 47, which came down to 19 in the 1960s, 15 in the 1970s, 11 according to the 1981 Census and was 9 in 1995 according to Demographic Estimates for Asian and Pacific countries and areas.

Infant mortality is considered to be a fairly sensitive index of the health conditions of a nation. Though it is difficult to control the endogenous causes like congenital abnormalities, the exogenous or environmental causes like nutrition, prenatal care, sanitary conditions, incidence of diseases to which infants are highly prone etc. can be controlled and this relfects and health measures taken by the community, government and agencies correlated with economic level that it could be used as an indirect index of a nation's level of economic development. Hobcraft et al. (1984) identified socioeconomic indicators of infant and child mortality using World Fertility Survey data in 28 developing countries. The most important variable seems to be the mother's education, the father's education and occupation. The mother's education seems to be particularly more strongly associated than the father's education and occupation during the first five years of life in Asian countries. This hypothesis of inverse relationships has been corroborated by Adamchak (1970) and Stockwell and Wicks (1984).

In India the picture varies with the highest being in Uttar Pradesh (167), the lowest in Kerala (39). Nag (1983) attributes the lower mortality in Kerala mostly to its higher social development and partly to its favourable environmental and hygienic conditions. Development of social services such as education, health and transport, through public policy measures is designated as social development. This is corroborated by Sachariah (1983). Dyson and Moore (1983) attributed the lower fertility in the southern states (including states of east) to higher autonomy of women in their kinship system. This was lacking in the north, along with adequate modern health care education and services. From the study of Caldwell et al. (1983) on an area in South India, it was concluded that changes in social vales have played a major role in the reduction of mortality in many societies.

There are many factors which influence and affect the mortality pattern in a society. Anthropologists have demonstrated that partiarchal societies in general have a mortality level favourable to males. Preferences for sons over daughters are found to be stronger. Sons always get better care in terms of food, clothing and medical care than their female counterpart. These differences remain unchanged throughout their life (Ahmed, 1982; D'Souza and Chen, 1982). This practice can be viewed in terms of economic rationality. If men are responsible for providing food and shelter for women and other dependents in the family, they need better physical and mental fitness for competing with others in the continuous war of resource holdings.

The variation in mortality situation among regions exists every where. The regional differences occur primarily due to differential exposure of the individuals to the amenities available for prevention and treatment. Climatic factors may also play an important part, as may some biological factors such as low birth weight. Infants with low birth weight are known to be at high risk during their infancy (Wray, 1971). Although we have no suitable data to prove it, it has been shown in other studies that children born above 3500 metres exhibited decreased weight (Weitz et al., 1974; Pawson, 1977; Bangham and Sacherer, 1980).

Religious difference in demographic behaviour is an established fact. Apart from economic activity there are some social norms and spiritual values which distinguishes one religion from another. This differential creates some differences in life style and thereby differences in mortality levels, although it will be difficult to identify the contributing factors and their significance to the differences. For instance, Simmon and Bernstein (1982) observed the highest infant mortality due to tetanus among Hindu families in North India. Hindus quite often use cow dung for the cleanliness and purification of their houses. People suspect that these might be causes for higher tetanus among them.

Among the socio-economic factors, education is observed as the most influential factor in differentiating people's social and demographic behaviour. Social scientists very often use the level of education as an index or socio-economic status (Kitagawa and Hauser, 1973; Bucharest Conference, 1974). Several studies have observed the mother's education as a more influential factor than the father's education.

The area of dwellings is found to have an inverse relation with mortality in general. This is also an economic indicator. The higher social class people are more likely to have larger dwelling areas, and people in higher social class have more ability to take curative as well as preventing measures of health. There might be some other environmental aspects underneath this relation.

The use of a fixed latrine is supposed to be a health-related practice, and expected to have an important effect on mortality. People who use fixed latrines have lower mortality for all the age groups than people who do not. Rehman et al. (1985) also observed the same pattern of relationship with this variable. These factors are not independent of the economic condition of the people, and thus not independent of the effect of education. In the absence of education, these factors may be considered as an economic indicator and the variation in economic condition usually goes with the variation in nutrition level which affects the mortality level.

The mortality rates of neonatal, post-neonatal, the infant and the child have shown a direct relation with the distances of the government dispensary, public health centres, the hospital, the primary school, and qualified and other doctors. The rates increase as the distance of these places increases from the respondent's places. Other than primary school, all these places are the source of medical help. Although nearness of the primary school does not increase medical help to the needy people, it has some indirect influence in the community through education such as increase of the knowledge of preventive measures. Other factors such as the *Dai* (traditional birth attendents), number of visits by the field-worker, occurrence of natural disasters and epidemics also show a systematic pattern with mortality rates. Thus the community characteristics have sufficient influence on the mortality levels of the community. If the analytical approach shifts from the birth and death rate to survivorship, that is, the average number of living children per mother, the number of surviving children is related to both the birth and death rates, which can fluctuate independently to some extent. However, infant mortality is proportional to total mortality. The decline in mortality can be traced to better health and nutrition for infants, improved delivery practices, the use of hospitals for child birth, governement trained nurse-midwives, control of epidemics to which children are especially vulnerable.

In this study, the integrated picture of health and sickness, nutritional status, socio-economic conditions, settlement pattern and environmental conditions in relation to existing medical and sanitary facilities available was obtained, so as to find out the main health problems and necessary measure to improve health status.

For combating various diseases, improvement of the health system will certainly play a dicisive role, but over-all improvement in socio-economic sector will bring about good results. In diseases like diarrhoea and other infections, pure drinking water supply, good sanitation, drainage, personal hygiene, education and better nutrition will bring the desired results. Health is not, therefore, the exclusive concern of the health system, but also, indirect ways, of development styles. Drinking water, proper drainage and good health education especially of women can save more life than medicine itself. The effort should be both endogenous and exogenous.

KEY WORDS AND ABSTRACT

KEY WORDS Himalayas. Ecology. Fertility. Mortality. Diseases. Tribals. Caste Groups.

ABSTRACT Human settlements get formed and organised due to the interdependence of individuals. It offers them opportunities and amenities which makes life more comfortable by providing better means of livelihood, mutual support, *inter alia* the previlages that community living provides. Health in the broad sense of "quality of life' rather than only the absence of disease, is a universal goal even if cultural variations encrust in the way it is defined and achieved. Health situation is a complex dynamic equilibrium which stems from the entire socio-economic condition. In the present paper an attempt is made to study the integrated picutre of health and sickness, nutritional status, socio-economic conditions, settlement pattern and environmental conditions in relation to existing medical and sanitary facilities available, so as to find out the main health problems and necessary measure to improve health status of the peoples of Sikkim state.

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Author's Address : **Veena Bhasin**, Research Scientist, U.G.C. 'C', (Professor Grade) Department of Anthropology, University of Delhi, Delhi 110 007, India

The *Riti-Bhagya* System in Western Nepal : Farmers and Artisans, Caste and Gender

Mary M. Cameron

INTRODUCTION

This study examines the nature of the ties that bind low-caste people to high-caste people in a rural agrarain community in far western Nepal called Bhalara. Bhalara is the seat of a former kingdom located in Bajhang District of the Seti Zone. The former kingdom was one of many such lineage-based ruling principalities in Nepal that enjoyed varying degrees of sovereignty and that figure importantly in local people's concepts of politics and government. From the advent of nationalist unification of Neapl in the mid-1950's to the present democratic era, the material base of traditional intercaste *riti-bhagya* (patron-client) and land tenure relations has eroded due to increasing scarcity in arable land and penetration of capitalist market forces. The main causes of the land decline include: a doubling of Nepal's population from eight million to nearly nineteen million people since unification; erosion of the Himalayan foothills at a steady and pernicious rate; and sporadic land reform policies that have not successfully transferred land from those with plenty to those with none (Bienen, 1990; Eckholm, 1976; Regmi, 1978; Seddon, 1987; Seddon et al., 1979). As a result, the low-caste families in Bhalara struggle daily for survival.

At an average altitude of 4500 feet, Bhalara enjoys rich seasonal changes from cold winters to hot and dry springs that erupt into many rainy months of summer monsoon. The most spectacular season is autumn when the brilliant green rice is ready for harvest, the days are crisp and sunny, the nights cool and comfortable, the harvest ripe, and the mountains spectacular. Bhalara is an isolated region, accessible only by foot after an initial daylong flight from Kathmandu. Dry goods are portered in from India, journeys taking one month.

FARMERS, ARTISANS AND CASTE IN THE HIMALAYAS

The people of Bhalara call themselves *gauko manchay* (village hill people). Their clustered hamlets of stone, wood, and mud houses dot the sides of rolling and ever-rising hills that peak in the western Himalayan mountains, and flatten and descend to the Gangetic plain in the distant south. The vast snowcapped peaks are visible from only the highest vantage points in the surrounding area, but the mountains frame the identity of these people as hill peasants-small-scale farmers who use no mechanized or capitalized means of production, have little capital for exchange purposes, and have a high population density to feed and house. From every vantage point in Bhalara one sees steep and narrow terraced slopes, green with fertile crops of summer rice or winter wheat, and brown in the late spring and fall between growing seasons. Connecting the hamlets are a myriad of human and animal footpaths cutting across fields and up the sides of hills, guiding people to and from their fields, their neighbours' homes, and more distant sites. There are no roads in Bhalara, nor is there electricity or running water inside the homes.

Caste ranking in Bhalara is similar to that found in India and the rest of Nepal and is based on relative ritual purity. The ideological link among the low-caste groups is their ritual impurity relative to those above them. Although there are many arguments within caste theory about what makes the low-castes low (for a full discussion *see* Cameron, 1995), locally they are labelled *nachunay manchay* or *jaat* (not touchable people or caste), *saano jaat* (small caste), and *talo jaat* (low caste).

In addition to their untouchable status in relation to those of high-caste, there is ranking among the low-caste groups themselves. The upper ranked and intermarrying groups include the following artisans and specialized laborers : basket weavers, goldsmiths, ironsmiths, masons, and former guards for the local king. These artisans, some of whom are also marginal farmers, do not touch those of caste rank lower than themselves. The second tier includes leatherworkers and tailors who do not intermarry but are of equivalent status. At the bottom of the caste hierarchy is a single group of potters, musicians, and female prostitutes who are untouchable to all other groups above them. The highest ranked and most ritually pure groups in the Nepalese caste structure are the Brahmins, followed by the Thakuri and Chhetri castes[1].

Luhar Ironsmiths : The Luhar[2] make agricultural tools and household utensils such as sickles, knives, hoes, shovels, plough tips, nails, and axes. The work of the ironsmith requires physical strength and endurance of noise and heat. A Luhar's smithy is a noisy hut adjoining the house, a popular place for low-caste men to socialize. All households in Bhalara require Luhar commodities. Even if not engaged in farming, each family minimally requires sickles, axes and knives. Thus, the Luhar are the most economically secure low-caste in Bhalara.

Okheda Guards : The Okheda provided a caste-based service (rather than being artisans) as former guards and tax collectors for the local king. Today the few Okheda families in the region are farmers and laborers.

Oudh Masons : The Oudh are masons and carpenters, and like the Okheda, are few in number. All houses and shops in Bhalara have been built solely or partially by the men of the Oudh caste. The demand for their services is sporadic and most of them subsist from farming and laboring.

Parki Basketmakers : The Parki make a variety of storage baskets and floor mats from bamboo procured in the high hill regions. Their products are more expensive than those of the other low-caste artisans, but most families in Bhalara own one or more grain storage baskets, flour sieves, and bread baskets. Only wealthier families (Brahmin, Thakuri, Chetri) own nonessential Parki products such as floor mats. Baskets and mats are well made, can last a decade or more, and are aesthetically pleasing with their smooth golden surface.

Damai Tailors and Seamstresses : The Damai are tailors and seamstresses. The skill of sewing is kept within the caste since Damai marry only other Damai. They are often called "master", a term for someone with a speical skill. The Damai men also perform entertaining and ritual roles at weddings.

Sarki Leather Artisans : The Sarki make products from cow and water buffalo skin. These include leather sandals and shoes, plough harnesses, saddles, and flour sifters. The demand for these products is sporadic; farmers need new harnesses only after several years, and the sturdy leather sandals and shoes have been replaced by Nepalese or Indian manufactured rubber thongs. As a result of low demand for their products, the Sarki are extremely vulnerable economically and are the poorest caste in Bhalara. Their children are malnourished and uneducated, and their hamlets are crowded and crumbling.

Baadi Potters and Entertainers : The Baadi are not farmers, and they have no desire to become farmers (unlike the other low castes). No Baadi families own agricultural land, and they never seek to buy or rent land. However, Baadi are fond of livestock and several families own and raise water buffalo. But primarily the Baadi are potters who make water vessels and pipes out of local red clay. However, their products are gradually being replaced by plastic, bronze, and brass containers from India and other parts of Nepal. The Baadi are also entertainers - singers, dancers, and female prostitutes - and are the lowest ranked in Bhalara's caste hierarchy.

Table 21.1. Lists the activities involved in the production and service processes of each artisan and entertaining caste, and provides a breakdown of men's and women's involvement in these activities. As can be seen in table 21.1, men in general are more involved in artisan production than women, yet women's degree of involvement varies from complete involvement in the entire production process (as among the Damai and Parki), to partial or supplemental involvement (as in the Baadi, Sarki, and Luhar), to complete absence (as in the Oudh caste).

RITI-BHAGYA STRUCTURE AND PRACTICE

Integrated into the agricultural economy of

1. This structure mirrors that of India (Dumont, 1970) but with two unique features. There are no recognizable Vaishya groups, who occupy the third level on the Indian ranking system (Hitchcock, 1978; Hofer, 1979). Rather, at this third level are the Matwali groups which include the numerous Tibeto-Burman (and largely Buddhist) ethnic groups in Nepal, such as the Newar, Tamang, Sherpa and Magar. There are no families from these ethnic groups in Bhalara.

2. The Luhar are also known as Kaami in other parts of Nepal and in India. "Luhar" is more commonly used in Bhalara.

Bhalara is a traditional system of labor and grain exchange with rights of inherited patronage called *riti-bhagya*. The *riti-bhagya* system of the past and the present binds low-caste families to high-caste families through economic interdependence, advocacy and aid, and Hindu religious ideology. In exchange for low-caste products and services, high-caste landowner patrons called *riti* regularly provide harvest shares to, and are expected to meet many other subsistence needs of, their low-caste landless dependents, called *bhagya*. Harvest payments, called *khalo*, given by landholding *riti* families to low-caste *bhagya* families serve as the economic and moral backbone of the patron-client relationship (Scott, 1976) since they establish the right of each family to ask for services, food, or cash advances from the other in time of need. Thus, the *riti-bhagya* system in Nepal developed as a South Asian form of feudal economy in which landholding and labor relations followed caste lines. Its Indian equivalent is the familiar *jajmani* system (Beidelman, 1959; Caplan, 1972; Dumont, 1970; Elder, 1970; Gould, 1953; Gould, 1967; Harper, 1959; Kolende, 1963; Pocock, 1962; Raheja, 1991). The *riti-bhagya* system was, and is today, fundamentally an economic one.

Table 21.1 Gender division of low-caste artisan activities

Caste	*Male*	*Female*
Baadi Potters, entertainers	collect, mix clay. pound clay. shape vessel parts. dry. fire. decorate./dance sing, drum.	carry, mix clay, shape pipes. carry fodder. deliver goods./dance, sing, prostitute.
Sarki sew leather goods	skin animal. tan hide. design and stitch goods, deliver.	design and stitch goods. deliver.
Sunar gold- and silver-smith (none in survey sample)	collect materials. sell gold, silver. design, create jewelry: fire, hammer gold into sheets, silver into pellets; make wax mold; melt gold into mold, pround silver into shape; shine, decorate, deliver.	pump bellows. deliver.
Luhar ironsmith	collect, recycle iron scraps; fire, pound iron into tools. deliver.	pump bellow. deliver.
Parki weave baskets	collect bamboo. split into strips. design. weave. deliver.	collect bamboo. split into strips. design. weave. deliver.
Oudh mason	collect rocks, clay, manure, wood; break rocks, carve wood; measure, construct wall, house, steps.	-
Damai tailor, seamstress	buy cloth and/or notions; sew men's women's, children's clothing, deliver.	buy cloth and/or notions; sew men's, women's children clothing. deliver.
Okheda guards (none in survey sample)	guards and tax collectors for the former king	-

Up until modern times, lower caste families worked exclusively in commodity and service production for upper caste landowners, and few had little need for land. Throughout the reign of the Bhalara kings many lower caste families worked for the royal family. Low-caste people who were interested in farming were given small amounts of temporary sharecrop (*adhiya*) or plough land (*haliya*) by the ruling family. *Haliya* is a form of land tenancy in which land was exchanged for ploughing the king's fields (and later those of other high-caste patrons).

Low-caste labor ties to other nonruling landholding families such as Brahmins and the indigenous Khas people evolved as rice cultivation developed, population increased, and agricultural production intensified, Upper caste and landholding families who needed low-caste commodities (such as farming tools or clothing), services (such as laundering), and labor developed economic relationships with those lower caste families. Low-caste families, in turn, relied increasingly on the *khalo* harvest shares from their patrons; upwards of eighty per cent of the total food consumption for some families was comprised by *khalo* payments that adults (and older adolescents, particularly those married) had earned. Certainly the vast majority of low-caste families maintained patron-client relations with many upper-caste families.

The economic interdependency between low and high-caste families eventually involved nearly all families in the Bhalara community, and continues today. To guarantee that both parties meet their economic obligations to one another, a kinship-like dimension to the *riti-bhagya* system has developed in which exclusive rights to employment and labor from certain families were established. In keeping with the patrilineal system of property inheritance, low-caste rights to *riti* and high-caste rights to *bhagya* were passed from father to son for generations. Thus, caste-based economic interdependency developed in such a way that for the last few hundred years the rights to *riti-bhagya* relations among the families of Bhalara have been inherited patrilineally[3]. Joined at the seams through generations of consanguinal males on both sides, the values that circumscribe *riti-bhagya* relations include the right to employment. Under most circumstances a *riti* patron will not and cannot replace the low-caste *bhagya* with another family of same caste. And the low-caste family who "eats" a *riti's khalo* is responsible to them. However, if an artisan client fails to meet the labor expectations of the relationships, the high-caste patron has the right to find another artisan.

Artisan products are given either to *riti* or sold to non-*riti*. The non-*riti* consumer is aptly called the *kinay manchay* (buying person) because she or he shares a situation-delineated economic relation with the low-caste artisan - simply, one pays a relatively set price for the artisans' products, and the relationship ends there. This single market type of transaction contrasts with the inherited *riti-bhagya* patronage, which has two main features; 1) continuous negotiations over material exchanges, extending indefinitely in time; and 2) guaranteed *khalo* harvest shares.

The bulk of *khalo* payments is in the form of unhusked wheat and rice (the two main crops in Bhalara) but may include other grains such as millet, lentils, and soybeans[4]. Although *khalo* is considered a payment for services rendered, the *bhagya* must still go to the threshing floor or the *riti's* house to obtain it. This practice is called *maagnu* (asking or begging) (*see* Cameron, 1993 for a further discussion of *maagnu*). In addition to the *khalo* harvest shares, all of the commmodity-producing castes charge a fee called *basho* for their labor and products at the time of delivery.

The Right and Responsibility to Produce

The concept of the right to produce appropriately describes certain inheritance practices in low-caste lineages. The right to produce for certain *riti* families is inherited through lineage males, and includes the right to dispose of those production rights - in other words, to substitute one's own production with someone else's. In this, rights of dispensation of *riti* production relations make it possible for low-caste people to rent or buy a *riti* from another low-caste family. For example, one Damai man purchased a *riti* in a nearby village for Rs. 500 ($20) and moved his tailoring business there. Since he used family resources to buy out the other *bhagya*, he is expected to share *khalo* from his new *riti* with his mother and brother.

The most common reason for *riti* changes is a male's departure for India. In his absence, the man's wife fulfills the *riti* obligations with the help of her brothers-in-law. Temporary *riti* arrangements such as these are so flexible that with a minimal amount of effort at meeting the patron's obligations, a woman can still 'beg' the *khalo*. However, if after a few years the obligations cannot be met successfully, the rights must be sold to others; this will be signalled by increasing reluctance of *riti* to give *khalo* to the *bhagya*. Before ties are severed, though, the *riti* may request other substitute forms of labor from the *bhagya*.

CONCLUSION

Transformations in Untouchable Women's Work: Reconceptualizing "Occupational Caste"

Within the *riti-bhagya* system, women's and men's productive work is delineated not solely through caste but through gender as well. Productive work directed toward family-based subsistence for which one gets paid in cash or in kind is meaningfully linked not only to one's caste and landholding status, but to whether one is female or male

3. An aspect of the patron-client system in South Asia that is often ignored by writers on the subject is that both high - and low-caste families require the commodities produced by other low-caste families (for example, low-caste goldsmiths need storage baskets woven by low-caste basketweavers), and therefore all caste groups maintain bhagya. However, the vast majority of payments and the longest standing relationships are those between high-caste landowning patrons and their low-caste and predominantly landless clients.

4. The exception to this is the low-caste patron. Due to the general scarcity of grain among low-caste families, low-caste *riti* pay for low-caste commodities with exchanges of services or artisan commodities, rather than grains.

and married or unmarried, as well. For people of low caste, productive work is often labelled by anthropologists as "occupational" because of the artisan commodity and service production contracted by landholders (Bennett, 1983; Berreman, 1963; Beidelman, 1959; Caplan, 1972; Dumont, 1970; Elder, 1970; Gould, 1953, 1967; Harper, 1959; Kolenda, 1963; Pocock, 1962; Raheja, 1991). Low-caste work in agricultural (*i.e.*, nonartisan) production done for either themselves or for others has been ignored or incompletely addressed in the anthropological literature on South Asia, particularly in discussions about caste. Reasons for scholars' overemphasis on so called "occupational" work of the people of lower castes include the history of their landlessness, their economic dependency on upper caste patrons, the unique qualities of artisan work in the rural peasant economy, and the (invalid) conflation of lower caste ritual roles with their overall subsistence work. Indeed, one finds the terms "occupational caste" and "low-caste" used interchangeably throughout the literature on South Asia.

It must be recognized, however, that *all* work done by low-caste women for patrons - whether artisan commodity or agricultural production - integrates the low-caste domestic mode of provisioning into the production relations demarcated by the local *riti-bhagya* system. The *riti-bhagya* system demands not just the artisan work of men, but lower caste female labor of all kinds as well. This point is important to refiguring our understanding of (inherited) patron-client relations found throughout South Asia. Specifically, we need to reconsider the economic dimensions of *riti-bhagya* relations from being reproduced solely through the "occupational" work (*i.e.*, artisan and service) of low-caste (male) clients for high-caste patrons, to one in which lower caste female labor of many types is seen as fundamental to reproducing those relations.

Applying the label "occupational" to low-caste work in general is misleading because, while it may accurately describe many low-caste *men's* work, the term "occupational" does not accurately descrbe the productive work of today's *women* of untouchable caste. Low-caste women's work is not confined to, nor is it necessarily defined by, artisan production. Due to the changes in the gender division of labor low-caste women now spend more productive time in agricultural than artisan production (Cameron, 1995). This is a distinct and identifiable change from the past, when low-caste women's labor was not significantly different from their male artisan counterparts.

Furthermore, lower caste women's contemporary productive work is heterogenous and flexible. Women are farmers for their families and other families, daily-wage laborers in agricultural and nonagricultural production, entertainers, and porters. They may or may not engage in artisan production. But the issue of women and "occupational" work is not only an empirical one, it is a theoretical one as well. Given the meanings of 'impurity' often associated with low-caste artisans and their products, women's lack of participation in artisan production compels further reflection on the nature of caste in relation to gender.

KEY WORDS AND ABSTRACT

KEY WORDS Caste. Nepal. Patron-Client. Farmers. Artisans. Gender.

ABSTRACT This study examines the nature of the ties that bind low-caste people to high-caste people in a rural agrarian community in far western Nepal. From the advent of nationalist unification of Nepal in the mid-1950's to the present democratic era, the material base of traditional intercaste *riti-bhagya* (patron-client) and land tenure relations has eroded due to increasing scarcity in arable land and penetration of market forces. Integrated into the subsistence agricultural economy, the *riti-bhagya* system of the past and the present links low-caste families to high-caste families through economic interdependence, advocacy, aid, and Hindu religious ideology. Low-caste artisans and laborers include ironsmiths, goldsmiths, basketweavers, masons, guards, potters, tailors and seamstresses, and entertainers. The study concludes with a re-examination of the gender division of labor among the lower caste artisans.

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Author's Address : **Mary M. Cameron, Ph.D.,** Assistant Professor of Anthropology, Department of Sociology, Anthropology and Social Work, 7018 Haley Center, Auburn University, Auburn, Alabama, U.S.A.

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Ecology and Health Status of the People of Ladakh

Veena Bhasin and M.K. Bhasin

INTRODUCTION

Health status in Ladakh division of Jammu and Kashmir state is directly related to ecology, human settlements and amenities available. In human ecology, every thing is connected with everything else. Health —the mental and physical state of population, reflects the quality of the country's population and labour force and help to enhance human productive capacity by way of reducing its losses due to sickness, death and inability. The ecololgical and socio-cultural factors that influence the incidence of health and disease help to understand man's health behaviour in its widest manifestations. It is believed that anthropological research techniques, theories and data can be used in programmes desired to improve health care systems in community. Improvements in the health care system have immediate effect in reducing infant, child and maternal deaths. Other improvements in the health are due to other social and economic variables, ranging from significant improvements in the health delivery systems and increasing ability of individual households to deal with health care privately. Health is not a set point but a continuum. It is a bounded variable, with the variation between regions, individuals and time period. Variation between individuals is not entirely genetic, in part it is genetic and in part it is the interaction between the individual and the environment in which an individual is brought up. Man's health depends upon the balance of external and internal environments and absence of dietary and disease insult.

Factors determining the health status or more precisely;"non-health status" (including incidence of sickness, duration of sickness) of a family are numerous and complex. Sometimes the root cause of a disease is very difficult to discern because some factors do not cause a disease themselves but operate through other factors. Health education, attitude, belief practices are among such factors. Some diseases may be completely hereditary, acquired from the previous generation. Some diseases are not easily diagnosable even by the medical practitioners, or some diseases have different gestation periods. Therefore, in any empirical study it is simply impossible to determine the full set of factors affecting the health status of family members. However, three major groups of factors determining the health status of the family have been identified.

(a) Demographic Factors : (i) Family size; (ii) Age structure/Dependency; (iii) Sex composition;

(b) Socio-economic Factors : (i) Family income; (ii) Educational level of the family; (iii) Nutritional intake of family members; (iv) Crowding level in the family; (v) Settlements condition; (vi) Water and sanitation situation;

(c) Exogenous Factors : (i) Medical systems and health services.

The relationship of family size with the health status of the family members is ambiguous. It is often postulated that parity is closely related to child and maternal morbidity and mortality. High parity implies more births at older ages and the close intervals, which can affect child health by prematurely interrupting breast-feeding, reducing food supplementation and child care time. Close birth intervals could also affect maternal nutrition during pregnancy, which can result in under development of foetus and consequently low birth weight of the baby. Therefore, family size is positively related to the incidence of sickness in the family. Substitution or redistribution of duties within the families can take place when older children become pseudo-parents. They take care of younger children and older parents, and along with the parents contribute income to the family, which in turn allows the family to have a better standard of living and maintain good health. Children can also render positive psychic value of their parents and other members of the family. In this context family size is expected to be negatively related to the incidence of sickness. Thus the net affect of family size is subject to empirical verification.

Similarly, age structure also affect the incidence of sickness in the family. The concentration of young and old age population in a family have positive association with the incidence of sickness. Given the socio-economic, cultural and nutritional conditions of the population, incidence and extent of suffering is subjected to regional seasonal variation. Sex composition of family members is another factor which is expected to have some effects on the health status of the family. Life expectancy at birth is lower for females than for males. Female mortality in all age-groups except of infants is higher than for males. Female morbidity is also higher than that of males. The high concentration of females in the family, both in absolute and relative terms is positively associated with the incidence of sickness.

Family income can effect the health status in many ways. Higher income increases the purchasing power, which in turn insures greater access to nutritious food, better sanitation, better treatment and ultimately better health of the family members. Education of the family members is expected to have negative effect on the incidence of sickness. Nutritional intake is another crucial factor in determining health status of family members. Maternal nutrition is an important factor for the growth and development of the child. Malnourished children are easily affected by infectious and contagious diseases. Families having better nutritional intake are expected to have low incidence of sickness. The nature of human settlements, its dwelling units, essential services, community facility and public utilities all affect the health status of the community.

Good housing conditions, clean water and sanitation facilities may help to ensure better health of the family members.

Besides the possible interaction of demographic and socio-economic factors discussed above medical systems are an integral part of all cultures and effect the health status of the people. Medical systems incorporates all of the health promoting beliefs and actions and scientific knowledge of the members of group that subscribe to the system. The medical system includes the totality of health knowledge, beliefs, skills and practices of the every group. It includes all clinical and non-clinical activities, the formal and informal institutions, and other activities which are even remotely connected with ill health of the community. Environmental sanitation and nutritional education and scientific knowledge underlying these activities are just as much part of the medical system as the physician's practice. "Every culture has developed a system of medicine which bears an indissoluble and reciprocal relationship to the prevailing world view. The medical behavior of individuals and groups is incomprehensible apart from general cultural history" (Pellegrino, 1963:10). The medical systems of all groups, however simple some may be, divided into major categories (1) "disease theory" system, and (ii) a health care system.

A disease theory system embraces beliefs about the nature of health, the cause of illness,and the remedies and the other curing techniques used by doctors. In contrast, health care system concern with ways employed by the society to deal with sickness and maintenance of health. The knowledge of disease theory and health care system of a society enables us to cope more wisely, more sensitively while introducing new medical systems among people who have known traditional systems previously. Traditional disease causation ideas often persist long after western innovation in health care become attractive.

In the tradition of anthropological science, the study was undertaken within total social and cultural context. General ethnographic investigations of Ladakhi culture was carried out. Although research work was carried in few villages, but it did not confined only to those. My main aim was to understand Ladakhi culture and society; rather than in describing the Ladakhi village system. Village was chosen as unit of study because it is the most manageable functional unit in which a pattern of Ladakhi culture and structure of Ladakhi society could be studied. The main purpose of the study was to obtain an integrated picture of the community health and sickness, nutritional status, socio-economic conditions, settlement pattern and environmental conditions against the background of the existing medical and sanitary facilities available, so as to discover the main health provisions and necessary measures of bringing about improvement in the health care system.

AREA AND PEOPLE

Ladakh is remote and rugged mountainous region of Jammu and Kashmir State, India (Fig. 22.1). Ladakh is a model of human adaptation to an extreme environment. The culture, an extrasomat-

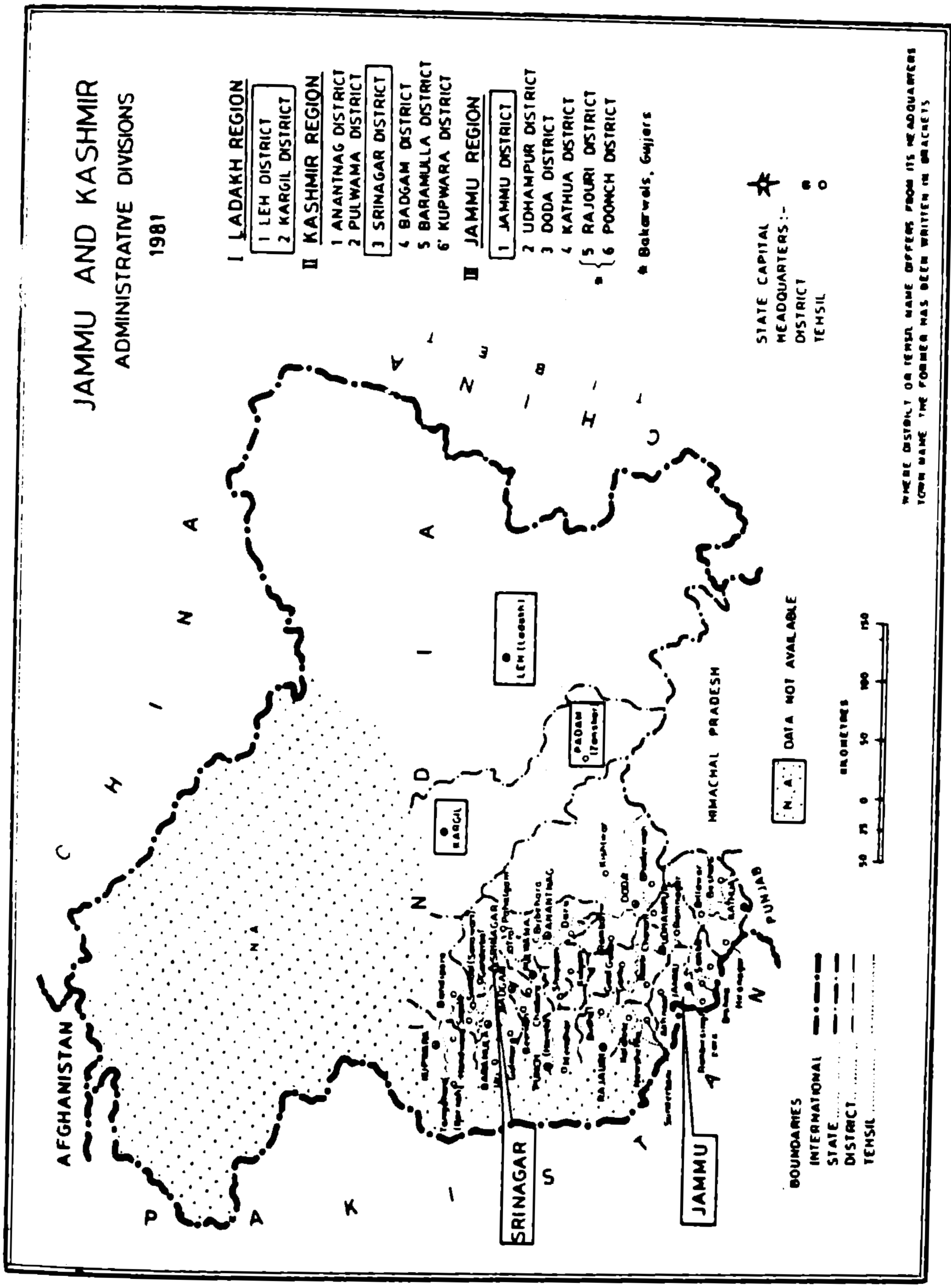
JAMMU AND KASHMIR
ADMINISTRATIVE DIVISIONS
1981
I LADAKH REGION
1 LEH DISTRICT
2 KARGIL DISTRICT
II KASHMIR REGION
1 ANANTNAG DISTRICT
2 PULWAMA DISTRICT
3 SRINAGAR DISTRICT
4 BADGAM DISTRICT
5 BARAMULLA DISTRICT
6 KUPWARA DISTRICT
III JAMMU REGION
1 JAMMU DISTRICT
2 UDHAMPUR DISTRICT
3 DODA DISTRICT
4 KATHUA DISTRICT
5 RAJOURI DISTRICT
6 POONCH DISTRICT
Bakarwals, Gujjars
STATE CAPITAL
HEADQUARTERS:-
DISTRICT
TEHSIL
CHINA
AFGHANISTAN
PAKISTAN
HIMACHAL PRADESH
PUNJAB
SRINAGAR
JAMMU
KARGIL
LEH (Ladakh)
PADAM (Zanskar)
N.A.
DATA NOT AVAILABLE
KILOMETRES
BOUNDARIES
INTERNATIONAL
STATE
DISTRICT
TEHSIL

Fig. 22.1

ic medium to counteract environmental stresses and life style in Ladakh region is developed through the justified experiences of centuries and it stayed unchanged until the mid seventies when it was opened to tourism as a part of the overall development programmes. Ladakh is among the rare places in the world where a highly developed and consistant traditional culture has come down intact into modern times, and still function in harmony with nature. It is a multi-racial, multi-cultural model that has maintained a steady state population level adapted to the environment and has a fair chance of surviving the on-slaught of tourism, if the development of the area is properly managed.

Ladakhis have shown infinite resourcefulness and determination in their effort to sustain life. The Ladakhis are shrewd practical people. They have to be, living as they do in an extremely harsh geoclimatic region. Within Ladakh's habitable portions, different religious, linguistic and ethnic groups coexist practicing agriculture and pastoral activities. According to its system of rivers, Ladakh can be divided into number of valleys with an uneven distribution of population, and with inadequate communication facilities. The different valleys (Indus, Dras, Suru, Nubra, Zanskar) reflect variations in the quality and availability of agricultural land, other resources and climatic conditions. These variations could very well lead to difference in the health status of people in different valleys. Other constraints affecting the health status of the people are historical, socio-cultural, economic and development factors.

Ladakh has remained isolated for its strategic position, political reasons, difficult terrain and inhospitable climate. However, the isolation was not complete as until 1947, Ladakh was the centre of trade routes with Skardu, Srinagar, Hoshiarpur Kulu and through these the wide plains of India beyond Lhasa and Yarkand. Caravans of horses, mules and camels laden with Yarkand silk, *Namdas* and *Charas*; or on reverse journey with Indian spices and dyestuff or traders travelling to Gartok in western Tibet to attend yearly September market carrying coral, gold and Yarkand cups and dishes. The most of the Ladakhis themselves were not traders but acted as transporters or carriers. Few *Kahlon* and their relations were involved in the trade, especially of pashmina wool, the under fleece of the sheep from Changthang.

Apart from this long distance trade route, there was a local inter-regional trade more fundamental of Ladakh's economy. The operators of this trade were individuals from several hundred households who regularly took grain from their fields, loaded it on donkeys and carried it to high altitude plateau of south-east Ladakh and western Tibet where Changpa, nomadic herdmen grazed their huge flocks of pashmina goats and Huniya sheep but grow no crops. Bartering their grain for Pasham, wool and salt these peasant traders undertook return journey. While returning they took longer routes often taking in Skardu in Baltistan where they exchanged wool and salt for dried fruits and moved to Srinagar. There they sold, Pasham and Skardu apricots for cash and bought enough rice, maize and buckwheat along with other luxury goods.

Ladakh, with an area 97,872 square kilometre, has witnessed great changes in its political structure, social structure, economic life and cultural values during the last hundred years. Ladakh formed originally a part of Tibet, but in the fifteenth century it become independent under a line of Tibetan kings who accepted the Grand Lama as their suzerain. This dynasty continued to rule till nineteenth century. Muslims invaded Ladakh in order to establish Kashmir's sovereignty over Ladakh. The continuous attacks on Ladakh from Kashmir led to the change of its dynasty. In actual affect however, it became an integral part of the state in 1842 with Zorwar Singh's conquest under the orders of Raja Gulab Singh of Jammu. After Zorawar's death Ladakh again declared its independence. Since 1947 Ladakh become a part of India after the accession of Jammu and Kashmir state to Indian Union. Ladakh has been strongly influenced by Tibet in its religious and cultural life.

Ladakh is a multi-linguistic, multi-religious and multi-ethnic area. Historical events have played their part in creating such a mosaic. The people of Ladakh are a mixture of Mongolian and the Aryan races. Tibetan nomads who practiced Bon religion were the first inhabitants of ancient Ladakh. They migrated with their flocks of sheep, goats and yak from one pasture of another on the upland plains of Ladakh, which being too elevated for cultivation, were fit for only, pastoral use as they still do. The Mons were the first immigrants. They were Buddhists and remained so. They were followed by Dards from Baltistan. They dominated the Mons and occupied the cultivated areas. The original nomads who were of Mongolian Tibetan origin, did not resist the colonization of Ladakh by the Mons and the Dards. The last to settle in the Ladakh were the Mongols (Baltis). Ladakh was trade centre and traders from China, Yarkand, Tibet and Russia came and intermingled with local population. In 1427, Shah Hamdan came to Ladakh and was responsible for conversion to Islam. The bulk of the Muslims inhabit the town of Kargil where they constitute more than 93 per cent of the total population of town. The population groups of the Ladakh division can be classified according to the two major religious affiliation— Buddhism and Islam. In 1989, eight population groups from the Ladakh division have been declared scheduled tribes — Bodhs, Mons, Beda, Garra, Purigpa, Brokpas/Drokpas, Baltis and Changpas.

The population of Ladakh is unevenly distributed in the river valleys. This spatial distribution is influenced by host of environmental, historical, socio-cultural, economic, demographic and developmental factors. For example, environmental geographical factors, such as climate, terrain, soils, natural resources etc. could very well account for the variation in opportunities for economic activities in various regions. Administratively, Ladakh is divided into two districts —Kargil and Leh. Kargil district is further divided into two *Tehsils* —Kargil and Zanskar. 97,872 square kilometre of Ladakh division of Jammu and Kashmir state is inhabited by 1,34,372 out which 71,857 are males and 62,515 are females. The two districts of Ladakh division Leh and Kargil are inhabited by 68,380 and 65,992 people, respectively. The sex-ratio for Leh and Kargil was 886 and 853 females per thousand males, respectively. The density of population per square kilometer according to 1981 census is two and five for Leh and Kargil, respectively. Ladakh division includes 239 inhabited, three uninhabited village and towns of Leh and Kargil. The census of 1961 records that 96 per cent of the Ladakh is concentrated in its rural sector. The population of Leh town has registered a phenomenal growth of 58 per cent during the decade 1971-81 (Census of India, 1981). The 94.7 per cent of the total population of Kargil district is rural, while urban population represents only 5.3 per cent. At the *Tehsil* level the rural and urban population stands at 93.9 and 6.1 per cent in Kargil *Tehsil* while Zanskar *Tehsil* is rural in character. The only town of the district, Kargil is inhabited by a small population of 3,527.

Ladakh division is inhabited by followers of two major religions — Buddhism and Islam. 52 per cent of total population is Buddhist while 44.6 per cent are Muslims. The Baltis and Muslim Dards professing Islam and inhabiting the valleys' of Suru and Dras and the tract about Pashkim are called Purig. These are not geographically separated from the main body of Baltistan, which borders on Dras. Then there is an isolated colony of Baltis right in the Bodh (Buddhists) area only a few kilometre from Leh at Chushot. The largest tract of cultivated land is held by them at Chushot, on the left bank of Indus. The rest of the Ladakh division is inhabited by Buddhists Bodhs. The population increase of Leh District was 31.8 per cent during 1971-81 while in Kargil district it was 23.6 per cent. There is gradual increment over the decades and this may prove to be detrimental for the existing harmony between man and environment.

The institutionalized statues like polyandry and primogeniture which were believed to be key factors behind strong familiar ties; tackling problems of limited resources like cultivable land, water etc. and population growth are breaking down over the years due to legal sanctions, advent of education, health and changes in socio-psychological conceptions. In the study area, only 0.67 per cent Bodhs were found to have contracted polyandrous type of marriage. As a result in the absence of these crucial checks; betterment of health facilities and mild preference for family planning measure, the population is growing at an unchecked pace which needs immediate attention.

Many languages and dialects are spoken in Ladakh. Ladakhi is spoken by 56 per cent of the population of Ladakh. The next important language is Balti, spoken by 37 per cent population. Bodhi and Tibetan is spoken by two per cent each and Brokstat (Shina) and Kashmiri one per cent each. 62 per cent of the population speak an additional language besides their mother tongue. The Tibetan can actually be chosen as an option in Government schools in Leh, but it goes under the name of Bodhie and not Tibetan. Otherwise English, Urdu or Hindi is used.

Ladakh is a cold desert. Both southerly and westerly winds prevail in summer and winter making climate of Ladakh extremely dry and cold. The excessive dryness of Ladakh's climate is chiefly due to elevation, by which the air is rarefied as to be incapable of holding moisture in suspension. Ladakh experience almost arctic cold during winter when the temperature goes down as low as 23°C . The Leh and Kargil districts of Ladakh are situated at about 3,800 metre and 3,000 metre, respectively above the mean sea level and therefore, experience the extremes of hot and cold. The hottest month in Ladakh is July. The average rainfall per year does not exceed 96.4 mm in the east and 600 mm in the west. Similarly snowfall in the valley of Ladakh is scanty, inspite of high altitude. The spring, summer and autumn together has little more than five months, after which the snowfall closes all the approaches to area. To all intent and purpose, there are only two seasons in Ladakh short torrid summer and a long icy winter. Ladakh lies under a blanket of snow for six or seven months of the year.

The soils of Ladakh are neutral to slightly alkaline. The soils vary from sandy to sandy loam and pure clay beds are also found at some places. The texture of the soils are coarse. The range of sand in the soils varies from 20 per cent to 68 per cent. The sands are of loose type and lack capacity to absorb and hold sufficient moisture and nutrients.

In Ladakh, water is a precious commodity. Glacial waters from streams and rivers are laboriously brought to villages. Rivers have special importance in Ladakh, as these are the life line of the people here. The drainage system of the Ladakh division consists entirely of the three great mountain feeders of the Indus, the Singgechu or Indus proper, the Shyok and the Zanskar rivers. The Indus has no major cities or industries, nor a single dam or bridge on the main stream. Thus people have to depend on streams which flow regularly during summer season and bring water from glaciers. Water comes with great pressures from mountain causing gully formations. Water is first collected in check dams and then diverted to storage tanks. Storage tanks emanate small irrigation channels for irrigating individual fields. This is done throughout the growing period *i.e.* from May to September.

Ladakh mountains are almost devoid of vegetation cover and scattered grass patches, stunted cedars and willows are found in the moist scattered strips. The willows and poplars are the only timber trees, that are regularly planted along the irrigation channels. The pencil cedar (*Shukpa*), a small tree held scared by Ladakhis is indigenous. Availability of fuel wood is an acute problem in Ladakh due to limited and inadequate forest resources and higher per capita consumption due to extremely cold and prolonged winter. There is dearth of electricity in Ladakh, so that rules out this form of energy for cooking and room heating. The estimated annual consumption of fuel for both Leh and Kargil may be more than one lakh metric tons. About one third of this demand is met out with local shrubs whereas two third of the requirements are met with dried cattle dung. In Ladakh, due to high altitude and lack of moisture, dung dries up quickly and does not mould or ferment.

MATERIAL AND METHODS

The field work for the study was conducted between 1989 and 1992. The data were collected through observation and interviews with the help of schedules in villages selected from Leh and Kargil *Tehsils*. Since, the study focused on human settlements and health and disease, detailed study on 22 villages, nine in Leh district and 13 in Kargil district was carried out. These villages are located at different distances from the district headquarters. These settlements are at various altitudes. For statistical analysis 783 families provided the major data, out of which 280 were Buddhists and 503 Muslims. Percentage distribution of the population in the collected data by place of residence was 72.7 per cent Buddhists were rural and 27.3 per cent urban. Among Muslims, 62.9 per cent were rural and 37.1 per cent were urban. Descriptive data were collected from these and neighbouring villages. The data were collected under the following heads:

1. Human Settlements, Amenities and Human Activities
2. Social Environment (Socio-cultural variables)
3. Demographic Structure and Health Status
4. The Medical Systems

Data have been collected from five ethnic groups Buddhists–Bodhs; Muslims–Baltis, Argons, Drokpas and Purigpas.

Data were analysed altogether for Buddhists (total) and Muslims (total).

RESULTS AND DISCUSSION

In Ladakh the natural environmental constraints appear to dictate many aspect of traditional life, especially settlement sites and agricultural system. The location of settlements is however determined by their function as well as by their environment. There are three types of settlements in Ladakh: *Gompas*, forts and palaces; *Droksa*- grazing camps and agricultural villages. Traditionally all land belonged to the *Gyalpo* (king), who gave its portions to his cronies, courtiers and administrative officers and *Gompas* and the like in return for their services. There were *Gompa* Estates, Royal Estates and Noble Estates. *Gompa* Estates preferred hilltops for seclusion and aloofness. Royal and Noble Estates dominated by the needs of defence and prestige were also situated on hilltops. *Gompa* Estates as well as Royal and Nobel Estates were associated with supporting villages. *Droksa* and pastoral settlements requiring grazing grounds and water source preferred high valley/plateau or flood plains. The location of agricultural villages was important as it required arable land, water for irrigation and settlement site. Many sites fulfilled these conditions. So agricultural villages are located in deep and wide valleys, moraines, gorges, plains or terraces, fans, high valleys, silty lake beds and silty soil depositions. In Ladakh the total village area accounts for 0.6 per cent of the total area. Most villages are below 3,600 metres.

Practically, all the agricultural villages in Ladakh centre round a stream, which brings water from the glaciers at the higher altitude. Where such stream runs through a broadening valley, it is possible to lay out a series of terraced fields, which can be irrigated in turn by directing the supply in small irrigation channels. Above the area of cultivated terraces, and at the foot of the actual hills, where it is too rocky and steep to plough and sow, the houses are clustered, approached by stony paths or tracks. At the top of the hill of the village, and dominating its common life is the *Gompa*. A few houses are scattered here and there in the fields. The traditional irrigation system, the little channels and drains, is the characteristic feature of the Ladakhi village.

Ladakhi houses are often grouped together for protection, to get maximum benefits of sun and wind. People rely heavily on the local building materials for house construction. The house walls are generally built with large unburnt bricks or stones. The flat roofs are formed of small trunks of poplar trees above which a layer of straw is laid followed by a bed of earth. The stairs are made of stones. The doors are made of planks of poplar mortised together, iron nails are rarely used. The floors are of clay, firmly stamped down. 87.5 per cent of the sample households in the study area are *Kachcha* or semi-*pucca* and only 10.5 per cent are *Pucca*.

The houses vary from one to two storeys. In the study area 62 per cent houses are double storeyed and 38 per cent single storeyed.The ground floor is used for keeping agricultural implements and feed and fodder etc. On the first floor there is a spacious kitchen cum sitting room. Though the average number of rooms in a household is 5.3 in the study area, the kitchen is the only functional room in a traditional or modern household. Faced with scarcity of fuel and biting cold, the whole family spends most of the time crowded together around the fire in the kitchen. In some houses kitchen is on the ground floor. 61.6 per cent of the households in the study area have separate kitchen. Wherever located, the kitchen doors and windows are tightly closed to prevent cold winds from entering, the only outlet being one or two holes made in the roof to let smoke out. Some houses have chimney pipes jetting out by a hole in the ceiling. 76.4 per cent houses in the study area have chimney-pipes in the kitchens. Dry juniper shrubs and dried cow dung are the main fuel. Those having stoves use kerosene oil. There is normally no water outlet in the kitchen. The dirty water is accumulated in container and is thrown out from time to time, which is absorbed easily on dry surface.

There is no bathroom in Ladakhi houses as people do not believe in taking bath often. Only 19.2 per cent households in the study area have separate bathrooms. Almost all the Ladakhi houses have a separate lavatory (*Chaksa*). Ladakhi use nights soil mixed with dung as a fertilizer for enriching the soil. 80.3 per cent of the households in the study area have separate lavatory. There is no proper drainage system in the villages. General sanitary conditions are unsatisfactory in 66.8 per cent of the households in the study area. Satisfactory drainage system is present in only 28.7 per cent of the households. Ventilation is satisfactory in 50.1 per cent of the households in the study area. Housing condition index and place of residence is medium in 49.1 per cent, and low in 20.6 per cent and high in 30.3 per cent.

Though drinking water from natural sources is available in all the villages it is not treated or filtered. It is directly led from its sources either in galvanized pipes or small irrigation canals from the springs or canals from melting glaciers. Safe drinking water has been provided to 62 villages out of total 112 villages of Leh District. In Kargil, 102 villages covering population of 39,600 persons have been covered. The protected water supply for majority of population, still remain illusive for the people of Ladakh division as only 60.2 per cent of the sample households have piped water supply and 39.9 per cent have to procure water from other sources.

The essence of environmental hygiene was understood by traditional Ladakhis. When a new house was built, proper water supply (nearby), toilet and sewage system was insured. Each house had a traditional toilet. These toilets are a valuable mean of enriching soil and are pollution free. This is still the only method for human waste management in the villages except in Leh and Kargil towns.

The burgeoning population of Ladakh has aggravated the problem of water management. Traditional toilet proved to be effective in recycling of waste by using it as manure to enrich the cultivable land. Today the irregularity of ground soil supply (which is used in toilets instead of water in the traditional toilets) and the construction of modern flush toilets have led to various health and sanitation problems. The modern plastic and polythene culture of today have deluged the markets of Ladakh with polythene bags, packets and the like. Their usage is escalating environmental problems as these are non-biodegradable. Disposal of these in streams, *Nallahs*, drains result in clogging of the same affecting smooth water flow. The pathetic environmental pathology of the human settlements in Ladakh both urban and rural level reveals that only scanty attention has been given to the health of the people at the level of the settlements because of the number of the practical problems. These problems pertain to the in-adequacy of water supply and of waste-disposal, the unhygienic condition of housing and or residential neighbourhood.

The communication system in Ladakh is not well developed. At the end of the 1988-89, the Leh district was traversed by 764.3 km unsurfaced road. Out of 112 inhabited villages in Leh District 91 villages have been connected with the roads (surfaced and unsurfaced) out of which only 26 villages covering a population of 35 per cent were connected by surface roads. In the study area 91.2 per cent of the household are connected by surfaced road. Only 22 villages or 19.4 per cent enjoy the facility of bus service, Majority of rural population have to walk more than 10 km to avail the facility. Similarly, Kargil District at the end of 1989 was traversed by total 564 km of road length inclusive of black topped/metalled/shingled and unsurfaced. In Kargil district, 52 villages out of 127 villages or 40.9 per cent of the total inhabited villages have sort of transport link catering to 45 per cent of the population. The inadequacy of the communication facilities remain one of the basic underlying cause of the backwardness of Kargil District. However, in the study area 98.2 per cent of the households were connected by bus service. Communication facility index and place of residence is high in 84.3 per cent of the households in study area.

Postal services are also not adequate. Only 30 per cent of the total inhabited villages in the Leh District have post and telegraph service catering to less than 50 per cent of population. In Kargil district there are only 47 post offices and 140 telephone connections. 86.2 per cent of the households in the study area have post and telegraph facilities.

Despite hostile terrain and topography of the district, 110 out of 112 villages *i.e.* 98.2 per cent of its total villages have the educational facilities. Besides Government's primary, middle, secondary and higher secondary schools. *Gompas* and Islamic institution also provide formal religious education to children. In Kargil district, out of 127 inhabited villages, 123 enjoy one or the other kind of educational facility. In the study area 50 per cent of the population have facility of primary education near the household, 23.0 per cent have facility of primary and middle level education near the household, 35.6 per cent have primary/ middle/and high school facilities near the household and 36 per cent have primary/middle/high and higher secondary facilities near the household.

In Ladakh, the nature of terrain and prevalent social system prevented the developed of markets. The Leh town, however has thriving market where people from, entire Leh district come and exchange or dispose off their goods. People have to travel long distances to avail market facilities. *Gompas* in Ladakh, apart from maintaining religious life of people, serve as a market place during the fairs and festivals.

Leh district lags behind in electricity generation also. Out of 112 inhabited villages, only 43 villages *i.e.* 39.8 per cent villages and 210 hamlets stand electrified at the end of 1987-88. In Kargil district, 16.5 per cent of inhabited villages have been electrified.

Agriculture and allied occupations such as yaks, sheep and goats rearing, weaving and spinning of wool etc. are the main occupations of Ladakhis. Industry whether small or large scale is insignificant. The topographical features of Ladakh Division tend of restrict land use. The rugged, harsh climate, altitude, short working season, negligible rainfall, extremes of high and low temperature, structure of soil limits agriculture mainly to river valleys and *Nallah* plains which is mainstay of the people. Net area sown in Leh and Kargil Districts was 9,940 and 8,860 hectares, respectively in 1986-87. Area sown more than once was only 114 and 920 hectares, respectively. Cultivable waste land amounts to 7,144 and 4,898 hectares, respectively.

The average size of landholding is small among both Buddhists and Muslims. More Buddhists own large tracks of land as the estates are passed on from one generation to another intact because of traditional law of inheritance. Among Muslims the landholdings are small as a result of fragmentation of land on break-up of a joint family. The traditional Ladakhi society was divided into four strata — *Ryal-rigs* (royalty, kings and lords), *Sku-drag* (nobility, prime-ministers, ministers, governors head Lamas and other state officials), *Damanrigs* (commoners, ploughman or farmers) and *Rigs-nan* (lower classes or artisan classes —carpenters, musicians, blacksmiths etc. Numerically, aristocracy and lower classes are represented equally in society, constituting five per cent in any larger village. *Tronpa*, a middle class Ladakhi forms the majority of the households. Accordingly there were Royal and Noble Estates, *Gompa* Estates and big landlords who would lease out land or employ servants on their estates which were landless. These Estates were supported by agricultural villages. The residents of these villages had to supply their lords with fuel, milk, butter, tea, grass for his cattle, servants for their persons and labourers for their fields. The taxes in cash and kind were levied according to the size of land holding. The village headmen and village council origanised the *Rota* for the consideration for the *Begar* services. In addition, each family contributed money and labour to the village enterprises and institutions that operate for its general welfare. In 1948, Indian Government introduced certain land reforms to tackle the economy of Ladakh. The main problems was of the landless agricultural labourers on the big landed estates, *Gompa* estates and Royal and Noble estates. The state government resorted all the landed estates with effect from 13th April, 1948 compensated the landlords by grant of life-time maintenance allowances in their favour, and linked the size of landholding in proprietary rights to 182 *Kanals* only. Lands which thus became available were allowed to landless labourers and to those with uneconomic holding. Wet terrace cultivation, produces one crop annually. Huskless barley "Grim" is the main crop of the area, followed by wheat and inferior millets *i.e. Cheena* and *Kangani*. The inferior millets are grown as second crop in double cropped area after harvesting barley. Sowing of barely and wheat starts in the last week of March and extend up to second week of April in double cropped areas. In single cropped areas, sowing starts in the third week of April to middle of May.

Although, agriculture provides the bulk of the staple food, Ladakhis give an equal importance to animal husbandry. From this source they obtain additional food in the form of meat, milk, butter, hides and wool for clothing, animal dung as fuel and ropes etc. from animal hair. Other secondary traditional pursuits in Ladakh are various kinds of household industries like spinning, weaving and flour grinding (running *Ranthak* or water mills) and specialized occupations such as carpentry, tailoring, iron-smithery, medicine, religious and para-religious activities. More recently the increase in mercantile and government activity has created new sources of income in transport, road building, construction, whole-selling and retailing.

Though the household is the smallest and most important unit of production and consumption in Ladakhi society, there are activities that demand collective work. In case of need, standing groups larger than the households yet smaller than the village are available. Co-operative labour groups are formed on the basic principles of residential propinquity and kinship ties. There is exchange of agricultural implements, taking animals to pasture, grass cutting for winter, sowing, harvesting and thrashing etc.

Percentage distribution of Buddhist and Muslim groups, classified by sex-workers and non-workers and occupation in the area reveals that there are workers who indulge in labour activities for others and recieve remuneration from an employer. These include agricultural labourers/skilled workers/ small scale household industry/pretty businessmen/ livestock managing/small scale horticultural activities. There are other self employed labourers who work for themselves and thus do not receive any emoluments for their services. Those include men, women and children. In addition to workers and non-worders in agriculture, horticulture and animal husbandry, there are others employed in services like administrative, professionals, defence services and business entrepreneurs. Wage earning has increased because of spurt in construction work. Apart from these there is a category of non-workers which include persons performing household duties/ unemployed/retired and others. 80.9 per cent Buddhists female and 89.3 per cent Muslims female come under this category. 86.0 per cent of the Ladakhis female are non-workers, while 4.5 per cent males are non-workers. Labourers of all categories form 2.9 per cent males and 1.7 per cent females of the total Ladakhi population while owner cultivators, trade and commerce and service make up the rest of the Ladakhi economic structure. 49.3 per cent males and 4.6 per cent females are involved in service sector, of which 58.2 per cent males are Buddhist and 44.3 per cent males are Muslim. Out of 4.6 per cent females involved in service sector, 3.2 per cent females are Buddhist and 1.4 per cent females are Muslim. In trade and commerce 14.8 per cent males and 2.0 pèr cent females are involved. Service, trade and commerce has helped in the commercialisation of economy. Being primarily an agrarian economy, agriculture sector has been the prime source of employment for the vast majority of the Ladakhi's labour force. However, with an increased size of population and labour force, given a limited land base, the labour absorptive capacity of the sector would seem to have come to a saturation point. The introduction of labour intensive high yielding crop varieties gave a boost to labour absorption in the sector. But there would seem to be limit to the capacity of the sector to absorb any additional labour force. An increasing crowding out in the sector is further responsible for a gradual decline in per capita land holding (because of some legal structural changes in family, marital and inheritance pattern), resulting in low average return from the cultivation of land. Dependence on agriculture, therefore gradually became less attractive.

The inability of the agricultural sector to absorb additional labour to various non-agricultural sectors and migration of people to urban areas where these non-agricultural sectors are mostly located. The shift in work force from primary to tertiary activities is mainly due to tourism in extension of technical know-how through various government agencies.

Despite an increased pool of labour force in Ladakh as associated with a rise in total population, the level of those actually involved in labour force has been much lower. Both the crude and general activity rates of population demonstrate a low percentage. As the age structure of Ladakhi population is young, effective labour force is the group between 15 years and 59 years. The impact of young age structure on the economic well being of society can be observed through demographic "dependency ratios". The young age dependency (YAD) is high among both Buddhists and Muslims being 63.1 per cent and 70.1 per cent, respectively. Old age dependency (OAD) among Buddhists and Muslims of Ladakh is 9.6 per cent and 5.8 per cent, respectively. The total dependency ratio is 72.8 per cent and 76 per cent, respectively among Buddhists and Muslims of Ladakh. The underlying assumption in these ratios is that persons under 15 and those aged 60 would be unlikely to participate in economic activity and probably depend economically on those belonging to the segment of the population aged 15-59. OAD among Buddhists and Muslims of Ladakh is less than India's (12.3) and Kerala's (7.9 per cent). This indicates low survival rate to older ages. The problems of ageing population are amongst non-existent as the survival rate is low and in the traditional Ladakhi society among Buddhists family and marital structure was such that the ageing population could be easily cared for.

Female participation is low in all the age groups. General Activity Rate is 58.4 per cent and 49.7 per cent among Buddhists and Muslims of Ladakh, respectively and for Ladakh (total) it is 51 per cent. Crude Activity Rate among Buddhists and Muslims of Ladakh is 30.9 and 28.3, respectively.

Percentage distribution of Buddhist and Muslim groups of region classified by income share per person in the study area reveal that 63.6 per cent Buddhists and 62.6 per cent Muslims are below Rs. 500, 28.9 per cent Buddhists and 27.8 per cent Muslim in the Rs. 501–1,000 range. 7.5 per cent Buddhists and 9.5 per cent Muslim are in the Rs. 1,001 and above range. In the total income categories 30.7 per cent Buddhists and 28.4 per cent Muslims are in the 20,001-30,000 range. The median income per person among Buddhists is Rs. 4,000 and among Muslims it is Rs. 4,500. The total income per family among Buddhists and Muslims reveal that 6.8 per cent among Buddhists and 4.2 per cent among Muslims is below Rs. 10,000. 35.7 per cent Buddhist families have total emoluments ranging between 10 to 20 thousand while 28.2 per cent Muslim families are in this range. Only 8.6 per cent Buddhist families and 11.3 per cent Muslim families are in the 30-40 thousand range. 8.5 per cent Buddhists and 18.7 per cent Muslims are in the above 50,000 income range. The difference between annual income figures among Buddhists and Muslims is because of Argons – a Muslim ethnic group which is more progressive than other Muslim groups. Argons are progeny of Kashmiri Muslim males and Buddhist females. The Kashmiri Muslims in Ladakh were either traders or administrative officers. Their economic position was better than other Muslim groups.

Literacy rate for Ladakh (total) is 56 per cent. Among Buddhists and Muslims of Ladakh literacy rate is 54.6 per cent and 56.7 per cent, respectively.

Agriculture technology is extremely simple. Agriculture production is reduced by the shorter season and low temperature. Though fields are irrigated, rice (most productive per land unit) cannot be grown as a food crop because of environmental constraints. Agriculture is restricted to alluvial fans produced by streams of limited capacity.

A traditional Ladakhi farmer ensured that during the agricultural season, he must grow sufficient food to last through coming winter and perhaps little longer. He and his family member could make and maintain his own shelter, clothes, foot wear, ropes, leather wear and saddlery, ploughs and agricultural implements. The social institutions in the society supported reciprocal interchange of labour and tools. The harsh environment and finite resource base has resulted in limited food production. Severe limitation on the land with irrigation facilities available for cultivation and lack of market for exporting local products has prevented the commercialization of agriculture.

The finite resource base resulted in limited production of food grains and livestock products on which large population base could not be sustained. Among traditional Ladakhis the relative population homeostasis was achieved through social customs such as polyandry and monasticism. Traditional Ladakhi family structure, the marital system and mode of inheritance all helped in maintaining the population at a surprisingly low level. The focus of the family was the maintenance and management of the estate and network of relationship with other related families in a co-operative chain. The dominance of religion in daliy life of Ladakhis helped in preserving the traditional life. There was little change in operative technology, almost no surplus production. The inter regional trade was limited to barter with grain, butter, wool, salt being the main exchange commodities. Regional isolation helped to retain the traditional socio-economic system intact till the winds of change swept in.

The fabric of traditional socio-economic system was shattered by extrinsic forces like development forces and political events. Schemes of irrigation, afforestation, land conservation and reclamation and improved water supply have been introduced. Import of food grains and industrial commodities has put an end to self sufficiency of the region. The economy of Ladakh is changing from a traditional subsistence economy to a commercial consumer economy.

With the increase in the tourist traffic and the employment of local people in the government offices and administrative posts, new ideas are infiltrating in the social life, affecting the traditional social structure.

People living at high altitude are subjected to environmental stresses, namely, hypoxia, extreme cold, rugged terrain, exposure to ultraviolet radiation, aridity and limited natural resources. At high altitude where ecological constraints are high, socio-cultural factors and economic development have been found to have effect on the demographic structure.

The overall sex-ratio among Buddhists and Muslims of Ladakh is 956 and 951, respectively. For Ladakh (Total) the sex ratio is 933. The Buddhists of Sikkim show a lower sex-ratio of 921, whereas the ratio for Sikkim (Total) is quite high (982). The sex-ratio of Ladakh is close to sex-ratio of Nepal (953) and Bhutan (958). The high sex-ratio indicate that women are not subjected to undue discrimination. Females of this region form a sizable part of work force which increase their economic value but often hard work together with harsh climate take its toll. Other reasons for the existing sex-disparity could be comparatively more male births, poor nutrition, housing and sanitiary conditions, frequent child bearing associated with unskilled midwifery. Of course the cause of the low sex ratio is not only under caring of female children and female infanticide, but also the under reporting of female births.

Age specific distribution among Buddhists and Muslims of Ladakh division depicts that ratio is 36.5 and 39.9 in the age groups 0-14 dependent children, pointing to a young population structure. The ratios in the active population age-groups 15-64 for both Buddhists and Muslims are 61.3 and 59.0, respectively. The ratio in the aged dependents 65+ is small in both the groups, being 2.0 and 1.2, respectively. This reflects less old age dependency and few problems. For the Ladakh (Total), the ratio in the age groups 0-14, 15-64 and 65+ are 38.8, 59.8 and 1.2, respectively showing a young population structure and low survival after 65 years. The average age of Ladakhi population is 17.9 which is less than Sikkim's 26.2, India's 25.4 and Kerala's 26.7. The age structure provides indication of future pattern of population growth and the potential demand for various goods and services. Age structure, school age population, labour force population are products of the demographic process and are crucial elements in development planning.

Child-woman ratio (CWR) observed among Buddhists and Muslims of Ladakh is quite high *i.e.* 676.2 and 759.3, respectively among women in the age group 20-49. The CWR of Ladakh (Total) in the age group 20-49 is 674.1 which is higher than Kerala's 525 but lower than Indian average of 695. In Nepal and Bhutan the CWR is 738.5 and 756, respectively which is higher than Ladakh's total. The mean age at child bearing among Buddhists and Muslims of Ladakh is 26.6 and 29.0, respectively. As the CWR is high in Ladakh, the health status of the family is affected by it because the CWR is directly proportional to disease incidence in the family.

Crude Birth Rate (CBR) among Buddhists and Muslims of Ladakhi is 24.5 and 21.4, respectively. For the Ladakh (Total) CBR is 22.4 which is almost equal to Kerala's 22.9. The CBR 22.4 of the Ladakh division is much less than state and Indian average of 33.4 and 32.6, respectively. It is not surprising in a community where small families were valued because of shortage of arable land; polyandry linked to primogeniture precluding land fragmentation and assuring labour concentration in the family. The fraternal polyandry acts to reduce aggregate fertility.

General fertility rates for Buddhists and Muslims of Ladakh are high being 95.8 and 58.5, respectively. For Ladakh (Total), GFR is 89.0. The high GFR indicates that number of women in 15-49 age group is less compared to total population but fertility is high. The GFR of Buddhists of Ladakh (95.8) is less than India's Buddhists AGFR of 114.0, but nearer to Sikkim's Buddhist GFR of 92.6. The GFR of Ladakh (Total) 89.0 is less than India's 145.2 and more than Kerala's 83.6. In the present study though the proportion of births in the total population is less, it is high to the population of women in the age groups of 15-49.

The number of children born per women by age is a clear indication of the fertility in any community. In this respect, difference is seen between the Buddhists and Muslims of Ladakh. Among the Buddhists group there is an increase from 54.9 in the age group 15-19 to 219.2 in the age group 25-29. Among Muslims of Ladakh it increases form 30.4 in the group 15-19 to 177.8 in the age group 25-29. This shows that there is a preference for more children resulting in high fertility. Despite governmental measures to educate people on the advantages of family planning, the age old preference for a large family is still prevalent among Muslims of Ladakh. Among Muslims there is increase fertility rates of women in age group 20-24, 25-29 and 30-34. Fertility among Muslims women lasts up to 40-44 age group whereas it almost stops among Buddhists women in the corresponding age group. Among Buddhist females, fertility starts and ends up early. It is highest in the age group 25-29 among both the communities *i.e.* 219.9 among Buddhists and 177.8 among Muslims.

In Ladakh, children are considered as the blessing of God. Fertility and sterility are considered to be in the hands of supernatural. Though Ladakhi wanted their women to have children but had means to control the population. Family and marital structure and mode of inheritance maintained population at a low level. Ladakhis fraternal polyandary wherein brothers farmed there land in extended families in which a group of brothers ran the estate under the leadership of the eldest who was the prime inheritor. There was only one marriage per generation on the estate. Monomarital system with fraternal polyandry limits population while maintaining an effective labour force on the estate.

Another population controlling factor among Ladakhi Buddhists was monasticism. Traditionally, a second son born in the family was ordained to monasticism, implying a marked control on reproductive potential. Combined with polyandry, this produced a surplus of unmarried women. There was some input of illegitimate children to the population. Number of such children was small, and these children remained on the estate of their mother's brother.

Today polyandrous, marriages are becoming rare and since it is not a legal form of marriage* the cohabitation of brothers with a wife of one of them is purely informal arrangement of economic benefit. The breakdown of the monomarital principle and percentage decrease of monks and nuns mean that Buddhists population is on increase. In the last decade around 70 per cent increase in Ladakhi population has been recorded, the CBR 22.4 in the present study is still much less than the State and Indian average of 33.4 and 32.6, respectively.

Among Muslims, the different ethnic groups Purigpas, Baltis, Drokpas and Argons all show different fertility rates. Muslim Dropkas, seem to be comparatively less bothered about small family size, health and sanitary awareness, educational attainments, contraceptive usage thereby registering higher CBR than other groups. Muslim Baltis are more conducive and accommodating towards such issues and are adapting them gradually for their benefits. Muslim Argons, being traders are mostly economically well off and show preference for higher educational attainment and do not see children as economic assets. As they are mixture of Buddhist females and Kashmiri male traders, they share preference for better living conditions and life style.

Every culture has its particular explanations for ill health. Religion has been held responsible for many differences and norms affecting the fundamental values and behavioural patterns in life including health behaviour. Two major religions – Buddhism and Islam are practiced by different population groups of Ladakh. The form of Buddhism prevalent here is not of spiritual type and the people practicing Islam are convert from Buddhist strata. The popular religion both of the Buddhists and Muslims is based on demonolatory and in this there is no deep cleavage between the two sects. Buddhism of Ladakh is a mixture of Bon, the old religion of Tibet, *Tantrism*, *Mahayana* and *Lamaism*.

In Ladakh, there are cultural, social and psychological conditions that produce and maintain supernaturalism. Supernaturalism provides the needed explanation, suffering is caused by evil spirits, evil eye, even good spirits if not kept in good mood or neglected or offended unwillingly. The Ladakhis believe in basic principles of merit and sin. They also believe in a vast array of gods and spirits who must be propitiated at the appropriate time for the general welfare of the society.

The main characteristics of the Ladakhi religion are divination, possession, exorcism, propitiation and expiation. The Ladakhis belief in spiritual beings has withstood the test of time as the main function of these beliefs was to ward off the misfortunes and illnesses caused by devils and environmental factors. The main function of religion in this society is to help people to cope with the problems of suffering and provide means for getting relief from the suffering. That which cannot be explained pragmatically is considered the actions of supernatural and people's viability to cope with such acts form the basis of religious system.

The Ladakhi's supernaturalism, must be explained by reference to its unique context and universal processes and functions. The Ladakhis

* As polyandry was declared illegal by the Buddhist Polyandrous Marriages Prohibition Act of 1988 (A.D. 1941) (*See* Laws of Jammu and Kashmir. Vol. III, pp. 878-881).

adaptation to its diverse ecological and historical context has given rise to culture, which has persisted and transmitted through generations. Since suffering both poses an intellectual problem and is experienced as an existential condition. Ladakhis supernatural explanation gives meaning to their problem of suffering and enable them to cope with it.

Causes of sickness, as conceived by the Ladakhis are various spirits and ghosts; sickness by magic and ritual neglect of good spirits.

Physical environment as well as socio-economic conditions and constraints have effected the spatial pattern of diseases in Ladakh. Ladakh's geographical position with extreme environmental constraints of high altitude and harsh climate conditions are the factors which determine the nature and type of diseases in Ladakh. Ethnically the Buddhists live at higher altitude generally on the alluvial fans than the Muslims who are settled in the lower altitudes generally along the river basins. Since the area is sustaining large volume of child population, it is expected that disease pattern would be dominated by those related to child, maternal and old age sicknesses. Child sickness is dominated by three —diarrhoeal, respiratory and skin diseases. The total sicknesses are concentrated in nine-type of diseases —diarrhoeal diseases including cholera and dysentery, other gastro-intestinal problems; lungs and respiratory problems including tuberculosis, asthma and pneumonia, skin diseases and rheumatism. Diseases such as heart diseases, gastroenteritis and acute respiratory infections are still the greatest killers in children and infectious diseases and nutritional diseases are still major health problems in the adult population. There is high prevalence of chest diseases. The prevalence of tuberculosis (*Lochoan*) is more in Muslim dominated areas. The majority of the cases were from Kargil, a Muslim dominated district and Chuchot —a Muslim dominated village in Leh district. Even among Muslims, it is more common among Baltis, belonging to Shia sect. Most of the tuberculosis cases were reported from a belt of village along the Indus river. The possible cause is the environmental dust. The ecological conditions — desert with little vegetation, high winds particularly in spring and autumn prevailing in the area, produces dust storms in Indus valley. Health hazards associated with air pollution are further compounded by the burning of biomass fuels (wood, dung and crop wastes) for cooking and heating. Another reason for the chest diseases is considered the cigarette smoking which is a recently acquired habit and its frequency is increasing. The effect of cigarette smoking on chronic obstructive lung diseases is well known and it is even more marked in the presence of smoky kitchen and environmental dust.

Both natural and supernatural means are employed for the recovery of the patient. Ladakhis act pragmatically, basing their action on the advice of the specialists they consult. Depending on what he thinks is the nature of his sickness, a Ladakhi makes a choice of consulting medical practitioner, choosing between a Lama (religious man), a *Lhama/Lhapa* (faith healer, oracle), *Amchi* (traditional healer) or allopathic doctor. However, this choice is not decisive *i.e.* a person may consult one or more medical practitioners at the same time depending upon the nature of the sickness. If a Ladakhi initially believes his illness to be supernaturally caused, he will never consult a physician, but will turn at once to one of three types (Lama, *Lhama/Lhapa*, *Amchi*) of indigenous practitioner. Once the diagnosis of super-natural causation is made, various kinds of therapeutic procedures can be initiated, depending on the nature of the illness and type of practitioner who deals the case. In case of illness where cause is physical as well as non-physical, both physical and ritual cures are necessary.

In case of physical illness, *Amchi* is consulted, who heals by means of medicines and charms. If despite the efforts of Lama and *Amchi* the illness persists, then *Lhama/Lhapa* is consulted. *Lhama/Lhapa* is a spirit medium who performs curing rites. They are considered miraculous healers. Among Muslims *Akhun* is priest cum medicine man, almost a counterpart of Buddhist *Amchi*. The Buddhist *Amchis* have a thorough knowledge of herbs which they collect themselves on the hills during the spring and summer months and rest they buy from the market. The *Amchi*, not only dispenses herbs and other form of medicine based on an extensive pharmacopoeia, but frequently utters some spells or perform some rites as well, either over the patient or the medicine, which enhances the therapeutic efficacy of the medicine. Should the doctor attribute the illness to supernatural causation, however, charms, spells and amulets together with herbs comprises his materia-medica. The *Amchis* do not have advanced equipment like X-ray machines, yet they can diagnose a sick person by examining their pulse, urine, stool etc. *Amchis* treatment mostly consists of cautery which is a strong counter irritant. There is no recognized institution in Ladakh for the *Amchi* training. The students are trained under the guidance of experienced and recognised *Amchi*.

In the realm of allopathic care system, in 1987-88 there were two hospitals in Ladakh, one in Leh district and the other in Kargil district. The hospitals in Leh and Kargil are well equipped. There are six and five primary Health Centres in Leh and Kargil, respectively. In Leh there are eight allopathic dispensaries and 86 subcentres while in Kargil there are 12 allopathic dispensaries. The position of the availability of medical amenities up to 1987 in the Leh district indicates that though the Leh town boasts of satisfactory Health and Family Welfare Department, only 48.8 per cent of the total villagers are provided with medical facilities within the village itself. However, the position of population in terms of coverage by medical care is more encouraging (63.9 per cent) than what came out in the term of the proportion of villages. As many as 63 villages have no medical facilities available. Most of their inhabitants have to avail of this facility at a distance of more than ten kilometers. It was noticed that as the distance from the nearest town increases, the proportion of villages covered under the facility decreases. It appears that net work of these various institutions is adequate for a population of 68,380, but most of these institutions are not functioning or so poorly manned that these are not able to provide required service as per programme.

In the sphere of medical facilities, the position of Kargil District is far from satisfactory. Out of 127 inhabited villages, only 47 or 37.0 per cent were having a dispensary or a Primary Health Centre or a hospital. Of these 47 village, 37 villages constituting 36.3 per cent of the villages are in Kargil *Tehsil* and 10 villages comprising 40.0 per cent are in Zanskar *Tehsil*. In terms of population coverage only 51.2 per cent population could avail the medical facility. There are in all 80 villages which have no medical facility available within the village and while two villages among these have this facility at less than five kilometers distance, the inhabitants of the other 78 villages have to cross more than five kilometers for receiving medical treatment.

Inspite of having a natural/supernatural/traditional and government health care system functioning in Ladakh, the morbidity and mortality statistics are high among Ladakhis. The prevalence of various diseases is affecting the health structure of Ladakhis. Among Ladakhis the Crude Death Rate (CDR) is 14.3 among Buddhists and 16.4 for Muslims. For Ladakh (Total) it is 15.7, which is higher than India's CDR of 10.0 in 1994. The economic and social factors which affect mortality are many and complex. They include education, occupation, nutrition, housing conditions, sanitation, public health services, medical services and general living standards. Definitely, the environment, the people are living in and the climatic pressures are taking toll of the lives.

The health status of the Ladakh region is poor. The critically low economic status of the people and the related poor level of nutrition, sanitation, housing etc. explain the prevailing pattern of disease and death. Of particular concern are high infant and child deaths, and high incidence of diseases. The health situation among the children of Ladakh is unsatisfactory and has to be viewed against the background of their socio-economic status. The child population constitutes the growing bulk of their population. These conditions call for the diversion of increasing attention and resources to deal with problems of child death. Here children die of diseases usually not considered lethal elsewhere.

As the population age structure is young the population in the age groups 0-14 is 38.8 per cent for Ladakh (total). This young population is associated with high degree of morbidity and high rates of mortality. Infant mortality among Buddhists and Muslims is 97.6 and 152.8, respectively. The infant mortality among Ladakhi Buddhists is lower than Buddhists of Sikkim (177.8) but is higher than Kerala's 29.0. The infant mortality rate is high among Muslims of Ladakh (152.8) which is quite high than India's IMR of 104.0. The main cause for high infant mortality rate is widespread poverty, illiteracy and insanitary conditions. People are not aware of the immunization measures taken by the government to bring down infant mortality. The traditional and indigenous methods are more prevalent than biomedicine to cure illness. In contrast, among Buddhists of Ladakh, neonatal mortality rate (NMR) is 24.4 and post natal mortality rate (PNMR) is 73.2 which is lower than Muslim's NMR 69.4 and PNMR 88.3. The PNMR of Buddhists (73.2) and Muslims (83.3) of Ladakh is higher than India's 38.2 but are less than Sikkim 111.1. The neonatal mortality rates of Ladakhi Buddhists 24.4 is much less than India's NMR 65.8 but is slightly higher than Kerala's 7.7. Perinatal mortality and foetal death rates are high among both the communities being 69.8 and 90.9, respectively and 88.9 and 132.5, respectively. Still birth rates among Buddhists and Muslims of Ladakh are 46.5 and 64.9, respectively. Deliveries generally takes place at homes with the aid of untrained relatives. There are no maternal child welfare centres in the vicinity of the most of the villages. People are not aware of immunisation for the children in the early stages. Infant death rates are higher in the delivery cases attended at home by untrained *Dais*, it is 81.1 among Buddhists, 78.6 among Muslims and 79.0 for Ladakh (total). Under five mortality rates among Ladakhis are very high pointing towards some basic wrongs existing in society. It may be harsh climate, subsistence economy, malnutrition, illiteracy, insanitary conditions or lack of conceptual health awareness.

The risk of death varies with the age of an individual. Furthermore, improvement in public health and medical services have been found to effect different age groups to a different extent. Age wise mortality shows a U-shaped curve indicating a high rate up to age of 14 years and after that a very low rate and a steep rise after the age of 55 years.

Age-specific death rates among Buddhists and Muslims of Ladakhs show that mortality rate in the age groups 0-4 is high being 39.6 and 36.4, respectively. Mortality rates in the age group 60-64 are 69.0 among Buddhists and 84.1 among Muslisms of Ladakh. In the age group 65+ the mortality rate is 111.1 per thousand among Buddhists and 160.3 per thousand among Muslims of Ladakh.

Infant mortality is considered to be a fairly sensitive index of the health conditions of a region. Though it is difficult to control the endogamous causes like congenital abnormalities, the exogenous or environmental causes like nutrition, prenatal care, sanitary conditions, incidence of diseases to which infants are highly prone can be controlled and reflects the health measures taken by the community, government and other agencies. Apart from genetic and endogenous factors, biological factors like the age of mother, order of birth, prematurity and birth spacing also have a bearing on child surviving.

Low death rates have been achieved in parts of India, where primary health care procedures, midwifery, maternal education on breast feeding and weaning, vaccinations, oral rehydration of victims of diarrhoea, and antibiotics against respiratory infections have been implemented.

Health supporting utilities are supposed to have some direct or indirect affect on health status of the people. It was found that mothers do not generally panic when a child is struck by a diarrhoeal episode, especially when such cases are associated with developmental stages of the child (teething, walking and crawling). Most mothers do not seek treatment outside the home until the third day. The decision making process is influenced by traditional values, distance to health facilities, availability of other pharmaceutical products and/ or financial resources. However, treatment outside home is sought only when the episode persists and is resistant to home management techniques. Mother's decision to seek health care in modern facilities comes after a complicated process of choices or alternatives. Housing conditions and household attributes, represents health environment at the household level. Type of construction, number of rooms, separate toilet, separate kitchen, cattle shed, bath rooms, chimney in the kitchen/rooms, drainage system/sewerage system, ventilation, general sanitary conditions all represent health environment.

Mortality was found to be related to availability of sanitation, piped water supply, utilization of health services and host of socio-economic and demographic variables at household level.

The area of dwelling is found to have an inverse relation with mortality in general. This is also an economic indicator. The higher social classes are more likely to have larger dwelling areas and people in higher social class have more ability to take curative as well as preventive measures of health. Fixed latrines and sanitation is an equally important factor in bringing down infant mortality. It has been found that presence or absence of sanitary conditions affects the mortality differentials in the study area. It was observed that where sanitary conditions were satisfactory, the mortality differentials were low.

General and infant mortality respond favourably to education. It was observed in the study area that among Buddhists and Muslims of Ladakh, the educational achievements of both husband and wife affected the infant mortality differentials. The analysis reveals that educational achievements of both husband and wife are significantly associated with infant and child mortality. As expected, the probability of dying declines with age of child and education of mother. In Ladakh, the mother's education is more influential factor than father's education and occupation. In the study area in Ladakh where land-lordship is an important criterion of social and economic status, the infant mortality differentials were affected by land ownership. The infant mortality differentials were high among landless and were minimum among the people who owned less than 10 acres in both the groups. Both the groups, Buddhist and Muslim, classified by income, showed that the infant mortality differentials were high among those whose income was less than Rs. 10,000/- per annum and minimum in those households where income was more than Rs. 50,000/- per annum. Nature and occupation of both husband and wife is strongly associated with infant mortality.

The study from Ladakh corroborates the theory that social development and various facilities available in the study area attribute to lower mortality rates. As observed that infant mortality is significantly associated with *Pucca* roads, bus services and mass media. When the communication facilities index is high mortality is low.

The analysis of mortality rates of neonatal, postnatal, the infant and child reveal that the distance of government dispensary, public health centre and hospital is significantly associated with the mortality rates. The rates increase as the distance of these facilities increases from the respondent's place. Other factors such as the *Dai* (traditional birth attendants), number of visits by field workers, occurrence of natural disasters and epidemics also show a systematic pattern with mortality rates. The Maternal and Child Health Programme has not been successful in extending service to the target population. In terms of immunisation, only 46.6 per cent Buddhists and 41.4 per cent Muslims have been immunised. Survey data also show that most of the women prefer to deliver at home.

In view of the difficult means of communication and distance of dispensaries from the villages in Ladakh, medical aid is not availed of by Ladakhis except in serious cases. However, in areas, despite easy accessibility survey findings show that a sizable proportion of those who were ill did not seek treatment in health centres or hospitals. Ladakhis depend on traditional folk-medicine practioners who besides relying upon certain occult phenomena deal with various herbs for preparing herbal medicines for therapeutic use. Throughout the Ladakh, the people are obsessed with the uncanny unearthy activities of spirits, ghosts and deities. The diseases all thought to be caused by supernatural, demand magico-religious remedies to cure of maladies. Ladakhis resort to various magico-religious practioners for relieving the people of death and disease caused and delegated by the wrathful supernatural. Percentage distribution of deaths (1986-88) among Buddhists and Muslims in the present study was reported highest by respondents while availing the allopapthic medicine. Though they fail to mention that allopathic medicine was taken as a last resort or in terminal cases. It was found that deaths reported by availing the services of traditional folk medicine practioners was minimum or negligible. The reason underlying this was that their first choice was traditional folk-medicine.

Despite improvements in health facilities in Ladakh in the past, no significant improvements in health status could be achieved. Morbidity pattern in Ladakh shows that the incidence of diseases is concentrated more among children and old-age people. Sickness among children aged upto five is due to diarrhoeal, respiratory and skin diseases. Most of the diseases causing sickness are highly associated with crowding widespread poverty, poor housing and sanitation facilities. Vast majority of the population suffer from malnutrition. Low weight at birth is a major cause of child sickness and death. Family size is positively associated with the average number of sick members in the family, and average duration of sickness. High level of dependency in the family and high proportion of females correspond with a higher incidence of sickness. Presence of health facilities in the locality do not have any significant differential effect on the family health status. The findings of study show that the greater the extent of traditionalism in the Ladakhi society, the wider the prevalence of belief in supernatural powers as causing sickness and the higher the rate of consulting traditional healers. We also see, however, that the belief in supernatural causes may exist alongside the belief in natural causes. In case of sickness Ladakhis first avail the services of a traditional healers and if this treatment is unsuccessful he will turn to biomedicine. In case the biomedicine is unsuccessful, he will turn back to traditional healers. Since traditional Ladakhi medicine draws its strength from the belief in supernatural and *Karma*, all things that happen to man, both good and evil are considered be the will of God. According to Ladakhis, both health and illness are caused by God, with the help of natural and supernatural powers created by him. Powers of strong faith, courage and great patience are the source of healing. The ceremonies of visiting the traditional healers, have established a relationship of psychological-therapeutic dependence on the part of the Ladakhi with regard to healer. This dependence is deeply rooted in their psyche and reinforced and legitimized by the Ladakhi culture. It is important to note the difference between the bodily conceptions in Buddhism and those of biomedicine. In the former the body is seen as part of the universe, interconnected to all elements of the universe and functionally interdependent. In biomedicine body parts are separate and functionally independent marking high modernism in medical practice. The analysis seem to indicate that there is some association between ill health and mortality with large family size. However, without taking into account many other factors such as life-style and environmental conditions, one can only regard the above conclusions as tentative. The household survey data show that large family size has adverse effects on education and health. In terms of educational achievement children from large families have lower educational achievements than their counter-parts in small families, although mother's educational level and income are equally important in explaining educational differences. Such children are more likely to participate early in money earning activities, which is closely related to educational level achievements. Participation in labour force and employment are restricted to low paying jobs, without much skill requirements. As adults, they are likely to marry off early to someone of the similar economic group. In terms of health those from large families are likely to be badly off because of poor nutrition and inability to afford medical services. Thus, there is a vicious circle difficult to break. The implementation of development programmes is clearly not sufficient to break the cycle. The families themselves need to take positive steps to ensure that they are able to enjoy the benefits of development programmes.

Based on findings of the present study, the policy implications are as follows:

General emphasis should be placed on creating public awareness about primary heath care both at the household and community level. Indigenous medical practices in comparison to biomedicine therapy are mainly based on the belief system. Hence, the opening of health centres is certainly not enough and hence the need for cultural factors that tend to an efficient administrating of medicine. Traditional *Amchi* system which has stood the test of time is indeed unique and has proved reliable and effective for Ladakhis must be protected. Health facilities, especially in rural areas should emphasize the health care of women and children. While immunization against major diseases has already started, diseases which are related with congestion, impure drinking water, poor hygiene and sanitation, could be kept under control if educating the public on primary health care becomes a part of the local health care services. Greater emphasis should be placed on creating facilities for the treatment and control of infectious diseases which are closely associated with cramming up of family members in a room during winter months at household levels. Given the interlinkage between health, education and occupation, all are important in their own sphere, emphasis should be placed on improvement in all.

While the control of population should be among the prime objectives of the Government's development programmes, in an effort to redeem the adverse consequences of growing population because of breaking up of monomarital system or polyandrous marriages and decrease in number of monks. Greater emphasis should be on creating employment opportunities according to the needs of the population. Emphasis should be placed on the creating employment opportunities in the non-agricultural sector. Distribution of educational institutions across different geographical areas should cover, rather on the relative concentration of school age children in the respective localities. Rather than constructing new facilities, under resource constrains, maximum possible effort should be made to maintain properly the existing institutions. Greater emphasis should be placed on creating health awareness about primary health care.

Given the interlinkage between health, education and occupation, local institutions could be used for multiple purposes. For instance, the existing school building could be used as health centre, or as a training institute for new technology, new crop variety, cropping pattern and even for development of local skills.

KEY WORDS AND ABSTRACT

KEY WORDS High Altitude. Adaptation. Human Ecology. Disease. Fertility. Mortality.

ABSTRACT In human ecology, everything is connected with everything else. Health is not a set point but a continuum. It is a bounded variable, with the variation between individuals is not entirely genetic, in part it is genetic and in part it is interaction between the individual and the environment in which an individual is brought up. In any empirical study it is simply impossible to determine the full set of factors affecting the health status of family members. However, three major groups of factors determining the health status of the family have been identified. (a) Demographic factors, (b) Socio-economic factors and (c) Exogeneous factos. In the present study, ecology and health status of the people of Ladakh has been undertaken. Ladakh is a remote and rugged moutainous region of Jammu and Kashmir State, India. Ladakh is a model of human adaptation of an extreme environment and is among the rare places in the world where a highly developed and consistant traditional culture has come down intact into modern times, and still function in harmony with nature. It is a multi-racial, multi-cultural level adaptation to the environment and has a fair chance of surviving the on-slaught of tourism, if development of the area is properly managed. The people of Ladakh are a mixture of Mongolian and the Aryan races. Ladakh division is inhabited by followers of two major relgions : Buddhism and Islam. In Ladakh the natural environment constraints appears to dictate many aspects of traditional life, especially settlement sites and agricultural systems. There are three types of settlements in Ladakh : Gompas, forts and palaces, Droska-grazing camps and agricultural villages. Practically, all the agricultural villages in Ladakh centre round a stream, which bring water from glaciers at the higher altitude. Housing condition is generally not good in Ladakh villages. Though almost all the Ladakhi houses have a separate lavatory (*Chaksa*) as Ladakhis use night soil mixed with dung as a fertilizer for enriching the soil, but there is no proper drainage system in the villages. General sanitary conditions are unsatisfactory . Agriculture and allied occupations such as yaks, sheep and goat rearing and spinning of wool etc. are the main occupation of Ladakhis. Industry whether small or large scale is insignificant. Physical environment as well as socio-economic conditions and constraints have effected the spatial pattern of diseases in Ladakh. Ladakh's geographical position with extreme environmental conditions of high altitude and harsh climate condition are the factors which determine the nature and type of disease in Ladakh. Since the area is sustaining large volume of child population, the disease pattern is dominated by those related to child, maternal and old age sicknesses. Child sickness is dominated by diarrhoeal, respiratory and skin diseases. Most of the tuberculosis cases were reported from a belt of villages along the Indus river. The possible cause in the environmental dust. The ecological condition - desert with little vegetation, high winds particularly in spring and autumn prevailing in the areas, produces dust stroms in Indus valley. Health hazards associated with air pollution are further compounded by the burning of biomass fuels (wood, dung and crop wastes) for cooking and heating. Every culture has its particular explanation of ill health. Causes of sickness as conceived by Ladakhi are various spirits and ghosts; sickness by magic and ritual neglect of good spirits. In Ladakh, there are cultural, social and psychological condition that produce and maintain supernaturalism. Supernaturalism provides needed explanation for cause of suffering. Mortality in Ladakh was found to be related to availability of sanitation, piped water supply, utilization of health services and host of socio-economic and demographic variables at household level. Despite improvements in health facilities in Ladakh in the past, no significant improvement in health status could be achieved. Morbidity pattern in Ladakh shows that incidence of diseases is concentrated more among children and old-age people.

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Authors' Address : **Veena Bhasin and M.K. Bhasin**, Department of Anthropology, University of Delhi, Delhi 110 007, India

Ecology and Economy of an Eastern Himalayan Tribe — The Apatanis

Jogada Phukan

INTRODUCTION

Both plants and animals are highly interdependent on each other. No body can deny the multiple role of forests and trees in the life of the animals, specially of the human beings. Forests exercise ameliorative influence on the micro-climate of a region; they also help in the conservation of moisture and soil, control of floods, growth of pasture etc. They also provide means of livelihood and welfare to tribal and rural population (Deshmukh, 1987). Before modernity has entered into their areas, these people both in the hills and in the plains adapted themselves to their natural settings, using bio-mass or bio-mass-based products available to them for their food, shelter and clothing, such as, some sort of food, fuel like fire-wood, cow-dung, crop-waste, fodder, organic fertilizer, thatches and leaves for roofing, bamboo and cane for building materials, herbs for medicines, cotton for clothings etc. Men had to adjust their livelihood, their day to day work in the society according to the ecology and environmental condition. From time immemorial, men have cultured varieties of methods for procuring food and other necessities of life by domestication of plants and animals. We agree with Melville J. Herskivits (1955) that before the stage of herding of animals and cultivation of food crops, gathering, hunting and fishing existed, life was lived on the basis of finding and utilizing of roots, nuts and berries or game animals. When cultivation developed, techniques of cultivation varied from place to place according to climate, formation of the soil, its location, its fertility and men's culture and labour force. The simplest agricultural implement was the digging stick, a pointed branch hardened by fire. Most of the primitive people, particularly in the hills, use shifting cultivation, employing slash and burn technique. Permanent cultivation like wet-rice cultivation was popular among some communities only. Notable techniques of growing crops, like terracing and irrigation were known to fewer tribes in the hills. An outstanding example of irrigation is found in the American South West, where it has been practised since early pre-Spanish times. Example of terracing as an aid to agriculture is found in the Andean Highlands (Herskovits, 1955). In Arunachal Pradesh, the twentifourth state of the Indian Union, shifting cultivation was widely practised in all the districts, till the government, convinced of the ecological hazard effected by slash and burn method, had recently taken steps to control the practice of shifting cultivation and popularise wet-rice cultivation. But unlike all other tribes of Arunachal Pradesh, who until a generation ago, lived in small communities isolated from the outside world and from each other and used shifting cultivation, the Apatanis lived concentrated in a single densely populated valley (Haimendorf, 1978) and have been using permanent wet-rice cultivation since a long time back when most of the Indian hill tribes used the slash and burn cultivation. It is, therefore, proposed to study here as to how the ecology and environment of the Apatani-inhabited area influenced or has been influencing on food factor - its production, consumption, trade etc. and on the way of life of this small but compact laborious tribe. The objectives of the present study are :

1. To trace out the kind of food the Apatanis used to eat before they practised wet-rice cultivation in their present habitat, and to find out if there is any change and continuity in their technique of cultivation, due to inroad of modern technology to Arunachal Pradesh;
2. To trace out whether population-growth in the limited land-area and modernization have posed economic problems and imbalance among the Apatanis ; and
3. To trace out whether the same ecological conditions favourable for permanent cultivation are also favourable for agro-based or forest-based industries in the Apatani Valley.

LAND AND THE PEOPLE

The Apatanis are the inhabitants of the Apatani valley of the Lower Subansiri District of Arunachal Pradesh. The whole state is a territory of hilly terrian on the southern slopes of the Eastern Himalayas. It is situated approximately between 26°30' and 29°28' north latitude and 79°24' and 91°25' east longitudes. Before the advent of the British, this land was an unexplored one, inhabited by a number of independent hill tribes. The Lower Sabansiri District is approximately between 26°55' and 28°42' north latitudes and 91°42' and 94°37' east longitudes. The district as a whole presents mountaneous features.

The Apatani area comprises about hundred and thirty eight square kilometres which include the uninhabited forests *i.e.* upto the traditional boundaries of the Nishis, the second largest tribe of Arunachal Pradesh.

The climate of this area including that of Ziro, the District Head-quarters, is pleasant during summer; but to its geographical location in a high altitude, the whole area is extremely cold during winter. Being in a heavy rainfall zone, monsoon starts as early as March and lasts upto September.

As the whole of Arunachal Pradesh, being highly mountaneous and criss-crossed with swift-flowing rivers and rivulets, transport and communication was extremely difficult during the pre-independence period. There was hardly any motorable road anywhere in the entire region upto 1974. The whole Lower Subansiri District was full of dense forests with wild elephants. Due to lack of easy communication each village behaved as a self-contained tradition-bound unit, aloof from the others. Foot-tracts served as the only means of inter-village communications. Even communication with the plains of Assam and Tibet used to be through foot-tracts. After independence, there took place a good deal of improvement in road, transport and communication.

It is peculiar to note that the whole Apatani valley is surrounded not only by hills and ranges in all directions but also by two hill tribes - the Nishis and the Hill Miris. The small river Kille and its tributaries, like the Nile of Greece, flowing from the north to south, not only enrich the natural flora and fauna of the valley, but also supply the required amount of water and manures to the terrace-rice cultivable fields.

Originally the Apatani valley consisted of seven villages sheltering about five hundred inhabitants. Now, due to rapid growth of population, the number of villages have been increased to twelve with a population of more than twenty thousands (Kani, 1993). To feed the extra population, two new settlements, namely, Talley at an altitude of 2500 metres high and Hakhe Tari at an altitude of 1800 metres high are being established.

Of the Apatanis, whose numerical strength is not more than 30% of the total tribal population of the district, the majority live in the Apatani valley and 5% live in different parts of the state, especially in the capital complex *i.e.* Itanagar, engaged in government services, public works and trade and business organisation, in different capacities.

At present, the people call themselves as Apatanis. Formerly, they were known as Anka Miri, Ankas, Apatang etc. The people exhibit Mongoloid physical features with their yellowish body complexion, flat nose, scanty facial hair, straight coarse head hair, thick cheek bones and frequent occurrence of epicanthic folds in the eye lids.

Origin and Migration of the Tribe

The history, origin, migration etc. of the Apatanis can be traced and assessed from the myths and legends prevaliling among them. The words uttered by the priests in ritual functions also give us some valuable hints on the mythical origin. In the same way, marriage and certan ceremonial songs depict their origin and history. The legendary tale about the origin of the Apatanis speaks that Abotani, a mythical ancestor of the far eastern Himalayas, was the first ancestor of the tribe and the world. Kani (1993) found from the myths of the Apatanis that their three forefathers were generated at a mythical place at the present Zang Bambo valley of Tibet. At an early date, they migrated in groups of their present habitat in waves. The Apatani priests chant about the mythical migration routes of the tribe very often in theie religious performances. In priest's chants, some mountains with snow-covered peaks of Tibet and China are found. According to folk-lore, the Apatanis came down from the extreme north of the Subansiri and Siang districts of Arunachal Pradesh. The rivers and rivulets, found in their myths reveal that after migration to the present habitat, they have not migrated to other places in group.

Apatani Economy

Agriculture is the basis of Apatani economy. Wet-rice and terrace cultivation is the way of life of most of the Apatanis. Recently, due to increrase in population, some of them have bifurcated their sources of income into different fields. Besides rice, they raise millet for preparation of beer, one of the important items of all religious ceremonies, maize and also many green vegetables.

As agriculture being the basis of economy and rice, the staple food of Apatanis, we must discuss the technique of Apatani wet and terrace rice cultivation. About 30% of the Apatani land are their cultivation fields, situated at an altitude of more than 1500 metres high and generally are flat, wet and privatised, whose encroachment is never allowed for an inch even. The topographical setting of the Apatani valley and the natural environment have made the people to resort to irrigated terrace cultivation instead of jhuming. The valley is shaped like a dried lake with different layers of terraces. Apatani legends say that the valley was created by draining out the water of a big lake full of aquatic reptiles. There is much to believe that the valley, surrounded on all sides by mountains, was once a lake and due to silts brought to the lake by streams from the surrounding mountains, it became gradually shallower and shallower resulting at last the creation of a valley, full of fertile soil. A number of streams are coming down from the hills and every one of the streams that ring the Apatani country is utilized by the people for irrigating the cultivable land. The streams are first tapped at the top end of a side valley where the highest terraces exist and then channelised by construction of dams and canals so as to water the lower terraces until it flows into the broad bowl of the main valley. At the head of the valley the terraces are narrow and as the valley broadens, the terraces grow in size and become wider. The lay out of the terraces, construction of dams and ducts show considerable skill and high degree of co-operation among the people. The channels are dug deep into the soil and the dams constructed are secured against onrush of flood water by rows of wooden stakes, sometimes reinforced by strong bamboo matting. Small amount of water is drained out to the highest fields. Water is so channelised and terraces are so prepared that all the terraces get sufficient water for cultivation, and the central bowl is kept under water or at least moist during most part of the year. Normally water is not allowed to overflow the dams, and the terraces are drained through wide wooden or bamboo pipes.

There are two types of rice fields, *viz*., (i) the higher terraces that get watered during monsoon and that dries up soon after harvest, and (ii) the central bowl kept under water or at least moistened almost throughout the year. It is used for growing different types of rice. The latter categor of soil is used for cultivation of late-ripening variety of rice, called *emo* and the other category of fields is used for cultivation of early-ripening varieties of rice like *Pyare, Pyate* and *Pyaping*, which ripen in early August, late August and September, respectively.

The Apatanis donot use animals and plough for cultivation. The topography of the land does not allow them to use the mechanised devices like the tractor. They use flat wooden batons, iron hoes and even animal horns and shoulders-blades of cattle for digging up the fields.

In the lower terraces and in the central bowl, the terraces are cleaned and dug over with the help of hoes before each period of cultivation and then water is drained to the field with the help of channels. The water, brought to fields, is allowed to be filtered slowly into the soil. Then it is paddled by men and rarely by women, who treadle the mud underfoot so that the soil is churned knee-deep to smooth paste. The preparation of soil in the higher terraces are obviously different as these depend mostly upon monsoon rain. The soil here is dug by hoes and clods broken up by hands or moon-shaped hoes. Drainage of water is not enough to make the soil muddy and growth of rice depends mostly upon monsoon rain. Seedlings for paddy are prepared first in nurseries and then transplanted at eight inches apart by women and girls in the fields, thoroughly puddled and made muddy. Transplanting starts in the middle of April and is completed by the end of May. Weeding of paddy fields is done two or three times in case of meagrely-watered fields. Harvesting of early variety starts in August and lasts till early November. After harvesting, the paddy is thrashed on the spot by being beaten against a standing wooden board and then carried in baskets to the owner's granary.

The land-use pattern of the Apatanis is very unique. Over the above the maintaining of the terraces fertile and in tact, they use every inch of land, not only for the material development of the tribe but also to preserve and maintain the natural ecological balance. Quite apart from their neighbours who, at random, destroy forests and allow soil-erosion, the Apatanis carefully preserve forest resources and bamboos. Groves of bamboo and pine trees occupy a considerable part of land of every Apatani and no Apatani family is considered economically independent without possessing atleast one bamboo grove.

Though the hills surrounding the valley abound in bamboo, the Apatanis cultivate bamboos sufficient for their need. They also grow pine trees, and a number of fruit trees. The Apatani valley is full of colonnades of blue weeping pine, a peculiar variety which the people regard as their cherished possession. Their folk-lore says that the seeds of this variety of pine trees were brought by their ancestors when years and years ago they migrated to the valley from the land in the far north-east. They have community groves, individually owned groves and trees, and clan forests, which are preserved and used economically for community and personal use respectively. In Bordoloi's (1987) words, "they are really expert in environmental management. An Apatani is allowed to cut a matured tree provided he plants one before he fells the tree. Failure to do this means a fine of Rs. 500/- and he can never escape from it.... Bamboo groves are kept so nicely with fencing as if they are flower gardens. Pigs are not reared because they destroy vegetation and make the atmosphere nasty. Of course, each family keeps a pig which might be needed for a *Puza*. Cows and mithuns are kept in the jungles so that they may not destroy crops and vegetables in the villages".

From the above, we know that early Apatanis were very hard-working. They have been practising wet-rice cultivation since time immemorial with human labour. Till now they are practising this type of cultivation without any human traction (Kani, 1993). Rice was their staple food. The people are habituated to taking rice three time a day as food. Rice, besides being their staple food, is also bartered at times for every essential commodity with the neighbouring tribes.

From the fact that rice was found in abundance in the Apatani valley and in the absence of any written or oral evidences about the use of roots as staple food by the tribe at any time of history, it can very well be concluded that the Apatanis never depended upon any kind of roots as staple food after their settlement in Arunachal Pradesh. For the following reasons we can come to the conclusion that they were not a hunting-gathering tribe; rather they were a settled tribe, though remained unknown to the outside world.

Migration

It has already been mentioned that the Apatanis migrated from Tibet and China where Whoanghoo and Shikiang civilisations prevailed. The land for China was not largely fertile. So the people in groups began to migrate in search of land or settlement. As they have come from a socially and economically well-organised country (Joshi, et al., 1973), they brought with them the technique of cultivation. Apatani myths also say that their original fore-fathers came from Tibet and China. The secred lore of the Apatanis reveals that after entering Arunachal Pradesh, their ancestors settled, at first, in present Siang District. But due to unfavourable climatic condition they migrated to th present valley. Apatani's broken earthen pots, bounds of paddy and millet are said to be still found there (Kani, 1993). Kani (1993) found in their myth that their three forefathers were generated at a mythical place called 'Mudo Suppung'. This mythical place of the Apatanis is believed to be the present Zang Bamboo valley of Tibet. Also Kani (1993) emphatically says that the adoption of brilliant method of agricultural production, dwelling systems, social and religious practices of the Apatanis and other people of the Tani-group are the basic characteristic features of the Neolithic civilisation of the Aryans and the Mongoloid tribes.

Man Power

The Apatanis as a whole are a very laborious people. The topography of the land and the struggle for survival have made them sturdy. All the traditional foot-tracts from village to village and temporary bridges are their handiworks. We have already explained how they have been cultivating in hilly areas. It was possible in the past and even not it has been possible only due to their labouring capacity and culture of mind. Like the Ifugao and many other Far Eastern rice-growing folks, the Apatanis have also changed the physical features of the mountainous country they inhabit. Every year, they turn some small fallow plots into terrace fields. They are not content with merely maintaining an established system of terraces and channels, but seek to carry out improvements, whenever the yield of a field has not gone up to expectation. Thus, upkeep of terrace fields, dams and channels have always absorbed a major part of the Apatanis' time and energy. The tribe can boast of being the first tribe of Arunachal Pradesh to use fish-farming (Haimendorf, 1980). Besides this distinction, the Apatanis of the Lower Subansiri District can boast of the unique position in the paddy-cum-fish culture in the Apatani country[1]. Majumdar (1979) goes to the extent of saying that the Apatanis are unique in many socio-cultural characteristics in the whole of Arunachal Pradesh, nay, in the whole of North East India.

Myths and Folk-songs

Apatani folk-lores, consisting of myths, tales, proverbs, riddles and folk-songs, reveal that they have been practising wet-rice cultivation. Nobody denies the fact that folk-tales are more than the literary expression of a community. Even the Apatani proverbs confirm that this tribe depends on wet-rice cultivation (Kani, 1993). On the other hand, folk literature of the tribe does not reveal anything about the slash and burn cultivation.

Language

The language reveals some of the deepest roots of culture of a community. As such it is possible to vitualise the culture and food-habit of the Apatanis from their language also. No names of edible roots are available in their language. Even roots, like the sweet potato and wood potato, donot appear in their language. On the other hand, rice, rice-beer, rice-powder, granary, nursery are found in their language.

Festivals and Religious Beliefs

The belief in super-natural forces of the universe does undoubtedly comprise the core of religious functions of most of the people-whether literate or illiterate. The same is applicable to the Apatanis also (Pandey, 1981). They are rich, not only in economic and political field but also in religious ceremonies. As agriculture is the life-blood of the Apatanis, most of their festivals are agriculture-based. In order to increase the fertility of the soil and to have bumper crops, they propitiate different gods in the shape of some religious ceremonies or festivals on the eve of and after harvesting. An important festival of such nature, known as *Dree*, is celebrated every year in the month in July after transplantation of paddy and it makes everybody of the Apatani community active as all houses have to contribute rice and rice-beer for it. There are several other agricultural rites, observed by qualified priests with proper rituals.

Thus, the agriculture-based economy, rice as medium of exchange, rice-based slave system, privatised cultivable lands, rice as staple food, paddy-based festivals and rites, concentration of population, unique indigenous irrigation system used for cultivation, not finding mention of roots in their folk songs and language, prove that they never used roots as staple food. This precludes the Apatanis ever living a life on hunting and gathering.

The Government, of Arunachal tries its level-best for industrial development, focussing its concentration on medium scale industries of mines, minerals and sericulture[2]. But the Apatani valley being full of bamboo groes and pine trees, some local people on co-operative basis may try for the establishment of a paper industry with the help of industrial loan. Abundantly planted bamboo groves were the main house-building at one time, but now, due to availability of C.I. sheets and modern house-building and other materials, bamboo has lost its importance as prime building material. The surplus bamboos may very well be utilised for starting a medium-sized paper industry. Situated in the same monsoon climatic zone, the whole of Subansiri district abounds in wild bamboos. These wild bamboos can be very well utilized for the purpose. Moreover, such a venture will help not only the Apatanis, but also all the local rural people of the vast Lower Subansir District for improving their economy. The people will get incentive to grow bamboo groves on commercial basis.

From the foregoing discussion, it is possible to conclude that the Apatanis have well organised agricultural system along with indigenous system of irrigation and method of soil preservation, planned aforestation and sense of maintenance of natural ecological and environmental balance.

KEY WORDS AND ABSTRACT

KEY WORDS Terrace Cultivation. Fish-farming. Terrain. Slash and Burn Cultivation. Irrigation.

ABSTRACT The Apatanis, the inhabitants of the valley of the same name, in the Lower Subansiri District of Arunachal Pradesh, is a tribal folk, most distinct in their overall ways of life from the neighbouring groups of tribesmen of the State. Far from being a hunting-gathering tribe, unlike the rest of the region, they are an

1. Socio-Economic Review, Lower Subansiri District, Government of Arunachal Pradesh.

2. Arunahal Pradesh : A Decade of Achievements, 1993.

intensive agriculturist community adept in terrace cultivation and keen in maintaining the existing ecological balance of the habitat. They have proved to be the precursors of fish-farming in Arunachal Pradesh. Industrious as the Apatanis are, they have a most sustainable development in the Himalayan highland environment.

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Author's Address : **Dr. Jogada Phukan,** Lecturer, North Lakhimpur College, Lakhimpur 987 001, Assam, India

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People of the Himalayas : Ecology, Culture, Development and Change
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The Mystic Kinnaur in The Himalayas : Its People and Forests

U.K. Banerjee and Shubhra Banerjee

INTRODUCTION

The geographical location of Kinnaur, one of the twelve districts of Himachal Pradesh (H.P.) is between 31°-05'-55" and 32°-05'-20" north latitude and between 77°-45'-0" and 79°-00'-50" east longitude and is composed entirely of a succession of mountains. In the east Kinnaur constitutes the international border with Tibet. The total area of the district is nearly 6679 sq km (11.7% of the total area of H.P.). The altitude varies between 2500 metres and 4000 metres though at some uninhabited places the height is still more (H.P. District Gazetteer, Kinnaur, 1971). The district headquarter, Reckong Peo is about 285 kms from the state headquarter, Shimla.

The Sutlej is the main river of the region, originating from Mansarovar (in Tibet). Other small rivers of the region include the Spiti river (Hangrang valley) and the Baspa river (Sangla valley), both these rivers finally merge with the Sutlej. Kinnaur is divisible in a number of valleys due to rugged and high mountains, rivers and streams. The valleys are : Bhaba, Kalpa, Ropa Ganjul and Hangrang. Each valley represents its own socio-ecological identity. The climate of Kinnaur is varied because of diverse topography. The three subdivisions of the district Nichar, Kalpa and Pooh have varied climate. Whereas Nichar and Kalpa have forests, in Pooh region, hardly any appreciable greenery exists leaving aside agricultural fields. Monsoon reach easily upto Nichar and decreases to Kalpa and there is no monsoon rain in Pooh subdivision. The average rainfall of the district is 21.51 cm (Distt. Gazette, 1991). During winter months snowfall is common and quite heavy.

Till 1960, Kinnaur was a tehsil (named Chini) and became a district on 29 April, 1960. The district is having lofty majestic mountains and deep gorges beholding and spectator with awe and giving mystic appearance. The area, because of tough terrain and hostile climate has remained rather unexplored as compared to other areas (Fraser, 1820). The local inhabitants of the area had more trade links with Tibet than with other surrounding areas except with Rampur Bushair which has now acquired the importance of state fair, the Lavi Trade Fair.

THE INHABITANTS

The inhabitants of the area commonly known as the Kinners are an age old tribe dwelling in the high north-western Himalayas since time immemorial. The Kinners seem to have had deep association with Hindu mythology. Ancient literatures refer to these people nearer to the order of 'God' alongwith Gandharva and Yaksha, the Indian mythical celestial beings. Raj Tarangini describes kinners to be born from the shadow of Brahma. The epics describe them as heavenly musicians or celestial choristers: "such creatures are supposed to inhabit a semi-clestial region high in the Himalayas" (Shashi, 1971). Indian iconography shows them as attendants in the courts of gods like gandharas. They were called Kimpurushas meaning "what kind (kim) of human beings (purushas). But Sankrityan (1956) holds the view that 'kimpurusha' is a distorted form given to enslaved and defeated Dasas. The term Kinner has found mention at several places in the Sanskrit literature and other literatures of India. Jataka stories have given the physical depiction of the Kinners as half horse - half man headed or Aswamukha (Shashi, 1971). Kinners have been praised by the great Sanskrit scholar Kalidasa in Meghdoot. However, Kinners find no mention of themselves in the Rigveda. The Kinners themselves believe to be one among the Khasia or Khasa (Khasha) of the Himalayan region (Dey, 1961). Kinners are known to have lived in the high western Himalayas, South of Kashmir and north-west of the Jaunsar-Bawar area (Shimla District Gazetteer, 1910).

The language of Kinners or Kinnauras radically differ from that of Bhoteas and also from Hindi of the plains (Fraser, 1820). Presently, ten dialects are spoken at various parts of Kinaur district (H.P. District Gazetteer, Kinnaur, 1971). Tibetan language *i.e.* the one spoken in western Tibet is spoken widely in the villages bordering Tibet upstream of

Pooh in the Nessang, Kuno and Charang villages adjoining Tibet. In addition, Hindi is also spoken. English language is also spoken by the educated.

THE FOREST

The topography of Kinnaur varies from moderate slope to high precipices. The whole district has been divided into three main climatic zones depending upon the precipitation along the entire length of the Sutlej valley. The Nichar area receives monsoon rainfall and has been placed in the wet zone. The area falling between Kilba and Purbani has been placed in the dry zone and the area beyond Purbani and Kalpa has been placed in the arid zone. The soil in the arid zone contains very little humus with poor moisture retention and is sandy with boulders.

The forests of Kinnaur cover 10% of the total geographical area of the district. Most of the area is devoid of vegetation because of poor soil quality and snow. As per National Forest Polity, 66% of the geographical area in the hill states should be under forest cover. Thus the district falls short by a wide margin. The vegetation of the district consists of *Pinus roxburghii, Quercus* species, *Rhododendron* species, *Abies pindrow, Pinus wallichiana, Cedrus deodara, Picea smithiana, Taxus baccata, Juniper* species. However, this list is not conclusive. But the vegetation in the arid zone of Kinnaur is very sparse and of stunted height because of cold. Neoza or chilgoza *Pinus gerardiana* forms the major naturally growing species in the arid zone. The nuts of this species are edible and fetch good price in the market. The export of this nut has improved the economic conditions of the right holders of the district.

Minor Forest Produce

The higher reaches of the distric have got many herbs and shrubs - for which Himalaya is famous - which have been identified as of high medicinal value. Notable among these are *Dioscorea deltoida, Viola* species, *Digitalis* species, *Aconitum hetrophyllum, Sassurea lappa, Artemisia* species, *Atropa belladonaetc.* Most of these are collected by the right holders and exported for sale in the market. They have found use in the preparation of dyes, essences etc. in addition to medicines. However the indiscriminate extraction of herbs, roots and seeds is threatening their sustained yeids (Karwasra, 1976; Anon. Report, 1991).

CONCERN FOR THE DETERIORATING ECOSYSTEM

The Himalayan ecosystem - Kinnaur included - ought to be tree - generating. Instead tree - felling has become a common practice resulting in creating of upland deserts. Much damage to the ecosystems of these areas has been done in the name of development. All these have been done at the cost of the sufferance of the local people and forests (Banerjee, 1994). Mountain environments have been ruthlessly assaulted. Kinnaur has not escaped from the clutches of assault in the name of development. Mountains being sensitive in their make up: tectonically, meteriologically and biologically, are most susceptible to the slightest disturbances and the consequences can be catastropic.

With the deterioration of the environment there has been concern all around. Fossils excavated around the district Kinnaur have shown the area to have had abundant vegetation. But now there is little or very little of the vegetation left. Efforts to plant the areas are not an easy task. The moisture and the humus content of the soil is very low. This requires identification of such species which can withstand the rigours of the area. Some species suitable for the area have been identified (Banerjee, 1993). This area requires special treatment for planting and this warrants re-orientation of the forestry research methods (Banerjee and Banerjee, 1995). This includes the methods to conserve the moisture of the soil so essentially required for planting. Some plantation work has been done by Desert Development Project (DDP) but the area requires still more dedicated efforts (Anon., 1981).

It takes a few minutes to fell a tree, but it takes years for a tree to grow the mature. The cold weather makes the growth of a tree very slow. The Kinner society is very much dependent on the trees. The edible nuts of the chilgoza pine have improved the economic conditions of the people. Damage to the ecosystem in the name of development is for everyone to see. Blastings made for making roads and hydroelectric projects in the area have made the strata more unstable. Road blocades due to this are now more frequent. In a case study from Central Himalaya, Haigh (1984) has discussed the social impact of the deforestation and road construction. These two factors have been identified in giving instability and weakness to a hill slope. Haigh has suggested factors of safety while constructing a road in such unstable terrains. However, such studies in the north-western hills of Himachal Pradesh are not forthcoming.

Nothing short of a revolutionary departure from the colonial strategy of the forest management can arrest the alarming rate of loss of forest cover and ensure successful and rapid afforestation in the Himalayan region. Strategy for forest management should no longer be seen as a collection of timber-producing trees but as an ecosystem of soil-water-vegetation in which trees play a number of significant roles, of which the production of timber is only one.

Involvement of the people, especially the local people in re-organising the forest management is the new concept. This involvement has helped in improving the ecological status of the area. This is required to be adopted in the Kinnaur district more vigorously as has been done elsewhere in the country. The population of cattle in the district is very high and their growth rate in the north-west Himalayan region is very high (Gupta, 1983). This has reduced for availability of grazing area per animal (Singh and Saxena, 1980) in the region. The cattle and the livestock population need to be reduced so that the balance of biomass could be attained. Rules are required to be framed to minimize cattle holding per invididual family per capita basis and only high yielding varieties be allowed to rear. This will help in reducing indiscriminate use of grass lands by a society which is predominantly pastoral. Further, unless suitable alternatives of energy are discovered, uncontrolled collection of fire-wood for cooking food and keeping the home warm would continue to add to the problems of the area. Now-a-days LPG, kerosene oil and fuel-efficient *chullahs* (stoves) are being made available to the local inhabitants. Almost all the villages of the district have electricity, but the people are yet to be motivated in large number in reducing their dependence on firewood.

Man has paid heavy price for playing with Nature. Attributes of civilisation have often been found bearing inverse relationship with world ecosystems. Maya civilisation of Central America suffered severe setbacks due to ecological mishaps, and the fertile valleys of the Tigris and the Euphrates turned arid 'due to erosion and accumulation of salts'. Mountains, forests and streams were worshipped and required offerings because they had power to affect weather, crops and fertility. In order to protect the ecology of the area, which if disturbed, will effect the local inhabitants most, a movement similar to 'Chipko' movement of Uttar Pradesh hills is required for Kinnaur to save it from the scourge of ecological catastrophe.

DEVELOPMENT - AT WHAT COST?

Development programmes in the hills are not uncommon. Large scale programmes have been executed in the mountains to tap the vast hydro-electric potential of the Himalayas. But these development programmes seldom help the local people. For the betterment of mountain economy and to ensure that the pressure on the Himalayan hills and its environment is checked and ultimately removed, development programmes have to strengthen the growth of production systems which are self-reliant, with minimum dependence on external forces. These programmes should promote the sustained use and growth of local resources. The primary concern, however, should be to ensure a long-term sustainability even at the cost of reduced short-term gains. This will not only help the local inhabitants economically also help stabilise the area ecologically.

CONCLUCION

Kinnaur and Kinners today do not epitomize singing and dancing. The inhabitants are educated and modern in outlook. The district has large hydro-electricity generation potential. The influx of outsiders has changed the outlook of the locals and the various development works have affected the ecology of the area. All these are robbing the once mystic land of its mystique.

KEY WORDS AND ABSTRACT

KEY WORDS Kinnaur. Kinner (Kannaura). North-Western Himalaya.

ABSTRACT Himalayas have long been identified with Indian culture. It has provided us with beautiful flowers, invaluable raw materials for medicines, perenial river water besides food and wood. Numerous articles, poems have been written on Himala-

yas eulogising its role. Indian mythology regards Himalayas as the most firm object on the world. But geologists have now identified Himalayas as the youngest mountain and it is still growing. Kinnaur district of Himachal Pradesh fall in north-western Himalayan region. Years of isolation has given it a mystique look. Kinners, as the inhabitants are known, find mention in Indian mythology and culture as the celestial choristers. The present article deals with Kinnaur, its people and its forests.

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ANNEXURE - 1

KINNAUR AT A GLANCE

1.	Area (sq km)	=	6400
2.	Total Rural Population	=	59,547 (49,837 in 1971)
	Male Population	=	31,598
	Female Population	=	27,949
3.	Population per sq km	=	9
4.	Number of females per 1000 males	=	885
5.	Total scheduled castes population	=	6331 (10.63% of the total population)
6.	Literacy	=	41.71%
7.	Total number of inhabited villages	=	77
8.	Number of household	=	12,457
9.	Number of occupied residential households	=	12,229

Source : Census of India, Series 7 (Himachal Pradesh) - 1981

Authors' Address : **U.K. Banerjee and Shubhra Banerjee,** Department of Silviculture and Agroforestry, University of Horticulture and Forestry, Nauni 173 230, Solan, Himachal Pradesh, India

Loss of Iodine from Iodised Salt During Traditional Way of Storage in a Rural Setup of Assam

S.K. Sharma and J. Mahanta

INTRODUCTION

Iodine deficiency disorders (IDD) are still considered as a major public health problem in our country (Ramalingaswami, 1973). High prevalence of goitre and cretinism was documented from various parts of the North-Eastern region, a Sub-Himalayan belt of India (Agarwal and Agarwal, 1993; ICMR, 1989). Environmental deficiency of iodine is considered as the major contributing factor for the development of iodine deficiency disorders. Supplementation of iodine by the distribution of the iodised salt commenced in India since 1984 in a phased manner. Considering the high prevalence of goitre and related iodine deficiency disorders as well as the geographical location of the North-Eastern region the sale of the noniodised salt is banned in this part of the country. Though the supplementation of iodine was initiated a decade back in this region. Still the prevalence of goitre was fount to be remarkably high (Patowari, 1993).

Loss of iodine from iodised salt during storage and transportation was documented earlier (Gopalan, 1987). Poor outreach of iodised salt was documented from the North-Eastern state, Assam (Sharma et al., 1992, 1994). The region has a humid tropical climate and also experiences heavy rainfall and frequent flooding.

Considering the aforesaid geo-climatic features, the present study was designed to evaluate the loss of iodine from iodised salt in the kitchen condition from this part of the country. It is also observed that in most of the rural sets-up of the North-Eastern region salt is traditionally stored in gourd shells, bamboo stump, unpolished earthen pots etc. In the present study an attempt was also made to find out the loss of iodine from iodised salt on storage and to suggest the suitable storage devices.

MATERIAL AND METHODS

The loss of iodine from iodised salt on storage in kitchen condition was evaluated by distributing the iodised salt to 20 randomly selected households under the Lahowal Primary Health Centre (PHC) of Dibrugarh district, Assam. A packet of iodised salt with known amount of iodine was provided to each household and requested to store the same according to their usual way of storage. Housewives were specifically requested not to mix the supplied salt with any other salt and to use the said salt for day to day household consumption. Iodine content of the salt samples were determined prior to the distribution of the salt by standard volumetric method (Karmarker, 1986). About 15 gm of salt were collected on every alternate day and iodine content of the salt samples were determined by standard procedure mentioned above.

To evaluate the loss of iodine on storage in different containers salt samples with known iodine levels, in duplicate, were stored in traditionally used containers like bamboo stumps, gourd shells, unpolished earthen pots and conventionally used plastic containers. Iodine content of the salt samples were determined weekly for a period of three weeks. Loss of iodine from these containers in covered and open condition was also evaluated.

RESULTS AND DISCUSSION

The loss of iodine from iodised salt in kitchen condition was found to be substanitially high. Though salt samples were distributed to 20 randomly selected households only 19 families cooperated in the study. Thus, the response rate was 95%. The mean iodine level of the 19 salt samples was 54.33 ± 4.96 ppm at the time of distribution of the salt. The average loss of iodine from the salt samples, in every alternate day, is represented in figure 25.1. It was observed that in the second day the loss of iodine was in the tune of 5.18 ppm (9.53%) and gradually raised to 30.53 ppm (56.2%) in the 20th day.

Table 25.1 represents the average loss of iodine from iodised salt stored in different containers. The mean iodine level of the salt samples, at the time of storage, was 49.28 ± 3.61 ppm. The loss of iodine, after three weeks of storage, was found to be max-

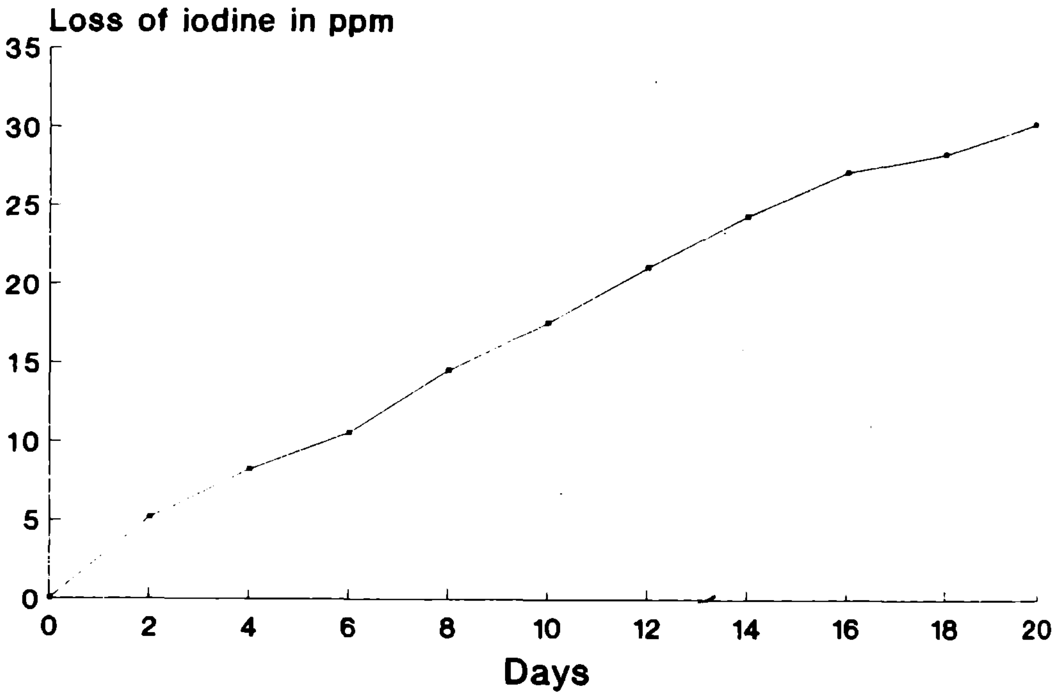

Fig. 25.1. Loss of iodine on storage in kitchen condition

imum (96.29%) when stored in unpolised earthen pot. Plastic container was found to be the most suitable storage device for the storage of iodised salt where loss is minimum (44.1 to 52.8%). Among the traditionally used storage devices, bamboo stump was found to be better than that of the gourd shell. Further it was also observed that the loss of iodine on storage can be minimised by keeping the salt samples in covered condition. In all storage condition loss of iodine was found to be substantially high (44.1 - 97.66%) in three weeks period. However 55-65% of the total loss occurs in Ist week and 88-100% of total loss in 2nd week of storage.

The present study revealed that the loss of iodine from iodised salt is considerably high in this part of the country in the kitchen condition irrespective of storage conditions. The loss was found to be of linear in nature. This may be due to high humidity and temperature of this region. Storage condition as a factor for the loss of iodine from iodised salt was also documented by Gopalan (1987). However, in our study, it was found that variation of loss of iodine can also be attibuted to the containers. Unpolished earthen pot was found to be unsuitable container to store iodised salt. The porosity of the earthen pot attributes to the leaching of iodine. Yet, this fact needs more elaborative study to establish the fact.

Loss of iodine was found to be more when stored in open conditions. This may be due to the absorption of moisture from the high humid atmosphere of Assam. Ranganathan and Nara Singa Rao (1986) also reported that the loss of iodine from iodised salt is associated with humidity and temperature in

Table 25.1 : Average percentage loss of iodine from iodised salt on storage in different containers

Period of storage in weeks	*Bamboo stump*		*Gourd shell*		*Unpolished earthen pot*		*Plastic container*	
	Open	*Covered*	*Open*	*Covered*	*Open*	*Covered*	*Open*	*Covered*
Ist	39.74	10.26	46.25	16.26	63.92	58.02	29.38	9.00
2nd	62.96	58.04	73.45	65.62	96.29	97.66	46.96	34.41
3rd	68.00	62.29	77.11	68.72	96.29	97.66	52.83	44.18

addition to other related factors.

The poor outreach of iodised salt as reported earlier from Assam may be correlated with environmental factors like high humidity, heavy rainfall etc. Therefore, in order to prevent the problem of ioding deficiency disorders in the population in addition to the distribution of regularly monitored iodised salt, public awareness is also very much essential

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KEY WORDS AND ABSTRACT

KEY WORDS Iodised Salt, Loss of Iodine, Traditional Storage Devices. Storage Loss.

ABSTRACT An attempt was made in order to evaluate the loss of iodine on storage in kitchen condition as well as storing in various containers including traditional storage devices. Loss of iodine was found to be as high as 56.2% on storage in kitchen condition in twenty days period. Covered plastic container was found to be the most suitable storage device. This was followed by traditionally used container like gourd shell and bamboo stump. Maximum amount of loss of iodine was documented from iodised salt stored in unpolished earthen pot. The loss of iodine from iodised salt can be minimised by storing in covered condition.

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Authors' Address : **S.K. Sharma and J. Mahanta**, Regional Medical Research Centre, N.E. Region (ICMR), P.O. Box - 105 Dibrugarh 786 001, Assam, India

Skilful Art of Weaving : A Study Among The Tai Khamyangs

Indira Barua and Bornali Das

INTRODUCTION

In the growth of human civilization, the introduction of weaving no doubt made a significant impact. We find that in human history, food, shelter and clothings are considered as the basic needs of human life. But on the basis of necessity and from the perspective of 'survival', their importance varies. At times it is argued that an individual can live a life time without shelter and cloth, but denial of food means certain death. Occasionally, it is also stressed that sex is the most vital need of the people. Of course, in the initial stage of human development, simple 'survival' was the basic issue of human beings, and men met the demand of clothing in the minimal way, and the needs were fulfilled from the environment itself. The use of clothing does not arise out of any innate sense of modesty, but the modesty results from customary habits of clothing or ornamentation of the body and its parts. Clothing was the next art after agriculture and building to acquire economic importance. With the introduction of an artificial dress material, the savage stage of evolution come to an end. Textile and textile designs of a people are an indication of the state of advancement in their material culture. Textiles are also a record of the historical, technological and mental development of the people who make them and for whom they are intended.

In the present study, an attempt has been made to describe this beautiful art of weaving and its related significance among the Tai Khamyangs of Assam.

HISTORICAL BACKGROUND

The Khamyangs or Khamjangs are a section of the Tais, who entered Assam about the beginning of the 18th century. The Tai culture is very old and rich, and its members are to be found from Assam to far into the Chinese province of Kwang-Si and from Bangkok to the interior of Yunan. Perhaps, they extend even farther into several other South-east Asiatic countries. The various 'Tai' groups entered Assam at different intervals of time. The earliest 'Tai' group that entered Assam were the Ahoms. The Ahoms, who under the leadership of Sukapha crossed the Patkai ranges in the year 1228 A.D. as conquerers and ruled about 600 years in Assam. The second group of the Tais entered Assam between the mid-18th and 19th centuries. This group comprised five divisions. They are the Khamti, the Khamyangs, the Aitons, the Phakiyals and the Turungs. The Tai or Shan languages spoken by these groups "belong to the Siamese Chinese family of the Indo-Chinese forms of speech" (Grierson, 1966:59).

The Khamyangs together with the Aitons and the Turungs are commonly known as the 'Shyam'. The word 'Shyam' is derived from the word 'Shan' by which the 'Tais' are also known. According to Grierson, the persons known to us as Khamjangs or Khamyangs are a section of Nora, who formerly resided on the Patkai range. Frequent references are made to them under that name in the Ahom chronicles. Occasional reference has also been made that this group once settled for a long time near Nongyong (Khamyang) lake, which is situated on the present Indo-Burmese border. It is believed that the name of the tribe Khamyang is derived from that lake. But the villagers forwarded a different view. According to oral tradition, the Khamyangs were in Assam for many centuries. After the first Ahom king Sukapha settled in Assam and considered this land suitable for permanent settlement, he sent his brother back to the region, now known as Burma to inform the Khamyangs about his conquest. According to this version, the Khamyangs claimed to have entered Assam along with the Ahoms. But it is difficult to confirm this version of the Khamyangs' migration and settlement in Assam. At the same time, it is a historical fact that the Khamyangs were assigned the duty of guarding the pass over the Patkais by the first Ahom king Sukapha. Later on, they left the settlement owing to the constant raid of the Kachins. Their late entry into Assam is also historically confirmed.

At present, the Khamyang villages are situated mostly in the Śibsagar and Jorhat districts of Assam. The number of Khamyangs counted at the census of 1891 was 751. At least, fourteen Khamyang villages could be traced, but during the last several years, many Khamyang families migrated to Arunachal Pradesh. The data for the present study has been collected from "Chola Shyam Gaon" situated in the Charaideo sub-division in the district of Sibsagar. It is about 40 km away from Dibrugarh town. The village is of moderate size and located on the western bank of the Saffrai river. There are 88 households with a total population of 685 souls. The total number of male is 345 and that of female is 340.

The Khamyangs are Buddhist by religion and the Vihar in each village plays an important role in their socio-religious life. They mostly speak Assamese in their day to day life. At present, there are only a few elderly persons, who know the Tai language. But they use various Tai words in their daily life, though it is difficult to trace their origin. Some of them also know Pali language and in every village, there is a provision of teaching Pali by the *Vikkhu* in the Vihar. Family is the smallest social unit and the number of nuclear family is slightly higher than that of the joint family. The traditional house type among the Khamyangs is pile-dwelling or platform type (*Chang-ghar*). But gradually it is in the process of elimination, due to scarcity of wood and bamboo in the neighbourhood. But still there are considerable number of *chang-ghars* to reflect their tradition.

The people are mostly agriculturists and their day to day activities are all centered around agriculture. *Ahu* and *Sali*, two varieties of paddy are the staple crops cultivated by the villagers. Among the Rabi crops they cultivate cabbages, potatoes, brinjals, turmeric, etc. A few villagers cultivate mustard and brinjal as cash crops. Apart from cultivation of cash crops, the people have a good deal of economic benefit from the practice of weaving as a domestic art.

ORIGIN OF CLOTHING

Before describing the significance of weaving among the Khamyangs, it is intended to describe very briefly about the origin of clothing. No one really knows for certain, when man started weaving cloths. Even Adam and Eve were known of their nakedness, when they had eaten the fruit of knowledge. Then they made aprons of fig leaves to cover their nudity. There are various hypotheses regarding the origin of clothings. One hypothesis emphasized that clothing originated in the decorative impulse, while the other put forward that male jealousy instituted clothing for the married women. Friedrich Ratzel (1844-1904) who originated the term "Anthropogeographie", stressed that if clothing was originally instituted with the idea of bodily protection only, the feet would have been protected first. Clothing he holds, stands in unmistakable relation to the sexual life. "The first to wear clothes is not the man, who has to dash through the forest, but the married women". The primary function of her dress was to make her rather unattractive to others by concealing her body. In the lower strata of human evolution, dress was considered as a protection from rain and cold.

All the primitive peoples, even those who put no clothings wore a single girdle. The modern version of the girdle is the belt used to keep the skirts or trousers up or the string to hold up the pyjamas. In the early stages, however, there was nothing to hold up and the girdle was used for its own sake. Its first form came from nature, the pliant bough or steams. It was mainly a male appendage, neither very tight nor very loose, and it was not a suspender, but a pocket. The savage man found it invaluable for carrying things, which would otherwise engage his hands and hamper his movement. This may have led to the idea of a suspender and may have been the beginning of later use as such.

By unconscious selection, the evolution of dress probably followed a course based on hygienic need. Of course, the primitive people had very little knowledge of hygiene, but in tropical regions, some form of dress was used for protection against the elements. The use of bundles of leaves and grass become natural and inevitable as soon as the girdle was there to hold them on. Along with improving the quality of clothes, the primitive man was gradually improving the technique of making it fine and smooth.

Another natural covering is the tree bark. In tropical countries, where scanty clothing is needed, certain trees have an inner bark which may be used for wearing purposes. It produced an excellent clothing, the best example being the celebrated Tapa of Polynesia. "In regard to the material employed in the manufacture of clothing, the most significant fact was the substitution of a kind of flax

(*Phormium tenax*) for the beatean *tapa* (bark cloth) manufactured from the inner bark of paper mulberry tree elsewhere in Polynesia" (Piddington, 1957:503). Bark was once used extensively in India for making clothes for *sanyasis* and mendicants. Mantles, cloaks and caps in the barbarian stage were confined to, certain particular purposes *i.e.* protection against rain, wind and the sun. In later stages, the use of these objects became a regular feature of outdoor life. Colour in dress involves many problems of aesthetic, psychological and biological importance. Behind fashion in colour, there seems to be a principle of unconscious adoptation to environment. There is no essential co-relation between the amount of clothing worn by a people and the nature of their habitat. Fitted clothing is found among the people who live in colder areas, while draped clothes are used by those who inhabit warmer regions.

The making of cloth is one of the most ancient of civilized craft. Its first requirement was a supply of natural fibres - vegetables such as cotton and flax, or animal - such as the wool of sheep. Weaving had its beginning among primitive peoples in the twisting, braiding and interlacing of grasses and coarse plant fibres in order to make simple garments, floor mates and other articles. Many people have contributed to developing this industry. But the finest machine in the world cannot spin threads comparable in fineness to many of the early hand-made materials. Textiles are woven in Africa, Mexico, Central America and the Andean highlands and in Eurasia except in the arctic and steppe areas, where skin clothing is found. Skins also predominate in the southern and eastern parts of Africa. Silk weaving was mentioned about 2600 B.C. and the earliest known Chinese textile is silk. It was being imported to Persia, Afganisthan and the Mediterranean countries long before the dawn of history. Weaving establishment were found in Egypt and fine needlework or embroidery seemed to have had its origin in ancient Egypt. Regarding the design, it may be assumed that it emerged from their experience in daily life. Primitive people decorated their caves, canoes by drawing pictures and art motifs, which they experienced in their daily life. When men started needlework or embroidery, they took the idea of those geometric art and tried to reflect those motives in their works on clothes. Early men probably regarded weaving as a mystic art.

Along with development, considerable progress is made in the weaving industry. But hand-loom weaving is by no means extinct, indeed it is still very flourishing and highly skilled craft actively followed in many parts of the world. India alone has still over 20,00,000 hand-looms at work. Cloths of the world reknowned quality of Harris tweeds are still made on hand-looms of great age and simplicity. (*The Book of Knowledge*, **Vol. 7**: 151, Stowell (Ed.).

Assam has a glorious cultural tradition in textile and handloom weaving. Hand-loom industry is the most important cottage industry in Assam. It has its rich traditions of woven textiles made from different materials using a variety of techniques for the processing of materials for weaving and embellishing. Even within the region, there are variations in styles of weaving which have been retained on account of distinct cultural traditions expressed through the people's ceremonials and rituals. It was mentioned by Das (1968) that a piece of cotton was found in a silver pot at Mohenjodaro, where the evidence of spinning of cotton and woollen thread could be traced. Gogoi (1982) narrated that during the pre-Ahom period also rearing of silk worm and weaving was known to the people of Assam.

Assam enjoyed a high reputation for producing silk of fine texture. The Muhammadan historians noticed that the silks of Assam were excellent and resembled those of China. In handwoven fabrics, cotton, *muga*, mulberry and *endi* are the basic raw materials. *Muga* silk has a natural golden colour and rare shining glow, which becomes more lustrous after every wash. "Assam silk, specially *Muga* was very much in demand in Europe, and it formed the staple trade of the East India Company during the 18th and early 19th centuries" (Gait, 1967:271). *Endi* is a mild warm silk, particularly suitable for winter. Hand-loom textiles have occupied a very important place in the economic and cultural life of the state and are still reckoned as a prestigious cottage industry.

There are eight different types of hand-looms used by the people of North-East India. These are (i) throw-shuttle loin weaving (ii) throw-shuttle loom (iii) fly shuttle loom, (iv) throw shuttle portable table loom, (v) fly shuttle frame loom, (vi) fly shuttle stey on pit loom, (vii) fly-shuttle stey on four posts and (viii) fly-shuttle Jacquaral loom and Dobby loom.

The instruments used for weaving along with the loom was made of wood, bamboo and cane. They are *Jatar* (Charkha), *Hale kati* (healed stick), *Bow* (heald), *Rass* (Reed), *Maku* (shuttle), *Mahura* (pirn), *Uqha* (bobbin), *Putol* (temple), *Kathi Rakha Sereki* (lease stick), *Garaka* (treddle of peddle), *Nasoni* (pulley), *Nasoni mari* (pulley bar), *Huta bharua Haku* (benting hook), *Dighol dung* (long lam), *Suti dung* (short lam), *Toldhara Dang* (balanced rod), *Nasoni Hoja* (jack frame), *Sereki* (suift or pool). Types of loom vary on the basis of ecology as well as culture. Certain looms are convenient for hilly areas, whereas others are suitable in the plains.

The art of dyeing was known in Assam from time immemorial. The dyes are procured locally from herbs and trees. The chemistry and methods of the preparation vary from place to place as well as from tribe to tribe. The types of trees and herbs used for the preparation of dyes are indigo plant (*Indigefera*), *Halodhi* (*Curuma lenga*), *Sewali* (*Nyethanthes arbartristas*), *Palash* (*Butea frendosa*), *Juatic* (*Bixa-ovellana*), *Rum* (*Strebilanthes flaceidifelius*), Gam lack. Although these plants are found all over Assam, every ethnic group guided by its cultural varieties chooses the colour of its own. Each group considers a certain colour or some particular colour as its exclusive possession, which no other group lay claim to. Most of the colours are procured from plants. The gum lac or laccic has been mistaken for a vegetable product, but is in fact an animal substance somewhat of the nature of cochined and is the product of an insect resembling the bee, which deposits this glutinous sediments on the branch of certain trees adhering to it. It is brought from there and bears the name of stick lac.

TEXTILE WEAVING OF THE KHAMYANGS

Hand-loom weaving is the proud previlege of the womenfolk of Assam. It is a folk art and the handloom weaving is unfold genius in its colour scheme, floral design, texture and durability. The Tai Khamyangs have their traditional dress pattern, colouring, textile design, etc. Both traditional and modern styles of clothes are worn by the Khamyangs. Clothes may serve to differentiate individuals or groups from one another on a basis of sex, age, occupation, rank or other social functions. "Individual of different ages are recognized in all cultures by variation in dress, prescribed behaviour patterns and differential social status" (Piddington, 1963:175). Clothings also serve to define ceremonial occasion, particularly those connected with religious ritual, marriage and mourning. Besides, it also provides satisfaction for self-assertive tendencies through display and it is indeed sometimes difficult to distinguish between clothing and ornament.

The traditional dress of the Khamyangs is also categorised on the basis of age, ritual activities and position or status. The people as a whole are followers of *Panchasheel*. In general, the male wear coloured strip *lungi* and a shirt. They also use *tangali*, which is simply a cloth belt. One *Khania Kapur* (long piece of cloth) is used to keep over the body. *Gamosa* (linen) is invariably used by one and every male. Though the youths use all sorts of modern dresses yet they also wear *lungi* and a shirt when visiting the Vihar on ceremonial occasion. But the *Asthasheel* (followers of eight principles) holder male uses white *dhuti*, instead of coloured *lungi* and white *Punjabi* shirt. The aged wear white *paguri* (turban) on the head. Generally, the *Asthasheel* holders do not use any foot wear. They also use a white *khonia kapur* or a wrapper to lay over the body and a *tongali* is tied around the waist.

The traditional dress of women may also be categorised on the basis of age and ritual activities. They wear black coloured *mekhela*, which is dyed at home. They also put on a girdle around the waist called *Sai-kup*. It is red in colour and made of cotton thread. There are some designs called *Kukura peto* on both the ends of *Sai-kup*. The length of a *Sai-kup* is 2.20 meter and the breadth is about 15 cm. For covering the breast, formerly the Khamyang women used a long striped cloth called *Fa-Nang-Wat*. It is about 2.3 meter long and 1 meter wide. But now-a-days the women use blouse of various colours in place of *Fa-Nang-Wat*. It is said that before attainment of puberty, the girls do not wear it, instead they wear a white cloth *Fa fek*, with or without border for covering the upper part of the body. Custom has it that if a girl has an unmarried elder sister, she does not put on a *Fa fek*, even after attaining puberty. Non wearing of *Fa fek* is a sign of unpreparedness for marriage.

The *Panchasheel* holder women use the above mentioned dresses. But the *Asthasheel* holder use white *mekhela* and *chaddar* instead of black ones. Some of the elderly women wear white turbans when they visit the Vihar or its yards. They also put on a garland containing 101 beads each. Along with the changing scene, the Khamyangs' dress patterns have also changed. The school and college going children wear trousers, shirts, sareees, frocks, etc. But when they visit the Vihar at routine hours, they invariably use their traditional dress. Now a days, the girls wear black *mekhela* with various decorative floral designs even when they visit the Vihar on ceremonial occasions.

The Khamyang women weave most of the above mentioned clothes in their own looms. A loom is generally made of bamboo, and has a wooden frame. Four solid strong wooden or bamboo posts are required to make the frame. The domestic handloom is structurally almost the same as the throw-shuttle loom. But a special feature is noticeable in the Khamyang loom *i.e.* the Tai *maku*. The *maku* is a wooden slender structure about 36 cm in length and 5 cm in breadth, with a rectangular central cavity in the middle for filling the spindle with yarn. A fine slit is on the side of the cavity in the middle to pass the yarn through the *maku*. A *maku*, which should be heavy one for convenient use is preferably made of *Nahar* (Mesua ferrea) wood. But while preparing *Sai-kup*, they are to use *Tai maku*, which is a distinguishing feature of Tai material culture. It is also made of wood, but bigger in size than the normal *maku*. Its length is 90 cm and the breadth is 10 cm.

The Tai Khamyangs have their own way of dyeing process. Only black colour is processed by them. The dyes are procured locally from herbs and trees. They use wild plant *Rum* (*Strebilanthes flaceidifelius*) to dye their *mekhela* in black colour. The plant *Rum* is about three feet in height and it is found in most of their kitchen garden. First, leaves are removed from the branches and kept soaked in water until these are diluted. It requires 3 to 4 days to soften the leaves. Then alum is added in the solution and the mixture is stirred. After sometime there appears a sediment from which the clear liquid is separated. The sediments are then preserved in an earthen pot for about 15 days. The sediments are then mixed with *borthekera* (graciapedun-culata), *modor mewa* (residue after preparation of indigenous alchohal, rice beer), *kharoni* (ash of the banana leaves) and a little amount of black dye, which is kept preserved unused over the year. The cloth is kept dipped into the mixture for about 30 minutes and then placed in the sun-light for drying. This is repeated for 4 to 5 times. The cloth is dipped again and again in a mixture of another liquid for permanency of the colour. When the whole process is analysed it is revealed that it is a time consuming method. It also requires varieties of materials in the dyeing process. At present, very few elderly women know this art.

Certain beliefs and superstitions are always associated with every sphere of human life. As weaving is considered as one of the important skills and arts of womenfolk, certain beliefs are associated with it. Any work connected with weaving is never started on Tuesdays and Saturdays. Generally, weavers try to complete their weaving work before *Bohag bihu i.e.* the community festival observed for seven days from mid-April. A cloth then remains unwoven or incomplete till the eve of the festival day is called *Bihu sera* cloth. A *Bihu sera* cloth is a sign of bad omen. People believe one will not achieve success if one wears it.

DAILY ACTIVITIES OF WOMEN

As weaving is exclusively a feminine job, it is pertinent to explore and understand the activities of women in a household. The Khamyangs lead a homogeneous group life and their life style is very simple. While there is hardly any rigid difference in work sphere on the basis of sex, ploughing is invariably a masculine job. Most other works, like milking, rearing of cattle, collection of fire wood, collection of wild seed for preparation of colour, fetching water, etc. are done by the womenfolk. On account of their laborious background, the Khamyang women generally remain active and hard working even in their advanced age. Hard working is a characteristic feature of the Thai women in Thailand also (Terewiel, 1980). During the agricultural season, apart from their usual household chores women spend several hours in the paddy fields. So, their workload increases many fold during the agricultural season. During the rest of the season, the women's workload is reduced considerably and they get sufficient leisure time for weaving.

From empirical observation, it is noted that the women are mainly engaged in household works in the morning hours from 4 a.m. to 8 a.m. or so. Early morning works include cooking, washing utensils, cleaning the dwelling house and the cowshed and the courtyard, washing clothes, etc. The Khamyang women are seen to be most attached to the young babies especially up to the age of 3-4 years. Those women having school going children remain engaged heavily with the young ones, both in the morning and afternoon hours. Such women have some respite during the mid-day hours; keeping them engaged in weaving and petty domestic jobs. But for women having small children, it is a full time job. Maximum time devoted in the weaving work is forenoon hours, from 10 a.m. to 2 p.m. and in the evening *i.e.* 8 p.m. to 12 morning. In the evening, the women become relatively free from domestic work.

The multi-dimensional roles played by the womenfolk in the Khamyang society is noteworthy. Every conscientious Khamyang woman is careful enough to spare some substantial time amidst heavy house-hold burden for spinning, weaving, dyeing or any other petty work connected with weaving, in some way or other. Thus weaving supersedes most other domestic works. This has helped retain the traditional one, despite cut-throat commercial competition beyond their village periphery. In case of weaving, the performance of male counterpart is also noteworthy. It is the males who generally make the main frame of the handloom and other component parts. Womenfolk procure the yarn from the nearby weekly market. Occasionally, males also buy the necessary yarn for their women.

The socio-religious significance of weaving is reflected in various spheres of Khamyang life. The religious significance is manifest from a festival called Poi Kathin. Generally, it is held in the month of *Kartika* (November) and at least five full sets of *Sibar* (monk's dress) are to be offered to a group of *Vikkhus* (at least five in number) belonging to different monestery. Among all the gifts, the people believe, the gift of *Katin Sibar* to a *Vikshoo Sangha* has great significance. It was reported that in olden days, the *Sibar* had to be prepared in a day's time *i.e.* from sunrise to the following day's sunrise. The preparation of the full set of *Sibar* within a day requires the combined efforts of all the women members of a village. The expertise and skill of weaving is reflected in such occasions.

The social significance of weaving is also noteworthy. Skill in the art of weaving and spinning is invariably held to be a highly socially significant accomplishment on the part of an Assamese woman. The girl who is unskilled in weaving is referred to as *'thupori,* meaning inept and unskilled and is not sought for as an accomplished bride. The social value attached to the skill in weaving and spinning was reflected by the derisive song in many communities. Among the Maori, it is sung "who will marry the women too lazy to weave garments" (Piddington, 1963 : 172). Among the Khamyangs also, this qualification is sought after at the time of marriage. It is rather a matter of prestige and obligation on the part of a marriageable girl to weave the artistically designed weeding clothes needed at the time of marriage. Besides the matrimonial sets of clothes, the Khamyang women need varieties of clothes for festive occasions and also as gift and presents to the guests. The Khamyangs, simple as they are, are seen to be more swayed by down to the earth needs of the society. Piddington (1963:173) observes, "Thus, it is found that such practical considerations receive, in general more attention in simple society than personality". In their day to day life, the Khamyangs still use hand-woven fabrics, even though the market is flooded with commercial mill-made clothes.

It has already been mentioned that clothing was the art next to agriculture that forms the economic base. The consumption pattern of clothings is difficult to measure in terms of money. But during investigation, it was confirmed that while preparing clothes at home, these could be made at half the market price. One of the women informants reported that of all varieties of clothes, the maximum number produced is *gamusa* and *chaddar* over a period of one year. She gave the approximate cost of weaving 11 pieces of *gamusa* as follows :

Kessa (raw) thread 9 *muthi*	9.00	x 9 =	81.00
Asu (border) thread 1 *muthi*	16.00	x 1 =	16.00
	Total cost	Rs.	97.00

Therefore, for one piece of *gamusa* she spent only Rs. 8.81 approximately. But in the market, the price of an ordinary *gamusa* is about Rs. 15.00 to Rs. 20.00.

In the same way, she gave me an approximate idea about the expenditure of the home made *lungi*. The thread required for 3 pieces of *lungi* is as follows :

Pakka thread	6 muthi	12.00	x 6	Rs. 36.00
Wool	1.5 kg	200.00	x 1.5	Rs. 300.00
Anchor thread	30 lesi	1.60	x 30	Rs. 48.00
	Total cost			Rs. 384.00

Thus, it is found that for one piece of *lungi*, the cost is Rs. 128.00 (approximately); whereas the market price for the same is Rs. 200.00. Further, the type of *lungi*, the Khamyang males use is not available in the open market, it is embossed with artistic design and is mostly confined to the Tai Buddhists only. So, non-Buddhists or non-Khamyangs purchase it as a unique sample piece of Khamyang culture or as museum exhibit. Moreover, the Khamyang women make beautifully decorated hand-bags, costing normally Rs. 80.00 per bag. These goods are not generally produced with profit motive, yet its economic implication cannot be ignored. Besides weaving *chaddar*, *mekhela* and *lungi*, the women folk also produce fabrics of various other essential articles at the domestic loom, *e.g.* curtains, cotton scarfs, rag clothes, mosquito nets, *khania kapur*, etc.

The table 26.1 on "Knowledge about Weaving" shows that almost all weavers know how to weave *riha*, *mekhela*, *gamusa*, and *bags*, the percentage being 98.5 and 95.7. The number of women who possess knowledge of weaving *lungi*, is 57, the percentage being 81.4, whereas the number of women who know the dye process is 31, having the percentage of 44.7.

When the analysis is made age-wise, it is found that in the age-group between 46-50 years and 56-60 years, almost all the women possess the knowledge of indigenous weaving and dyeing process. It was noted that only one woman of the age group between 71-75 years know weaving but lacked the knowledge of dyeing as she belonged to the Ahom community, that was unaccustomed to dyeing their clothes. It may specially be noted that in the age group between 15-20 years and 21-25 years, there is not a single Khamyang woman with the knowledge of weaving *Sai-kup* and dyeing. In the age group of 26-30 years, out of 18 weavers, only 7 are aware of the traditional art of weaving *Sai-kup*, and two have the knowledge of the dye process. Again, in the age group of 31-35 years, out of seven women, only one knows the traditional weaving and dyeing process. In the age group of 36-40 years, out of nine women, three are aware of the traditional weaving and five know the dyeing process. In the age group of 41-45 years, out of ten women, 4 know the traditional art of weaving and 6 know how to dye clothes. Thus, it is also confirmed from the table that most of the women between the age-group of 26-45 years, do not have any idea of their traditional art of weaving *Sai-kup* and other related process. It may be presumed that the younger generations are not interested in learning these traditional processes. This does not mean that they do not have respect for their tradition. Due to the inter-caste marriage also, the traditional art of weaving and dyeing process is gradually diminishing. A good number of marriages occur between the Khamyang and the Ahom community, both in the past as well as in the present generation. The non-Khamyang women do not know the dye process, so they weave *mekhela* with black coloured thread or purchase black clothes. They consider it as an easier way of keeping their traditional value.

Table 26.1 : Knowledge about weaving

S. No.	*Age-group (in years)*	*No. of Weaver*	*Saikup*	*Riha, mekhela chaddar*	*Bag*	*Lungi*	*Dye*
1	15-20	2	-	2	2	-	-
2	21-25	5	-	5	5	5	-
3	26-30	18	7	18	18	17	2
4	31-35	7	1	7	6	2	1
5	36-40	9	3	8	8	7	5
6	41-45	10	4	10	10	8	6
7	46-50	8	6	8	8	8	7
8	51-55	3	3	3	3	3	3
9	56-60	5	5	5	5	5	5
10	61-65	2	2	2	2	2	2
11	66-70	-	-	-	-	-	-
12	71-75	1	-	1	-	-	-
		70	11	69	67	57	32

The study clearly indicates that the Tai Khamyangs have a very rich tradition of weaving and textile pattern. As the textiles are also the record of historical, technological and mental development of the people, it no doubt helps in maintaining Tai Khamyang's identity. At the same time, its socio-religious and economic implication are also noteworthy, But it is also a practical reality that this beautiful art is on the verge of disappearing. So efforts should be made at all levels to preserve this art, which is also an identity mark of an ethnic group. Our great national leaders, Pandit Jawaharlal Nehru and Jai Ram Das Daulat Ram had made the following observation.

"Each section of our large population contributes to the making of the nation, in the same manner as each flower helps to make a garden. Each has the right to enrich and develop its own colour and form and to spread its own fragrance to make up the cumulative beauty and splendour of garden." So efforts should be made to spread the fragrance of each ethnic group for making a colourful Indian Nation.

KEY WORDS AND ABSTRACT

KEY WORDS Khamyang. Rum. Sai-kup. Kathin-Sibar. Asthasheel. Panchasheel. Tai maku. Bihu-sera.

ABSTRACT Textile and textile designs are a record of the historical, technological and mental development of the people. The present paper explores the skilful art of weaving among the Khamyangs, a section of Tai Buddhist community. The study indicates that they have a very rich tradition of weaving, textile pattern and elaborate dye process. Beside the skill of weaving, its socio-religious and economic implications are also noteworthy. Though, along with the modernization, this beautiful art is on way of disappearing, yet the Khamyangs preserve it to maintain their ethnic identity.

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Authors' Address : **Indira Barua and Bornali Das,** Department of Anthropology, Dibrugarh University, Dibrugarh 786 004, Assam, India

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People of the Himalayas : Ecology, Culture, Development and Change

K. C. Mahanta, Guest Editor

Impact of The Central Sector Jhum Control Programme in The Hill Areas of Assam

Girindra Nath Das

INTRODUCTION

The Hill Areas of Assam comprising the autonomous districts of Karbi Anglong and North Cachar Hills cover 15,322 sq km (19.5%) of the State's total geographical area of 78,438 sq km and a total population of 8,13,524 (3.6%) of the State's total population of 2,24,14,322 as per 1991 Census. The Kabi Anglong district lies between latitudes 25°30' and 26°41' N and longitudes 92°7' and 93°52' E and the adjacent North Cachar Hills district lies between latitudes 25° and 25°45' N and longitudes 92°30' and 93°30' E. Physiographically the Karbi Anglong district consists of two hilly lobes genetically belonging to the Shillong plateau of the eastern Himalayas and the two lobes are separated by the Kopili Valley. On the other hand, the eastern flanks of the Jayantia hills and the northern flanks of the Barail range constitute the North Cachar Hills.

The Scheduled Castes and Scheduled Tribes (Amendment) Act, 1976 specifies fourteen tribes in the two hill districts of the State. They are (1) Chakma (2) Dimasa Kachari (3) Garo (4) Hajong (5) Hmar (6) Khasi, Jayantia, Synteng, War, Bhoi, Lyngngam (7) any Kuki tribes (8) Lakher (9) Man (Tai speaking) (10) any Mizo (Lushai) tribes (11) Mikir (Karbi) (12) any Naga tribes (13) Pawi and (14) Synteng. According to 1991 Census the scheduled tribe population in the Karbi Anglong district accounts for 51.56% of the total population of the district, while in the North Cachar Hills district it accounts for 65.54% of the total population of the district. The largest ethnic group in the Karbi Anglong district is the Karbis while it is the Dimasa Kacharis in the North Cachar Hills district.

Shifting cultivation is commonly referred to as *jhum* and the cultivators as jhumia in Assam and other States of the North East India. Regarding evolution of the term 'Jhum' Rajmohan Nath (1978: 1) opines: 'China was known in old days by a general term 'Chao-Thieus' meaning God's Heaven land, and even to this day, the people of Northern Burma designate China by the general term 'Thieus' Chao-Thieus was later on shortened to Chuh-This, and was also pronounced as Zuh-This. Chao, Chuh or Zuh later on meant only high hill or high land. Cultivation carried on by picking up a high hill or high land was known as Zuh-moh or Zuhm cultivation'.

The precise statistical data on the extent of shifting cultivation in Assam are not available. However, the Task Force Report on shifting cultivation, Ministry of Agriculture, 1983 reveals that the annual area under shifting cultivation in Assam is 696 sq km and the number of families involved is 58,000. The fallow period varies from 2 to 10 years. The practice of such a primitive method of agriculture even in the last decade of the twentieth century has been a controversial matter among the scholars. Some are in favour of continuation of shifting cultivation while others are against it. Generally, it is agreed that shifting cultivation leads to large scale deforestation, soil erosion, low productivity and imbalance in the eco-system etc. 'Shifting cultivation has proved to be a menace. Besides decline in economic yield, the system has resulted into a series of serious environmental problems. There has been altercation in species composition and large scale invasion of exotic weeds. Local climax-species have got eliminated from jhum fields and are confined only to protected forests. Thus many of them are threatened and endangered' (Boro, 1996 : 1)

The Government of Assam have been implementing various schemes through the Development Departments to control shifting cultivation in the Hill Areas of Assam under the Five Year Plans. The first step in this direction was the establishment of Model Villages for rehabilitation of the jhumias. The scheme was, however, found to be partially successful. The Cash Crop Plantation Scheme initially implemented by the Soil Conservation Department, Government of Assam was later on handed over to the Assam Plantation Crops Development Corporation (APCDC) created on September 1, 1974. As a matter of fact, plantations have to be transferred on maturity to the jhumia families from whom plots of land were occupied for the purpose of plantation. But complete transfer has not yet been made. The progress of rubber and coffee plantations under the APCDC is satisfactory. During the Fifth Five Year Plan the Planning Commission introduced Composite Project to induce the jhumias for settled cultivation and to check depletion of forest cover in the Hill Areas of Assam. Despite utilisation of crores of rupees in this project, the progress was not satisfactory. As a result, it was replaced by Integrated Jhumia Development Programme (IJDP). At first eleven experimental centres-six in Karbi Anglong and five in North Cachar Hills were taken up. Later on, one centre was dropped in Karbi Anglong. The ten centres carried out till 1986-87 showed encouraging results. Forty IJDP centres were, therefore, taken up from 1986-87. But due to some reasons three centres in each district were dropped. Altogether 34 centres covering 2157 households (1055 households in Karbi Anglong and 1102 households in N.C.Hills) were undertaken and these were continued upto March, 1992.

As per instruction of the Ministry of Agriculture, Government of India two Compact Areas were selected under Central Sector Jhum Control Programme in the two hill districts of Assam. The programme was launched in September, 1989. In the Karbi Anglong district, the Project Area is located within the jurisdiction of Chinthong Development Block, Hamren. In the North Cachar Hills district the Project Area 'Hadingma' is located within Jatinga Valley Development Block and Diyung Valley Development Block. The Chinthong Compact Area covers 1488 households of 36 villages while Hadingma Compact Area covers 1076 households of 40 villages. The Ministry of Agriculture, Government of India released an amount of Rs. 324.50 lakhs under the scheme for control of shifting cultivation with central assistance for the period from 1988-89 to 1990-91.

An evaluation study was conducted in the year 1992 in eight villages - five from Karbi Anglong and three from North Cachar Hills on the basis of random sampling. The Karbi Anglong villages are Borpu, Umpanchi, Harlongjuwe, Socheng and Umcherra while the N.C. Hills villages are Guliabra, Lungkhok and Thaisilinghawar. The selected villages consist of 300 households with a total population of 1633, the males and females being 874 (53.52%) and 759 (46.48%), respectively.

While dealing with the distribution of villages by size of population it is found that out of eight villages, two villages (25%) fall within the category 'below 150'. The number of villages within the category of '151-200' is found to be four (50%). Again, two villages (25%) fall within the category of '251 and Above'. The active age-group which includes the age-groups '16-30' yrs, '31-45' yrs and '46-60' yrs covers 823 persons (50.4%). On the contrary, the dependant age-group consisting of the age-groups '0-15' yrs and '61 yrs and Above' covers 810 persons (49.6%). The sex-ratio of the total population in the selected villages is 1000 : 868.

With regard to basic infrastructural facilities available in and around the surveyed villages, it may be said that out of eight villages, five villages (62.5%) are located by the side of the motorable road. Only one village (12.5%) is located at a distance of 18 km from the nearest motorable road. Out of the remaining two villages, one village is located at a distance of one kilometre only and the other one at a distance of 4 km from the nearest motorable road. It is, therefore, seen that the people are in a better position to derive maximum benefits due to location of the villages at a close distance from the motorable road provided regular bus service along with proper maintenance of roads are made available. So far as railway facilities are concerned, it may be mentioned here that the people of the surveyed villages except one can not easily avail themselves of the facilities offered by the railway stations due to location of these villages at a long distance ranging from 30-90 km from the nearest railway stations.

It has been found that out of eight villages, one village is located at a distance of 7 km from the Block H.Q., and two villages are 8 km away from the Block H.Q. The remaining five villages are at a distance of '14-75' km from the rêspective Block H.Q. In respect of post and telegraph facilities, it has been observed that the location of the post offices is within a short distance from most of the selected villages in comparison to the location of the telegraph offices.

So far as medical facilities are concerned, it is seen that the people of three villages may visit the nearest medical institutions located within a distance of '0-5' km while the people of two villages have to avail themselves of medical services at a distance of '6-11' km. But the remaining villages are more than 11 km away from the nearest medical institutions.

With regard to educational facilities available in and around the surveyed villages, it may be said that out of eight villages, seven have been provided with lower primary schools. The children of one village (Harlongjuwe) have to attend the L.P. school located at 2 km away from the village. High schools are located at Hamren, Umcherra, Gunjung, Dehangi and Haflong. For collegiate education the students from the selected villages may attend the Diphu Government College established in 1965, the Haflong Government College established in 1961 and the Rangsina College established at Donkamokam in 1983. Our field investigation reveals that the total number of children attending L.P. schools in 1992 from the surveyed villages is 314 out of which male and female students are 176 (56.05%) and 138 (43.95%), respectively. Again, the total number of students attending classes in Middle English and High School standard is found to be 106 and 57, respectively. In other words, 64 males (60.38%) and 42 females (39.62%) have attended Middle English classes while 33 males (57.89%) and 24 females (42.11%) have attended High English classes. In respect of students attending colleges from the surveyed villages it has been found that only nine male students have attended classes in colleges during the year 1992. Our field investigation further reveals that out of the total population of 1633, the number of literates is 706, the percentage of literacy being 43.23 (Male = 51.14% and Female = 34.12%).

In respect of marketing facilities it is seen that the people of three villages do not face difficulty in buying their essential goods or in selling their agricultural products since the markets are located at a distance of '0-5' km from the villages. Two villages are located at a distance of '6-11' km from the nearest markets. The people of the remaining three villages have to cover a distance of '17-20' km to visit the markets. However, it may be mentioned here that the Large Areas Multipurpose Societies (LAMPS) established at Hamren, Kanduli, Haflong, Gunjung and Nasingwari extend various economic benefits to the people of the surveyed villages.

So far as drinking water facilities are concerned, it has been found that tap water facilities are available in two villages (Umpanchi and Guliabra) only. The people of the remaining six villages use water from the nearby rivers, streams and wells etc. Our field investigation further reveals that only two villages *viz.* Harlongjuwe and Umcherra have been provided with electricity. It is to be noted that not a single village under study has been covered by cadestral survey which is highly essential for proper land records.

We come to know that out of 300 households, 260 nos. (86.67%) practise cultivation as the primary occupation. The number of households engaged in service and contract is found to be 34 (11.33%) and 6 (2%), respectively. This indicates that agriculture plays a pivotal role in the economy of the people. So far as secondary occupation is concerned, it has been found that out of 300 households, the number of households engaged in various types of secondary occupations is 80 *i.e.* 26.67% of the total households. Out of 80 households, 27 nos. (33.75%) practise cultivation as secondary occupation. Twelve households (15%) and four households (5%) are found to be engaged in service and contract, respectively. Moreover, we find 37 households (47.25%) to have adopted daily wage as secondary occupation. While taking into consideration the position of workers and non-workers in the surveyed villages we have found that the number of workers which includes earners and earning dependants is 881 (53.95%) and the number of non-workers, that is, total dependants is 753 (46.05%) of the total population.

Due to prevalence of shifting cultivation and non-availability of proper land records from the Cadestral Survey, it becomes difficult to discuss the land-holding pattern of the households under study. However, on the basis of our field study we come to know that before starting of the programme, out of 300 households, 151 nos. (50.33%) possess lands in the category '0-11' bighas, while 129 nos. (43%) possess lands in the category '12-23' bighas. Only twenty households (6.67%) possess lands in the category '24 bighas and Above'.

The total area of land possessed by all the households, just before starting of the programme, is found to be 3780 bighas out of which the area of land brought under jhum, wet and terrace cultivation is worked out to be 1560 bighas (41.27%), 800 bighas (21.16%) and 54 bighas (1.43%), respectively. It is also noted that 634 bighas of land (16.77%) is under homestead, 16 bighas (0.42%)

under fishery, and 374 bighas (9.89%) of land is kept for horticulture, while the area of land kept fallow is 342 bighas (9.05%). The rate of production of paddy in the selected villages is found to be 2.8 Ql per bigha in jhum, 3.4 Ql per bigha in wet cultivation and 3.1 Ql per bigha in terrace cultivation. On the whole, we come to know that despite low productivity in jhum fields the people of the surveyed villages are accustomed to practising shifting cultivation to a great extent. In this connection it may be mentioned here that before implementation of the programme, the total number of jhumia households in the selected villages is 257 (85.67%) out of which the fully jhumia households are 112 (43.58%) and the partially jhumia households are 145 (56.42%).

In order to wean the jhumias away from the age-old method of shifting cultivation, various types of schemes have been implemented in the surveyed villages. Some of the schemes are i) Land Development ii) Animal Husbandry iii) Pisciculture iv) Water Harvest Structure v) Cottage Industry vi) Handloom and Textiles vii) Plantation Crops/Horticultural crops/Orchards and viii) Agricultural Inputs etc.

i) One of the important schemes under this programme is land development which includes reclaimed or terraced land for the purpose of wet and rabi cultivation. The total area of terraced/reclaimed land in the surveyed villages is 111.43 hectares.

ii) With regard to veterinary inputs it may be said that buffaloes, milch cows, goats, ducks, pigs and poultry etc. have been supplied to the people of the surveyed villages for their economic uplift. The total number of animals and birds supplied to them is found to be 220.

iii) For the development of pisciculture, community fisheries have been provided under this programme. In addition, fish seeds, *kholihoi* (oil cakes), lime and rice bran, etc. have also been supplied for utilisation in the community fisheries.

iv) Schemes relating to water harvest structures which involve erection of earthen dams are implemented for the purpose of minor irrigation, fishery and duckery etc. in the surveyed villages of the Karbi Anglong district.

v) In respect of cottage industries, it has been found that only 16 households of the surveyed villages have received assistance in the form of tailoring and carpentry.

vi) With regard to handloom and textiles, it is observed that yarns have been supplied for weaving clothes. Moreover, looms and accessories including corrugated iron sheets for making temporary sheds for weaving have been provided to certain villages like Harlong-juwe and Umcherra etc.

vii) The people of the surveyed villages have also received assistance in the form of coffee and rubber plantation assistance on community plots and horticultural seedlings and grafts *viz.* pineapple, banana, mango, plum, ginger, guava, black pepper, turmeric and citrus etc. to improve their economic conditions.

viii) So far as agricultural inputs are concerned, it has been found that fertilizers like urea, superphosphate, NOP and chlorine powder etc., pesticides *viz.* anusar and various types of implements like spade, dao, sickle, fork and hand-sprayer etc. have been provided to the people of the surveyed villages.

Our field investigation reveals that as a result of implementation of the various schemes in the surveyed villages, the number of households engaged in shifting cultivation shows a decreasing trend. Out of the total number of 300 households of the selected villages, the number of households engaged in jhum just before starting of the programme was 257 *i.e.* 85.67% of the total households. After implementation of the welfare schemes it is seen that out of 257 nos. of jhumia households, 51 households (19.8%) have totally given up shifting cultivation. The remaining 206 households (80.2%) are, of course, practising it either partially or fully. In this connection, it is to be noted that at the time of our field investigation, the people did not receive immediate benefits out of the various family-oriented and community-oriented schemes. As such it is expected that the number of households leaving shifting cultivation would increase in the near future.

On the whole, we may come to the conclusion that with active co-operation of the people, proper implementation of the welfare schemes and timely release of required fund by the Government and follow-up action, the practice of shifting cultivation in the Hill Areas of Assam may be regulated and the fragile eco-system may be restored to a great extent. In fine, we quote the following few lines from a renowned anthropologist : 'We should not deny the fact that shifting cultivation is becoming more and more destructive of ecological balance and we should not argue for its continuance by saying that it is way of life and destroying the way of life will mean destroying the people themselves. The shifting cultivators have themselves understood that their method of cultivation is fighting a losing battle and that is why they themselves are trying to adopt other methods or whenever opportunity offers change over to other occupation.' (Majumdar, 1990: 31)

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KEY WORDS AND ABSTRACT

KEY WORDS Jhum Control. Eco-system. Hill Areas of Assam. Horticulture. Terrace Cultivation. Secondary Occupations.

ABSTRACT The Central Sector Jhum Control Programme was implemented in the Hill Areas of Assam from 1989-90 to 1991-92 with the intention of weaning the jhumias away from the destructive method of shifting cultivation by means of providing them with other productive occupations for improving their economic conditions and also for checking depletion of forest cover. The present paper analyses the impact of the above mentioned programme among the scheduled tribes (Hills) on the basis of a study conducted in eight villages of the Hill Areas of Assam. The study reveals that the people has gradually understood the evil effects of shifting cultivation and shown keen interest in giving up this cultivation provided suitable measures are adopted by the Government for ameliorating their poor economy.

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Author's Address : **Girindra Nath Das**, District Research Officer, Karbi Anglong, Diphu 782 460, Assam, India

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An Account of The Plants Used By The Mishings of Assam As Vegetables

C.L. Boissya and D. Kalita

INTRODUCTION

The 'Mishing' is a plain tribe of Assam. The total population of 'Mishing' is more than three lakhs (Pegue, 1981). According to Payang (1935), they migrated from Bor-Abor of Abor hills before the Burma war, to the plains of upper Assam. There are nine divisions (Khels) of the Mishings *viz.* Pagro, Delu, Dombuk, Moying, Shayang, Oyan, Samuguria, Tamar and Samua, each of which is again divided into numerous subdivisions. The Mishings have a common dialect, however, Tamar and Samuguria have adopted Assamese. They mostly inhabit in isolated pockets mostly along the bank of rivers, where forest mostly dominate. As they remain in far-flung areas, the modern civilization has almost not reached them. They mostly depend on plants for their daily needs. And as such like other tribals, the 'Mishing' population have a rich herbal lore so far as useful plants are concerned. This is probably due to their intimate connection with their surrounding forests and plants.

The term "vegetable" is usually applied to edible plants which store up reserve food in roots, steams, leaves and fruits and which are eaten either cooked or raw. Wild plants play an important role in the life of the Mishings as they directly depend on various wild plants as vegetable stuff in their day to day life. Generally the women and the young girls go into the forest for collection of vegetables. Mostly, the leafy vegetables are collected from the forest. Boiling of leafy vegetables is the most common practice among the tribals. Along with vegetables they cook some spices like *Zingiber officinale*, *Curcuma longa*, *Piper nigrum*, and *Capsicum frutescens*.

METHODOLOGY

'Mishing' inhabited areas were repeatedly visited to meet village head man and elderly people who knew about the wild plants for vegetables.

First hand formations from the local people were collected. Efforts were made to see the plants in wild and to collect plant specimens with their flowers (in case of angiosperms) and with sori (in case of ferns).

Plant materials used as vegetables were collected with their reproductive parts, herbarium sheets, were prepared and subsequently identified referring them to Botanical Survey of India (B.S.I.) herbaria, Shillong. Local names of the plants were also collected as far as possible. The plant specimens collected during the trips were carefully preserved in herbarium sheets.

The 'Mishing generally don't uses' oil and avoid fried vegetable. Fish and meat are generally taken by the 'Mishing' only after boiling with the vegetables. However, roasted fish and meat are also used by them. Underground fleshy plants parts are also roasted on fire and taken.

Photographs of some useful plant materials were taken.

DISCUSSION

The collected plant mentioned above are mostly wild. It is generally believed by the Mishings that the vegetable plants are useful and each of them has certain medicinal property. Further they believe that the vegetables provide them with energy to work hard.

So far no record on the plants, used as vegetables, by the people of Mishing community is available. This is evidently the first record of vegetable plants used by this community.

It is expected that the present study will bring into focus how the Mishings are dependent on the environment for sustaining their dietary habit. Further this account will give some indication about the availability of multiple variety of plants abounding in the Mishing habitats (Table 28.1). The work is expected to encourage other researchers in ethnobotanical research of the Mishings.

Table 28.1 : A list of vegetable used by the Mishings

S.No.	*Plant species with family*	*Local Name*	*Used Parts*
1.	*Abelmoschus esculentus* (L) Moench. (Malvaceae)	Bhendi (Mish.) Bhendi (Ass)	Fruit
2.	*Achyranthes aspera* L. (Amaranthaceae)	Pak (Mish.)	Young aerial portion.
3.	*Adhatoda zeylanica* Medic. (Acanthaceae)	Titabahak (Mish.) Titabahak (Ass.)	Leaf
4.	*Alocasia fornicata* (Roxb) Schott. (Araceae)	Aya (Misy) Kachu (Ass.)	Root stock
5.	*A. Indica* (Roxb.) Schott (Araceae)	Man aya (Mish) Man kachu (Ass.)	Root stock
6.	*A. odora* (Roxb.) Koch. (Araceae)	Dahi aya Mish.) Dahi kachu (Ass.)	Rootstock.
7.	*Alternanthera sessilis* R. Br. (Amaranthaceae)	Patewoi (Mish.) Matikuri (Ass.)	Young aerial shoot.
8.	*Amaranthus hybridus* L. (Amaranthaceae)	Maricha (Mish) Maricha (Ass.)	Young aerial portion
9.	*A. spinosus* L. (Amaranthaceae)	Tankane gayaak (Mish.) Kath khutora (Ass.)	Young aerial shoot
10.	*A. tricolor* L. (Amaranthaceae)	Lona maricha (Mish.)	Young aerial shoot
11.	*A. viridis* L. (Amaranthaceae)	Gayaak (mish.) Khutoria (ass.)	Young aerial shoot
12.	*Athyrium asperum* (Al.) Wise (Polypodiaceae) Fern.	Okan (Mish.) Dhekiya (Ass.)	Young leaf
13.	*Antigonon leptopus* Endle. (Polygonaceae)	Changiguti (Mish) Chaniguti (Ass.)	Young aerial shoot
14.	*Artocarpus heterophyllus* Lamk. (Moraceae)	Balang (Mish) Kathal (Ass.)	Fruit
15.	*Averrhoa carambola* L (Oxalidaceae)	Kordoi (Mish) Kordoi (Ass.)	Fruit
16.	*Azadirachta indica* A. Juss. (Meliaceae)	Nim (Mish) Mahanim (Ass.)	Leaf
17.	*Bambusa balcooa* Roxb. (Poaceae)	Baluka debia (Mish.) Bhaluka deiba (Ass.)	Young shoot
18.	*Basella rubra* L. (Basellaceae)	Paing (Mish.) Puroisak (ass.)	Young aerial shoot
19.	*Benincasa hispida* (Th.) Cogn. (Cucurbitaceae)	Paratapa (Mish.) Sal Kumura (Ass.)	Fruit and Young aerial shoot
20.	*Bischofia Juvanica* Bl. (Bischofiaceae)	Takir (Mish.) Urium (Ass.)	Young leaf
21.	*Brassica alba* Hook. (Brassicaceae)	Kampu petu (mish.) Baga shariyah (Ass.)	Young aerial portion
22.	*B. napus* L. (Brassicaceae)	Tule (Mish.) Laisak (Ass.)	Leaf
23.	*B. nigra* Koch. (Brassicaceae)	Eyyan petu (Mish.) Kala shoriyah (Ass.)	Young aerial shoot
24.	*B. oleracea* L. Var. botrytis L.	Phulkabi (Mish.) Phulkabi (Ass.)	Flower
25.	*B. oleracea* L. Var. capitata L. (Brassicaceae)	Bardhakabi (Mish.) Bandhakabi (Ass.)	Leaf
26.	*B. oleracea* L. Var. *gongylodes* L. (Brassicaceae)	Oul kabi (Mish.) Ul kabi (Ass.)	Modified stem
27.	*Calamus floribundus* Grift (Arecaceae)	Yobi (Mish) Bet (Ass.)	Shoot
28.	*C. latifolia* (Arecaceae)	Yobi (Mish) Bet (Ass.)	Young shoot
29.	*Calamus rotang* L. (Arecaceae)	Rang bet (Mish.) Rang bet (ass.)	Young shoot

Abbreviation used : Mish. = Mishing, Ass. = Assamese

Table 28.1 : Contd....

S.No.	Plant species with family	Local Name	Used Parts
30.	*Cannabis sativa* L. (Cannabinaceae)	Ganga (Mish.) Bhang (As.)	Leaf
31.	*Carica papaya* L. (Caricaceae)	Ambita (Mish.) Amita (Ass.)	Fruit
32.	*Centella asiatica* Urban (Apiaceae)	Attine manimuni (Mish.) Bor manimuni (Ass.)	Entire Plant
33.	*Chenopodium album* L. (Chenopodiaceae)	Bhotuwasak (Mish)	Young aerial portion
34.	*C. ambrosiodes* L. (Chenopodiaceae)	Bhotuwa (Mish.) Jilmil sak (Ass.)	Young aerial portion
35.	*Citrus maxima* Merr. (Rutaceae)	Sinkin (Mish.) Rabab tenga (Ass.)	Young leaf
36.	*Clerodendrum colebrookianum* Vall. (Verbenaceae)	Pakam (Mish.) Nephaphu (Ass.)	Young leaf
37.	*Coccinoa indica* W. & A. (Cucurbitaceae)	Kurula (Mish.) Kunduli (Ass.)	Fruit
38.	*Colocasia antiquorum* Schott (Araceae)	Aya (Mish) Kachu (Ass.)	Root stock
39.	*Corchorus capsularis* L. (Tiliaceae)	Marapat (Mish.) Marapat (Ass.)	Young leaf
40.	*Coriandrum sativum* L. (Apiaceae)	Ori (Mish.) Dhaniya (Ass.)	Leaf
41.	*Cucumis sativus* L. (Cucurbitaceae)	Babik (Mish.) Tiyah (Ass.)	Fruit
42.	*Cucurbita moschata* Duch. ex. por. (Cucurbitaceae)	Migom (Mish.) Raungalau (ass.)	Fruit and Young aerial shoot.
43.	*Cucurbita pepo* D.C. (Cucurbitaceae)	Tapa (Mish.) Kumura (Ass.)	Fruit and Young aerial shoot
44.	*Cyclosorus extensa* Nadu. (Polypodiaceae)	Rabji (Mish.) Bihlaungani (Ass.)	Leaf
45.	*Dillenia indica* L. (Dilleniaceae)	Champa (Mish.) Ou taunga (Ass.)	Fruit
46.	*Dioscorea alata* L. (Dioscoreaceae)	Mayong ali (Mish.) Kathalu (Ass.)	Modified root
47.	*Dolichos lablab* L. (Papilionaceae)	Pajap (Mish). Urohi (Ass.)	Fruit and young aerial shoot
48.	*Drymaria cordata* Willd. (Caryophyllaceae)	Laijabori (Mish.) Laijabori (Ass.)	Young aerial shoot
49.	*Eclipta prostrata* L. (Asteraceae)	Keharaj (Mish.)	Young aerial portion
50.	*Emilia sonchifolia* (Linn.) D.C. (Asteraceae)	Nanu (Mish.)	Young aerial portion
51.	*Enhydra fluctuans* Lour. (Asteraceae)	Aleshi (Mish.) Haleshisak (Ass.)	Young aerial shoot
52.	*Eryngium foetidum* L. (Apiaceae)	Sad ori (Mish.) Boungali dhaniya (Ass.)	Leaf
53.	*Ficus fistulosa* Reinwdt. (Moraceae)	konoi (Mish.)	Young aerial portion
54.	*Ficus hispida* L.f. (Moraceae)	Shore jori (Mish.)	Young aerial portion
55.	*F. racemosa* L. (Moraceae)	Jagya dimoru (Mish) Jagya dimoru (Ass.)	Leaf
56.	*Gardenia jasminoides* Ellis (Rubiaceae)	Tagor (Mish.) Tagor (ass.)	Petals of flower
57.	*Gmelina arborea* Roxb. (Verbenaceae)	Gamari (Mish.) Gamari (Ass.)	Petals of flower

Table 28.1: Contd...

S.No.	Plant species with family	Local Name	Used Parts
58.	*Hauttyma cordata* (Sauraceae)	Mosandari (Mish.) Mosandari (ass.)	Young aerial portion
59.	*Heliotropium indicum* L. (Boraginaceae)	Gapatugul (Mish)	Young aerial portion
60.	*Hibiscus-rosa-sinensis* L (Malvaceae)	Jasbaful (Mish.) Jabaful (Ass.)	Young leaf
61.	*H. subdariffa* L. (Malvaceae)	Taùngamara (Mish.) Taungamara (Ass.)	Young shoot and fruit
62.	*H. surattensis* Linn. (Malvaceae)	Rounga taunga mara (Mish.) Rounga taunga mara (Ass.)	Young aerial shoot
63.	*Hydrocotyle javanica* Th. (Apiaceae)	Aggine mani-muni (Mish.) Shoru mani-muni (Ass.)	Entire plant
64.	*Hydrocotyle sibthorpiodies* Lamk. (Apiaceae)	Aggine mani-muni (Mish.) Sharu mani-muni (Ass.)	Entire plant
65.	*Hydrolea zeylanica* (L) Vahl. (Hydrophyllaceae)	Laheti sak (Mish.) Laheti sak (Ass.)	Young aerial shoot
66.	*Ipomoea aquatica* Forsk. (Convolvulaceae)	Kolmeu (Mish.) Kolmou (Ass.)	Young aerial shoot
67.	*I. batatus* Lamk (Convolvulaceae)	Ninti alu (Mish.) Mitha alu (ass.)	Young aerial shoot
68.	*Lagenaria siceraria* Standl. (Cucurbitaceae)	Laow (Mish.) Jati laow (Ass.)	Fruit and young aerial shoot
69.	*Lasia spinosa* (L) Th. W. (Araceae)	Redecol (Mish.) Jang Kachu (Ass.)	Young leaf
70.	*Leea indica* (Burn) Merr. (Leeaceae)	Gadbudduk (Mish.)	Young leaf
71.	*Leucas aspera* Spreng. (Lamiaceae)	Namshingguseer (Mish.) Duron (Ass.)	Young aerial shoot
72.	*L. indica* (L) R. Br. (Lamiaceae)	Namshing guser (Mish.)	Young aerial shoot
73.	*Leucostegia immersa* Per. S.LL.A. (Polypodiaceae)	Ikam (Mish)	Leaf
74.	*Luffa acutangula* (L) Roxb. (Cucurbitaceae)	Jika (Mish.) Jika (Ass.)	Fruit
75.	*Luffa aegyptiaca* Miller. Gard. (Cucurbitaceae)	Bul (Mish) Bhul (Ass.)	fruit
76.	*Lycopersicum esculentum* Mill (Solanaceae)	Atjine (Mish.) Bilahi (Ass.)	Fruit
77.	*Malva verticilata* L. (Malvaceae)	Laffa (Mish.) Laffa (Ass.)	Young aerial portion
78.	*Malva viscus* L. (Malvaceae)	Supohi jaba (Mish.)	Leaf
79.	*Manihot utilissima* Pohl. (Euphorbiaceae)	Singgi mayang (Mish.) Shimolu alu (Ass.)	Modified root
80.	*Melastoma malabathricum* L. (Melastomaceae)	Phutuki (Mish.) Phutuki (Ass.)	Leaf
81.	*Mikenia cordata* (Burmf) Robinson (Asteraceae)	Parbotilata (Mish)	Young aerial portion
82.	M. micrantha Kunth ex. Hook (Asteraceae)	Parboti lata (Mish.)	Young aerial portion
83.	*Momordica charantia* L. (Cucurbitaceae)	Kella (Mish.) Kerela (Ass.)	Fruit
84.	*M. cochinchinensis* Spreng. (Cucurbitaceae)	Bat kerela (Mish.) Bhat Kerela (Ass.)	Fruit
85.	*M. dioica* Roxb. (Cucurbitaceae)	Kakiyal Kerala (Mish.) Kakiyal Kerala (Ass.)	Fruit

Table 28.1 : Contd...

S.No.	Plant species with family	Local Name	Used Parts
86.	*Murraya koeningii* Spreng (Rutaceae)	Narashingha (Mish.) Narashingha (Ass.)	Leaf
87.	*Musa balbisiana* Colla (Musaceae)	Athiya Kapak (Mish.) Athiya Kal (Ass.)	Inflorescence and young Pasudostem
88.	*M. paradisiacea* L. (Musaceae)	Jati Kapak (Mish.) Jati Kal (Ass.)	Inflorescence
89.	*Musa sapientum* L. (Musaceae)	Pura Kopak (Mish.) Pura Kal (Ass.)	Inhflorescence and fruit
90.	*Oldenlandia corymbosa* L. (Rubiaceae)	Banjaluk (Mish.) Banjaluk (Ass.)	Young aerial shoot
91.	*Osbeckia nepalensis* Hook. (Melastomaceae)	Kumpu Phutuki (Mish.) Boga phutuki (Ass.)	Young leaf
92.	*Oxalis corniculata* L. (Oxalidaceae)	Aggine alaichi (Mish.) Shoru taungachi (Ass.)	Leaf and flower
93.	*Oxalis corymbosa* D.C. (Oxalidaceae)	Boito alaichi (Mish.) Bor taungachi (Ass.)	Leaf and flower
94.	*Paederia foetida* L. (Rubiaceae)	Bonkiriba (Mish.) Bhadailata (Ass.)	Young aerial shoot
95.	*Peperomia pellucida* Kunth. (Piperaceae)	Papore (Mish.) Auni pan (Ass.)	Leaf
96.	*Phlogacanthus thyrsiformis* (Hardw) Mabbar (Acanthaceae)	Titaphul (Mish.)	Leaf
97.	*Pilea microphylla* (Linn.) Liebn. (Urticaceae)	Barali bokuwa (Mish.)	Young aerial portion
98.	*Pisum sativum* L. (Papilionaceae)	Motor (Mish.) Motor Mah (Ass.)	Young aerial portion and fruit
99.	*Piper thomsonii* (C. DC.) Hook. F (Piperaceae)	Popore (Mish.) Aunipan (Ass.	Leaf
100.	*Polygonum hydropiper* L. (Polygonaceae)	Bihlaungani (Mish.) Bihlaungani (Ass.)	Young aerial portion
101.	*Polygonum glabrum* Willd. (Polygonaceae)	Madhuphulang (Mish.) Madhuphulang (Ass.)	Young aerial portion
102.	*P. orientale* L. (Polygonaceae)	Bihlaungani (Mish.) Bihlaungani (Ass.)	Young shoot
103.	*Portulaca quadrifolia* L (Portulacaceae)	Nepali sak (Mish.)	Young aerial portion
104.	*Psidium guayava* L. (Myrtaceae)	Madhure am (Mish.) Madhuri am (Ass.)	Leaf
105.	*Ranunculus sceleratus* L. (Ranunculaceae)	Marsa (Mish.) Shuhoni (Ass.)	Young aerial shoot
106.	*Raphanus sativus* L. (Brassicaceae)	Mula (Mish.) Mula (Ass.)	Modified root
107.	*Rumex vesicarius* L. (Polygonaceae)	Suka (Mish.) (Suka (Ass.)	Leaf
108.	*Sambucus hookeri* Rehd. (Caprifoliaceae)	Suklati (Mish.) Suklati (Ass.)	Leaf
109.	*Sarchochlamys pulcherrima* (Roxb.) gaud. (Urticaceae)	Take (Mish.)	Young apical portion
110.	*Scoparia dulcis* L. (Scrophulariaceae)	Bon jalokia (Mish.)	Young aerial portion
111.	*Smilax macrophylla* Roxb. (Liliaceae)	Lorit (Mish.) Tikonibaha (ass.)	Young aerial portion
112.	*Solanum melongena* L. (Solanaceae)	Bayam (Mish.) Baungena (Ass.)	Fruit
113.	*S. nigrum* L. (Solanaceae)	Akon (Mish.) Pakmou (Ass.)	Young aerial shoot

Table 28.1 : Contd....

S.No.	Plant species with family	Local Name	Used Parts
114.	*S. spirale* Roxb. (Solanaceae)	Oko (Mish.)	Young aerial portion
115.	*Solanum tuberosum* L. (Solanaceae)	Guti alu (Mish.) Alu guti (Ass.)	Modified stem
116.	*Spinacia oleracea* L.Palang (Mish.) (Chenopodiaceae)	Palang (Mish.) Palang (Ass.)	
117.	*Stenochlaena palustre* (Linn) (Brown) Bedd. (Polypodiaceae) Fern.	Dhekiyalati (Mish.) Dekiyalati (Ass.)	Young leaf
118.	*Tragia involucrata* L. (Euphorbiaceae)	Pouji (Mish.) Chorat (Ass.)	Leaf
119.	*Trichosanthes anguina* L. (Cucurbitaceae)	Dhunduli (Mish.) Dhunduli (Ass.)	Fruit
120.	*T. dicaelosperma* Clarke. (Cucurbitaceae)	Bonoriya Patol (Ass.)	Fruit
121.	*Vigna sinensis* Endl. (Papilionaceae)	Duitoma (Mish.) Lecharamah (Ass.)	Pod.
122.	*Vitex negundo* L. (Verbenaceae)	Pachatia (Mish.) Pachatia (Ass.)	Leaf
123.	*Vitis trifolia* Linn. (Vitaceae)	Nakung (Mish.) Nol Taunga (Ass.)	Young aerial shoot
124.	*Wedelia calendulacea* Less (Asteraceae)	Bhimraj (Mish.) Bhimraj (Ass.)	Young aerial portion
125.	*Xanthium strumarium* K. (Asteraceae)	Tangam (Mish.) Agora (Ass.)	Young aerial shoot

KEY WORDS AND ABSTRACT

KEY WORDS Tribal People. Wild Vegetables. Modified Shoots. Young Aerial Shoot. Young Shoot. Herbarium.

ABSTRACT It is well known that a large number of plants yield useful commodities or raw materials for mankind. The tribal people have much more association and knowledge of the plants and the 'Mishing' are no exception to this. About 70% of the vegetables used by 'Mishing' people are collected from neighbouring forest, however, recently they have started cultivating some of the plants for their vegetables in their gardens. After repeated visits of some villages the plants used by the Mishings as vegetables are recorded as pointed out by the village head and some elderly people. A list of 125 such plants have been recorded in the present study. It is expected that this study will not only bring to light the names of the plants but will prove that these are useful plants for mankind. It is further expected that this study will encourage new research workers in the interesting field of Ethnobotany of the 'Mishings' of Assam.

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Authors' Address : **C.L. Boissya**, Botany Department Gauhati University, Gauhati 781 014, Assam, India
D. Kalita, Botany Department, T.H.B. College, Jamugurihat 784 180, Assam, India

Family Among The Sherpa of West Bengal

Palash Chandra Coomar and Manis Kumar Raha

INTRODUCTION

The Sherpa, a less known tribe, are the inhabitants of the Eastern Himalayas. In India they are concentrated in Sikkim and in the Darjeeling district of West Bengal. The Sherpas here have migrated to India from Nepal. They are Mongoloid and speak Sherpali with their own community people. While speaking with the people of other communities Nepali language is used by them as the medium of communication. At the time of writing Nepali scripts are used by them. Usually those who are educated know Hindi and also English. The Sherpa society is patriarchal, patrilocal and patrilineal in nature. It is divided into a number of *rus* (social division). These *rus* are exogamous in nature. Traditionally they used to practise community endogamy. That means they used to marry within their own community. But at present due to their contact with the people of other communities the rule of endogamy is gradually breaking down. Now marriage with the people of other communities is also taking place.

Majority of the Sherpas depend on agriculture and horticulture for their livelihood. Some of them are also engaged in service and business.

The Sherpa people are Buddhists and observe all major Buddhist festivals. *Lama* is functioning as religious head, and his main function is to officiate in different life-cycle ceremonies and religious festivals.

The Sherpas have their own *Dash Thari Samaj* (traditional tribal council), which is functioning not so rigidly as it did in the past. The main function of the *Dash Thari Samaj* is to look after the customary rules of their community. After the introduction of Panchayati Raj now the Gram Panchayat is acting as the agency for the developmental works of the villages and also to solve minor disputes among the villagers.

THE STUDY

The present study is conducted in two villages namely Upper Echchy and Sherpatar in the Kalimpong P.S. and Garubathan P.S. respectively under Kalimpong sub-division of Darjeeling district, West Bengal. These two villages are multiethnic in nature and the Sherpas are living with other communities such as the Chhetri, Rai, Gurung, Tamang, Sarki, Bhutia and the Lapcha. In Upper Echchy village altogether 117 families inhabit of which 43 (36.75%) families belong to the Sherpa community. The remaining 74 families belong to the non-Sherpa. Sherpatar village is numerically dominated by the Sherpa families (72) which cover 59.02% of the total families (122) and the rest of the 50 families (40.98%) belong to the non-Sherpa communities. In these two studied villages there are a total of 115 Sherpa families of which 62.61% families are settled in Sherpatar and 37.39% Sherpa families are inhabited in Upper Echchy village. These Sherpa families include 568 individuals of which 51.06% are females and 48.94% are males. In these Sherpa families there are some persons who belong to different non-Sherpa communities like the Lapcha, Bhotia, Chhetri and the Rai. These non-Sherpas become the members of the Sherpa families due to their marital relation with the Sherpas.

Size of the Sherpa Families

Number of persons in the Sherpa families vary from a single member to twelve members. From table 29.1, it is revealed that families with five

Table 29.1: Size of the Sherpa family

S. No.	*No. of persons in a family*	*Families No.*	*Families Per cent*
1	1	3	2.61
2	2	12	10.43
3	3	14	12.17
4	4	19	16.52
5	5	26	22.61
6	6	16	13.91
7	7	11	9.57
8	8	10	8.70
9	9	2	1.74
10	10	1	0.87
11	12	1	0.87
	Total	115	100.00

members have the highest frequency (22.61%), followed by families with four members (16.52%). Families with six members also have a significant position (13.91%).

According to the number of persons in a family, the families are classified into four types. Families with one to three members are categorised as small sized family; families with four to six members are classified as medium sized family. Large sized family includes the presence of more than nine members. Table 29.2 shows the distribution of the Shepra population in different sizes of the families. It is found from the table that medium sized Sherpa families have highest concentration (53.04%) in these two villages, and this type of families cover maximum number of population (53.17%). Small sized families come to second position (25.22%). The large sized families are none the less important. These bear a frequency 20.00%. But large sized families cover the second highest number of population (30.81%). The next higher frequency goes to the small sized families which cover 12.15% of the total population. So it is apparent that the Sherpas of the two villages studied generally prefer medium sized family.

Table 29.2: Family-size-wise distribution of the Sherpa population

S. No.	Size of the families / No. of members in the family	Families No.	Families Per cent	Population covered No.	Population covered Per cent
1.	Small Size (1-3 members)	29	25.22	69	12.15
2.	Medium Size (4-6 members)	61	53.04	302	53.17
3.	Large Size (7-9 members)	23	20.00	175	30.81
4.	Very Large Size (10 + members)	2	1.74	22	3.87
	Total	115	100.00	568	100.00

The Sherpas are living in different types of families. The presence of different kin members in the families divides the Sherpa families of these two surveyed villages into seven types. Families consisting of husband, wife with or without unmarried children are considered as nuclear type. In some nuclear families presence of some other relatives such as wife's unmarried younger sister or wife's unmarried younger brother is noticed. As a rule they are usually not supposed to stay with these families. But they stay in these families as members for some other reasons. These families are grouped as nuclear type families with adhesion. Extended type families includes either or both the parents with married son(s), son's wife (wives), with or without married son's children and with or without ego's unmarried children. In the extended families, where some extra kins like divorced daughter, daughter's daughter share the food and shelter with the other family members, are classified as extended type families with adhesion. The nascent type family includes only unmarried or widowed or divorced person(s). The families which consist of either of the parents with his/her unmarried son(s) and/or daughter(s) are termed as broken type of families. In the broken type family where some extra relatives of the ego are staying with the ego as her family members is grouped as broken type family with adhesion. Table 29.3 shows the distribution of different types of families among the Sherpas and the average size of these families.

Table 29.3: Types and average size of the Sherpa families

S No.	Types of family	Families No.	Families Per cent	Population covered No.	Population covered Per cent	Average size of the family
1.	Nuclear type	63	54.78	285	50.18	4.52
2.	Nuclear type with addition	6	5.22	35	6.16	5.83
3.	Extended type	27	23.48	193	33.98	7.15
4.	Extended type with addition	1	0.87	7	1.23	7.00
5.	Nascent type	4	3.48	7	1.23	1.75
6.	Broken type	13	11 30	36	6.34	2.77
7.	Broken type with addition	1	0.87	5	0.88	5.00
	Total	115	100.00	568	100.00	4.94

It is apparent from table 29.3 that most of the Sherpas (50.18%) prefer to live in the nuclear type family which score 54.78% of the total families. This type of families has 4.52 members per family on an average. The extended type (specially vertically extended type) families occupy the second position, which cover 33.98% of the total Sherpa population of the two studied villages. The extended families are larger in size (7.15) than other type of families as seen among the Sherpas. The broken type families also have a significant frequency, which is 11.30% of the total families and cover

6.34% of the Shepra population. The other types of family *i.e.* nuclear type with adhesion, extended type with adhesion, nascent type and broken type with adhesion are also found among the Sherpas in low frequency. The average family size of the Sherpas is 4.94.

Table 29.4 reveals the co-relation between the different types of families with the size of the families. Of the total 29 small sized families majority (58.62%) are nuclear type families followed by the broken type families (31.03%). Similarly in case of population also, highest number of the persons (66.67%) in the small sized families comes under the nuclear type families, second position is occupied by the broken type families (28.98%), followed by the nascent type families (4.35%). In case of medium sized families also highest number of families (67.21%) and largest population (66.89%) are covered by the nuclear type families. Extended type families scored second highest position (16.39%) and this type of families has in its credit 17.88% of the total population of the medium size families. Medium size families also include nuclear type families with adhesion, nascent type family, broken type family and broken type family with adhesion. But a reverse picture is seen in case of large sized families, where extended type families have the maximum frequency (65.22%) and also include 66.86% population. Nuclear type families secure the next position (21.74%) and this type of families has covered 21.14% population. Very large sized families are only two in number and these two families are of extended type.

It is revealed from the composition of the Sherpa families that the members of different generations are staying in the Sherpa families. On the basis of the presence of the family members of different generations the Sherpa families of these two studied villages have been classified into following four grades.

1) Grade-I This type of family consists of members of the ego's generation, ego's first ascending generation and ego's first descending generation.
2) Grade-II Members of ego's generation and ego's first descending generation are the constituent members of this type of family.
3) Grade-III Member's of ego's generation only are included in this type of family.
4) Grade-IV This type of family are composed of members of ego's generation, ego's first descending generation and ego's second descending generation.

Table 29.5 depicts the distribution of gradation wise different types of families among the Sherpas. It is observed from the table that Grade - II type families have overall highest frequency (73.91%) among the Sherpas of two studied villages in Dar-

Table 29.4 : Family type, family size and number of family members. Correlation

S. No.	Types of family		Samll size family (1-3 members)		Medium-size family (4-6 members)		Large size family (7-9 members)		Very large size family (10+ members)	
			Family	Population	Family	Population	Family	Population	Family	Population
1.	Nuclear type	No.	17	46	41	202	5	37	-	-
		%	58.62	66.67	67.21	66.89	21.74	21.14	-	-
2.	Nuclear type with adhesion	No.	-	-	4	21	2	14	-	-
		%	-	-	6.56	6.95	8.69	8.00	-	-
3.	Extended type	No.	-	-	10	54	15	117	2	22
		%	-	-	16.39	17.88	65.22	66.86	100.00	100.00
4.	Extended type with adhesion	No.	-	-	-	-	1	7	-	-
		%	-	-	-	-	4.35	4.00	-	-
5.	Nascent type	No.	3	3	1	4	-	-	-	-
		%	10.35	4.35	1.64	1.32	-	-	-	-
6.	Broken type	No.	9	20	4	16	-	-	-	-
		%	31.03	28.98	6.56	5.30	-	-	-	-
7.	Broken type with adhesion	No.	-	-	1	5	-	-	-	-
		%	-	-	1.64	1.66	-	-	-	-
	Total	No.	29	69	61	302	23	175	2	22
		%	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Table 29.5 : Generationwise gradation of the Sherpa family

S. No.	Gradation of family	Family No.	Family %
1.	Grade - I	1	0.87
2.	Grade - II	85	73.91
3.	Grade - III	8	6.96
4.	Grade - IV	21	18.26
	Total	115	100.00

jeeling district of West Bengal. The next position is occupied by the Grade - IV type families (18.26%), followed by the families of Grade - III type (6.96%). It means the Sherpa couple prefer to live with their children in their family.

The Sherpas live in the patrilocal society. After marriage the bride comes to the groom's residence to lead married life. It is their customary rule that male person holds the position as the head of the family. Generally the seniormost male member in the family acts as the head of the family. The head looks after the well-being of the other members in the family and in return the latter show their respect and reverence and extend co-operation to the head of the family. It is the head of the family who takes the final decision on any socio-economic aspect at the family level in consultation with the other family members. In some families in the absence of an aged male member, the charge of headship of the family is vested to the seniormost woman in the family. Table 29.6 shows the distribution of the head of the families according to their marital condition, age-group and sex.

It is observed from table 29.6 that majority of the families (82.61%) are male-headed. Among the male-headed families 43.16% heads of family are in the age-group of 30-44 years; 30.53% male heads come in the age-group of 45-59 years, and this is followed (17.89%) by the oldest men as head of the family (60 years and above). Among the male heads of family, married men an head have highest frequency (86.31%), followed by the widower (10.53%) as heads.

Only three (3.16%) unmarried men act as the head of the family. Majority (80.00%) of the widower heads of the family belong to the highest age-group *i.e.* 60 years and above, whereas married heads of the families are in the age-groups of 30-44 years and 45-59 years and have the strength of 48.78% and 31.71%, respectively. In case of female heads of the family 45.00% heads of the family belong to the age-group of 45-59 years. This is followed by 60 and above years (40.00%). Only 15.00% female heads of the families are in the age-group of 30-44 years, and this age-group has the highest frequency in case of male headed families also. Among female heads of the families, in maximum cases (80.00%) widows hold the position as the head of the family. Three divorced women (15.00%) and one unmarried woman (5.00%) act as the heads of their respective families.

So it is clear from the above analysis that married women have never enjoyed the position of headship in the family. As long as their husbands live or so long they stay with their husbands, their husbands function as the head of the family.

The above delineations have given a clear picture of the families of the Sherpas of Darjeeling district of West Bengal. They mostly live in the

Table 29.6 : Distribution of heads of the Sherpa family

S. No.	Marital status of the Head of the families		Male headed family Age grade (in years) 16-29	30-44	45-59	60-X	Total	Female headed family Age grade (in years) 16-29	30-44	45-59	60-X	Total
1.	Unmarried	No.	1	–	2	–	3	–	–	1	–	1
		%	33.33	–	66.67	–	100.00	–	–	100.00	–	100.00
2.	Married	No.	7	40	26	9	82	–	–	–	–	–
		%	8.54	48.78	31.71	10.97	100.00	–	–	–	–	–
3.	Widowed	No.	–	1	1	8	10	–	3	6	7	16
		%	–	10.00	10.00	80.00	100.00	–	18.75	37.50	43.75	100.00
4.	Divorced	No.	–	–	–	–	–	–	–	2	1	3
		%	–	–	–	–	–	–	–	66.67	33.33	100.00
	Total	No.	8	41	29	17	95	–	3	9	8	20
		%	8.42	43.16	30.53	17.89	100.00	–	15.00	45.00	40.00	100.00

families with 4 to 6 members. The medium-sized families are the most preferred ones which cover over half of the Sherpa population of the two villages studied. The nuclear type of the family is the societal profile and covers majority of the Sherpa people. It can well be asserted that the mountainous terrainous habitat of the Sherpas can sustain only small and medium-sized families having 2 to 3 or upto 4 to 6 members at the maximum. Most of the Sherpa families have members of the ego's generation and ego's first descending generation. The Sherpa families also have the highest frequency of married males as heads belonging to the age-group of 30-44 years.

KEY WORDS AND ABSTRACT

KEY WORDS Sherpa. Family. Agriculture and Horticulture. Buddhist. Hilly Terrain. Habitat.

ABSTRACT The Sherpas, a Mongoloid tribe of the eastern Himalayas, migrated from Nepal to India. These people have their own culture and social system, although some changes have taken place due to their continuous interaction with the people of neighbouring communities. In the Sherpa society family is the basic unit in all socio-economic and socio-religious affairs. The data for the present study have been collected from two villages in Kalimpong sub-division of Darjeeling district, West Bengal. The paper deals with various aspects of the Sherpa family including the size, type, composition and age-group of the head of the family etc. Their family structure also reflects the impression of the particular hilly terrain of their habitat.

Authors' Address : **Palash Chandra Coomar, Manis Kumar Raha,** 10/3, Jamir Lane, Calcutta 700 019, West Bengal, India

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Ecology of the Loktak Lake of Manipur and its Floating Phoom Hut Dwellers

K. Saratchandra Singh

INTRODUCTION

Loktak, the largest fresh water lake in North-East India having a typical tropical aquatic ecological characteristic is located on the low land south-western corner of Manipur Valley - one of the Himalayan midlands in the east, at an altitude of mean 790m above the sea level (Stat. Handbook of Manipur, 1985). With a maximum area of 88,975 ha. (DRDA, 1993), it spreads from north to south in an oval shape. For its terrestrial ecosystem of the land, the lake has formed a significant biotic component.

The varied wild food plants on its marshy shore, the aquatic vegetations and nuts such as Heikak (*Trapa nataus var bispinosa Linn*), Thangjing (*Euryale ferox salisb.*), Lemphu (root of water lilies) etc. besides a diverse fish biomass of the lake may be considered within the purview of the nutritional ecology of the land.

At least 55 rural and urban settlements are found around the lake with an approximate population of 1 lakh (Singh and Singh, 1994). When the maximum of the villagers live on dual economy of cultivation and fishing, nearly 30% lived on the sole occupation of fishing.

One significant phenomenon of this lake ecology is to find a universal habitation of the world's most rare deer species - the Brow antlered deer (*Cervus eldi eldi*), locally known as Sangai, towards the south-eastern part of the lake. These animals have found a congenial habitat on the floating phoom mass of nearly 40 sq km (Panwar, 1978). Since time immemorial, the sustantition of their population has, in a way, indicated their adaptive ecological efficiency despite of constant threat from the hunters.

EMERGENCE OF PHOOM HUTS

Adoption of human habitation on the phooms is claimed to have taken place since centuries back. It is referred to in the Legends of the Moirang principalities. Some elderly informants recollected such phoom hut dwellers being observed since before the World War II and increase in its number steady, after the last World war. Dun (1886) observed the lake surface dotted with floating islands composed of matted roots of aquatic plants used by the inhabitants for fishing purposes.

Loktak lake has inherently been the open fishing ground since very early days. Such facilities of free fishing, wet and deep water cultivations and gathering of wild vegetables as well from the marshes have been the main factors for attracting the people to find their habitation near the lake. Seasonal fluctuation of the lake from maximum shrinking size of 55 km during the dry season to overswelling of the volume around 300 sq km during the rainy season had influences in the ecosystem of the lake. Big water volume helped the fishes to their growth rate, while the small water facilitates easier fishing.

Vegetation of various kinds (of which many are used as food plants by the Manipuris) such as Komprek (*Oenantherajavanica*), Kolmani (*Ipomoea aquatica*), Pullei (*Alpinia galanga*), Loklei (*Hydychium coronarium koening*), Peruk (*Centella asiatica*), Yellang, Kengoi etc. are appeared to grow on the lake shore when the water level receded. During this time, the cultivators utilized the exposed land for paddy cultivation or for growing vegetables till the lands are again inundates by the raise of the water level in the next rainly season. The lake has a total catchment area of 980 sq km (Singh and Singh, 1994). In fact, the low lands surrounding the lake are mainly constituted by the contiguous paddy fields measuring a total area of about 14,000 ha.

Varieties of indigenous fishes such as Pengba/Tharak (*Osteobrama belangeri*), Ngara (*Tor tor Gray*), Ngatin (*L. Pangusia*), Ngachik (*Heteropneustus fossilis*), Ngatup (*Neomacheilus manipurensis*), Ngahei (*Eutropichthys vacha*), Ngaton/Khabak (*C. reba*), Ngawa (*Barilius barna*), Sareng (*Wallago atta*) and many other varieties are some of the species that were once caught in plenty from this lake, and they had a high demand for their exquisite taste. Pemberton (1859) accounted no less than 26 fish varieties from this lake, 18 common to the rivers of Bengal and 8 not found in any of them.

These fishes are migratory in habit as they reach Loktak lake and other smaller lakes of Manipur by swimming upstream all the way from Chindwin River of Myanmar *via* Manipur River just to find conducive grounds for spawning (Hora, 1921; Menon, 1954; Singh and Singh, 1985-86).

Loktak was also known for its plentiful migratory birds and waterfowls which were accounted to be about 84 species, of which 12 species are from outside India (DRDA, 1993).

Phoom Hut Dwellers

The infringement of the man over the floating phooms of the lake to find exotic dwelling abodes is another curious phenomenon of the lake. In 1986, nearly 275 permanent phoom hut dwellers were observed and the author physically surveyed 207 huts in the field work he conducted during the last week of December, 1986 and in other subsequent visits. Within a span of another 7 years, the number of the phoom huts are claimed to have increased to 688, of which 308 were classified as permanent dwellers (DRDA, 1993).

In 1986, an inhabitable phoom used to cost Rs. 350/-, but it has now increased nearly to Rs. 1000/-.

A single hut over one phoom is the normal order. One hut with one store house was also observed occasionally on a phoom. The overall technological aspect of a phoom hut is to maintain light weight by using minimum light weight materials. The size of a phoom which supports a hut has an average length of 52.55 ft and breadth of 47.38 ft with a thickness of 7.06 ft. Bamboo is the chief material for the frame work of such a hut. Reeds (*Erianthus arundinaceus Retz.*) are used for the walls while thatch (straw or Kambong mana *i.e.* leave of *Zizania latifolia*), are used for roofing. There is no raised foundation. The walls are not plastered with mud. A raft of bamboo covered with a mat of bamboo splits is the normal floor inside the hut. All the huts are of one single room rectangular structured type having a dimension of 19.52 ft length, 12.76 ft breadth and 10.14 ft height in average. The rear gable is too low that it nearly is about to touch the ground surface, as a way perhaps to protect the hut from the strong wind. For that matter, a homestead phoom is always anchored with heavy stone sinks tied in the 4 corners where in each 2 crossed bamboo poles are also fixed to reinforce the fastening. If the condition of a phoom is deteriorated, repairings are done with the insertion of phoom cakes underneath.

The huts would face towards the east like a Meitei traditional house, except those few ones which are oriented towards the south facing along the Sendra Road, Moirang. A hut has a single door of 4.6 ft height and 2.6 ft breadth in average. One kitchen is kept towards the north-western corner on an elevated mud oven.

Growing of plantain plants and some vegetables such as cabbage, mustard, broad beans, snack gourd, gourd, pumpkin and some local condiments were observed on some phooms. During lean season, many people scooped out Heikak, deep from the lake bed and they consume it to replace major meals. Fowls, ducks and cats are the common domestic fauna often observed in these homesteads.

PROFILE OF LIFE STYLE AT PHOOM

Full time devotion to fishing and the influence of their aquatic habitation, have given the hutments an impact on their sociocultural and economic life. Elaborate Meitei festivals, religious functions, and amusements are now conspicuously absent from their activities. As most of them are the Hindus, few Tulsi plants (*Ocimum sanctum*) were observed to grow in front of few huts. In a recent development, atleast 7 families, so far, have converted into Christianity under the Envegelical Free Church of India and a church having roof and walls with C.I. sheet is now under construction on a phoom located at the mouth of the Ningthoukhong Inlet Channel locality. The first church which has been now demolished was inaugurated on 7th February 1992.

Among these fishermen, the quantity and type of fishing gears they posses depend on the background of their fishing specialization and capabilities.

Phoom : A phoom is a matted floating mass as formed out of the subsequent accumulation of the decayed properties of the recycled aquatic vegetations specially water hyacinth - one of the dominant vegetations of the lake coupled with detritus properties. Its size may expand several meters in diameter with varying thickness. Some 64 plant species associated with Phoomdi have been identified (Deb, 1961; Bhatia and Sarkar, 1979). Water hyacinth which is said to be one of the fastest growing plants with biomass doubling time as low as 6-7 days (Pettel, 1964; Singh et al., 1983) is heavily infested in this lake.

Varying methods of fishing have been in use and in accordance with the needs (Hodson, 1908) from early days. Some of the chief fishing methods practised in the lake are the use of hooks and gorges, gill nets, Chinese dip nets, lift nets, cast nets and various cage traps such as automatic valved traps, Tekhaoloo, Taotharoo, Plunge baskets and multipronged harpoons etc. *Phoom namba* and *Moirang Langoi* are some of the typical community fishing methods practised in the lake.

The fisher folks are busy round the clock. Just at the dawn, they haul the catches from the nets, hooks, cages etc. After their lunch, the men folk again start setting the manipulations of the fishing gears and these processes may extend till late evening. It is the domain of the house wives to look after the disposal of the catches. They invariably sell them through the 'Unjas' whom they are locally known for the traders. These 'Unjas' come to the huts in the morning and procure the fishes in good bargain. On the next return, the Unjas often bring items of basic needs of a family and the cost is generally adjusted with that of the cost of fish.

When fishing activities are done mainly by the menfolk, the womenfolk undertake the domestic works which normally include going to the nearby market or shops on the lands for procuring groceries, fuels etc. At times, they also participate in catching fishes by using lift net - a very common small size type of Chinese dip net which is locally known as Nupi il (Ladies net). They operate it sitting on the edge of their homestead phooms.

A family has some basic utensils, Kharai (bamboo tray), baskets, kitchen wares etc. One or two or sometimes rarely three dug out canoes are the precious possession for a family.

FORMATION OF CLUSTERING GROUPS

Huts are formed into small clustering groups which are scattered mainly along the western fringe of the lake covering a large range of area begining from the Nachou village water zone on the north to Moirang zone to the south. The huts are normally set in an irregular pattern. However, those hamlets, which are located nearly at the interior lake areas are generally arranged in two rows leaving nearly 30 metres wide waterways in between. The present 207 huts are distributed broadly into 14 hamlets or clustering groups (Table 30.1). Concentration of the huts are more frequent at Ningthoukhong water zone area, where the fish catch yield is expected to be more due to the water flow which draw towards the Inlate channel of the Hydroelectric Project. The convenience for easy communication as facilitated by the Channel itself and also the prevalence of more other landing creeks at Moirang, Phubala, Ningthoukhong etc. is another factor.

Clustering groups are the small social units and they are usually formed by the heterogeneous families which may come from different villages of different directions.

Table 30.1: Distribution of clustering groups of Phoom dwellers of Loktak lake

S.No.	*Clustering group*	*No. of hut*
1.	Biharipat	11
2.	Leihaokhong	5
3.	Potsangbam Mamang	18
4.	Meleibipat	11
5.	Tompokpi Mamang	13
6.	Thengu Pandon	15
7.	Houjeng Sabal Pandon	8
8.	Ningthoukhong Pandon	38
9.	Ningthoukhong Mamang	29
10.	Lamyai Taothabi	6
11.	Lamyai Phumlak	18
12.	Phubala Mamang	19
13.	Thinungei Chekya	6
14.	Thingnungei Mamang	10
	Total	207

CHANGES IN LOKTAK ECOLOGY

Constant erosion and heavy degradation of forest, over and above the age old practice of Jhuming on the hill slopes, enhanced the Loktak lake to have undergone gradual siltation processes through centuries. As a result, the lake bed has become shallow and consequently dwindling even its overall size. Moreover, men's vehement exploitation of the lake through reclamation for pisiculture and other purposes has also posed a great threat to the existence of the lake. There are clear evidences that in Manipur valley quite many of the swamps have already been converted into places of human settlement leaving no trace of the original feature whatsoever.

When the *phooms or phoomdis* got rest on the land surface during the dry season, it transforms into a vast pasture land and also becomes a rich resource for various kinds of wild food plants and many other varieties of economic importance.

Commission of the Ithai Barrage on the Imphal River in 1983, for the purpose of backwater as a process of regulating water volume of the Loktak, has brought the following few phenomena of changes.

(a) The vast paddy fields measuring nearly 50,000 ha. have been submerged permanently, thereby rendering many villagers landless.
(b) Phoomdis which used to flow, otherwise, down in large quantities towards the Chindwin river of Myanmar through the Manipur River have now been ceased. As a result, the growth of phoomdis has become faster.
(c) The number of Phoom dwellers have been increased to find new economic basis by adopting specialized fishing techniques.
(d) As the upstream route of the migratory fishes has been checked, many kinds of indigenous fishes,have disappeared affecting the gastronomy of the people of the state. The newly introduced fishes such as major Indian and exotic Carps, Rou, etc. have become the major fishes of the lake. In a way, the quantum of fishes should have been increased in the lake after the regulation of water volume

CONCLUSION

The biomass of the Loktak Lake of Manipur, for its unique characteristics, has attracted the people to inhabit on its peripheral land, since time immemorial. The rich resource of fish from the lake which is the chief source of protein for the people of the state, the various wild ethnic vegetables of aquatic and marshes grown varieties and also the fertile shore of the lake are the special importance of this lake. The Loktak has been aptly called as the life line of the State. Man's occupancy on the floating Phooms of the lake surface to find another alternative habitation is of extreme case of their interaction with the lake ecology.

The biome basis for the brow-antlered deer and that of the hutments is basically the same as both have almost similar biotic support. The Phoomdi at Keibul Lamjao National Park for the deer is, of course, a vast phoom mat, whereas that of the hutments are of much smaller units.

The ever changing ecosystem of the lake has had constant effect on the morphometry and general biomass of the lake including the human beings specially in respect of their socio-economic pattern. Another factor that had brought a phenomenal change in the Loktak ecology was the historic commission of the Ithai Barrage in 1983.

The submersion of vast cultivable lands on the contiguous land around the lake has upset the socio-economic life of several nearby villagers. Many of them have resorted to taking alien habitation of the lake surface. For them yoke and plough, bullock cart, or any elaborate household amenities are no more the special items, but the new fishing technologies and the dug out canoes have become their indispensable possessions. A few families were observed to possess radios and tape recorders.

Although, the Loktak lake has suffered maximum ecological trauma, men's need for the lake is still eminent. A pragmatic approach is necessary in order to maintain and preserve the Loktak lake ecology so as to save several vegetations and lives.

KEY WORDS AND ABSTRACT

KEY WORDS Ecosystem. Fresh Water Lake. Phoom. Fishing. Adaptation

ABSTRACT This study has been envisaged to discuss the changing trend in the overall ecosystem of the Loktak Lake of Manipur, one of the largest fresh water lakes in North-Eastern India, as an approach to human ecology with special references to its floating Phoom dwellers. When the natural processes of erosion and siltation have been the constant experience of the lake, the most serious impact on its ecology came from the commission of the Ithai Barrage in 1983. The age old culture of the floating phoom habitation of the Lake surface is on the increase as many victims of landlessness have adopted fishing as their sole occupation by living on the phoom masses. They had to encounter the stresses of the lake life through gradual adaptation coupled with new technologies.

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Author's Address : **K. Saratchandra Singh,** Professor, Department of Anthropology, Manipur University, Canchipur 795 003, Imphal, Manipur, India

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Bibhash Dhar

INTRODUCTION

It is universally accepted that human beings are exceptionally capable to adjust or modify or alter their ways of life in accordance to the physical conditions around. Very little attention has been, however, devoted to examine what individuals actually do to adopt themselves in the variegated ecological situations. Ecology of humanity, in contrast to the other living beings is always influenced by technology and its material products. Beals et al. (1977: 174) has observed, "Technology has been called a cultural screen that people set up between themselves and their environment. As such it affects the ways in which they may both exploit and modify their environment." They grow food plants or domesticate animals for a steady supply of their necessities, precisely food. Thus the human beings are able to survive anywhere and in any condition. A limitation in technology often forces the societies to limit the use of environment. Thus we sometimes come across tribal communities that have an economy much simpler compared to their immediate neighbours. It is believed that demoestication of plants and animals took place in the Neolithic period and Childe (1948) has very correctly called the Neolithic a 'revolution' as it opened the door to an entirely new way of life. People began to produce their food and were less dependent on the whims of nature. The first stages of animal domestication or farming, though are the matters of further research still the scientists of yesteryears opined that the foothills and the upland valleys of the mountains surrounding Mestopotamia are probably the area where farming started. Protsch and Berger (1973) found evidence of goat and sheep in parts of Iran that are dated at 8000 B.C. In this context Childe's (1970:81) observation is worth noting, "Pure pastoral nomadism is familiar, and is illustrated by several peoples in the Old world; the Bedouin of Arabia and the Mongolian tribes of Central Asia are best known examples. How old such a mode of life may be uncertain. Pastoralists are not likely to leave many vestiges by which the archaeologists could recognise their presence." Childe (1970-81) further, and most confidently observed, "Whatever its origin, stock-breeding gave man control over his own food supply in the same way as cultivation did."

The Pangchen-pa are a group of tribal people inhabiting the inaccessible mountains of the Arunachal Himalaya. The Zemithang administrative Circle is the Pangchen country in the district of Tawang in Arunachal Pradesh. It is in the north-western corner of the state and borders China (Tibet). The Pangchen-pas live on the pastoral means of survival but their neighbouring tribes have made themselves recognised as expert mountain agriculturists. Of late the Pangchen-pas have taken up marginal farming along with animal herding. It has been observed from the different studies in African and Latin American situations that the pastoralists adopted grain production mainly to support a bigger population and also to tide away the situations created by natural calamities or animal raids due to inter group rivalry. The Pangchen-pas are not faced with such problems yet have adopted the marginal farming along with the age-old pastoralism.

Early studies on pastoralism focussed on pastoral value and attitudes and minimum effort has been, perhaps, put to understand the pastoral economy. During the last decade, not only anthropologists but other social scientists and geographers have attempted to study the pastoral behaviour in complete context. Sucessfulness in pastoral practices obviously depend on the specific technical knowledge of soil, floral coverage and animal deseases mainly. It is felt that anthropologists should not shy away from giving the descriptive account of the pastoral societies. These might not receive any academic acclaim but these are rather urgently needed to document the traditions before they are forgotten.

THE STUDY AREA

'Pangchen' has been derived from the traditional nomenculture of the mountainous region of Zemithang that forms the country of the Pangchen-pa. In the pre-independence period the present day Zemithang circle was traditionally known as the *Pangchen-Dingdruk*. Nanda (1982: 6) in this context made the following observation, "... the last division is that of Pangchen Dingdruk or the six *dings* (villages) or Pangchen which adjoins Tibet ... form the administrative outpost of Zemithang." In the Pangchen tongue Pa means the inhabitant. The Pangchen country is made of steep mountains with rocky braes mostly, as a result, cultivable plots on the brae region is limited. The patches of grassland on small plateaus here and there amid the rocky cliffs perhaps tempted the people to own animal herding as their livelihood. This is rather an adaptation to the specific physical surroundings. The Pangchens remain mobile for about eight months in a year but at the same time they have eight permanent villages in suitable locations in the circle. As the sheep, yaks and cattle keep on moving constantly from one pasture to another the people also move along with their herds to take advantage of good grazing conditions. During the period when bulk of the Pangchenpas keep themselves mobile along with the domesticated animals a few members from each family stay back in the villages for agricultural activities.

The very location of the Pangchen country has made it strategically important as it borders China (Tibet) on the north and the mountain kingdom of Bhutan on the west (Fig. 31.1). It constitutes of a number of sierra and mention may be made of the Thagla Ridge which is a very steep range of mountains. Winters experience snowfall while the monsoon brings heavy rains. Floral cover of the area includes oak, rhododendron and other varities of coniferous vegetation. In summer with the onset of rains the country swells up with annual growth of grass and shrubs.

The people under study are a tribal community of about 1200 souls. There are eight villages in total and all lines up on both sides of the river Nyamjang-Chu that flows turbulently from Tibet and washes the Pangchen country before flowing into Bhutan. The river flows in a north-south direction. Some of the villages are on the mountain tops overlooking the river. The people herd cows, yaks and sheep and since recent decades have taken to the production of grains such as barley, millet, mountain wheat, etc. Interestingly enough there is no information about the people in the anthropological world and the present work is the first of its kind. During the course of field investigation in the villages of Soksen, Kalyaiktang, Lumpo, Muchut, Brokenthang and Zemithang it was found that each village has got a series *Mro* (grassland) in the higher altitudes to pasture their livestock. It has also been found that the *Mrokpas* (the herders) of a single village form a cohesive social unit so long they remain in the *Mro* along with the sheep and cattle forming a single herd. A similar situation has been observed by Tomka (1992) during the course of his study among the Alota, a settled agropastoral community in the southwestern Bolivia. Tomka (1992:413) in the above context observed, "While each nuclear family has its own llama herd, often the small herds of related nuclear families (*e.g.* brothers' herd) were retained in a single large herd." A difference that has been observed between the herders of Bolivia and the Pangchen is that the latter being Buddhist do not corral their animals to be chosen for slaughter or be sent to abattoir. Pangchen diet is predominantly vegetarian and killing animals is almost a taboo. However, the people sometimes enjoy meat but only of those of their cattle that have died a natural death. They use vessels of leather for storing milk products.

HERD MANAGEMENT

Members of the family that herd the domesticated animals segregate in *Dawa Sumpa* (April-May, the third month as per the Tibetan-Buddhist calender) and start for the *Mro*. They remain on the move from one *Mro* to another higher and higher in the mountains as snow clears the stage bit by bit. After a good grazing in the mountain pastures these pastoral nomads descend to the lower pastures along with their herds in *Dawa Chupa* (November-December) as the winter sets in. Finally, the *Mrokpas* return to their respective villages to stay for about three or four months. The study was conducted in the monsoon when the graziers remain mobile with their herds. The *Morkpas* carry with them the provision and other equipments. The graziers have semi-permanent type of rock cottages in the *Mro* where they cook food and retreat by sunset. They do not construct any enclosure or stable for their cattle. In the study 100 Pangchen households were censused and it was recorded that they had 649

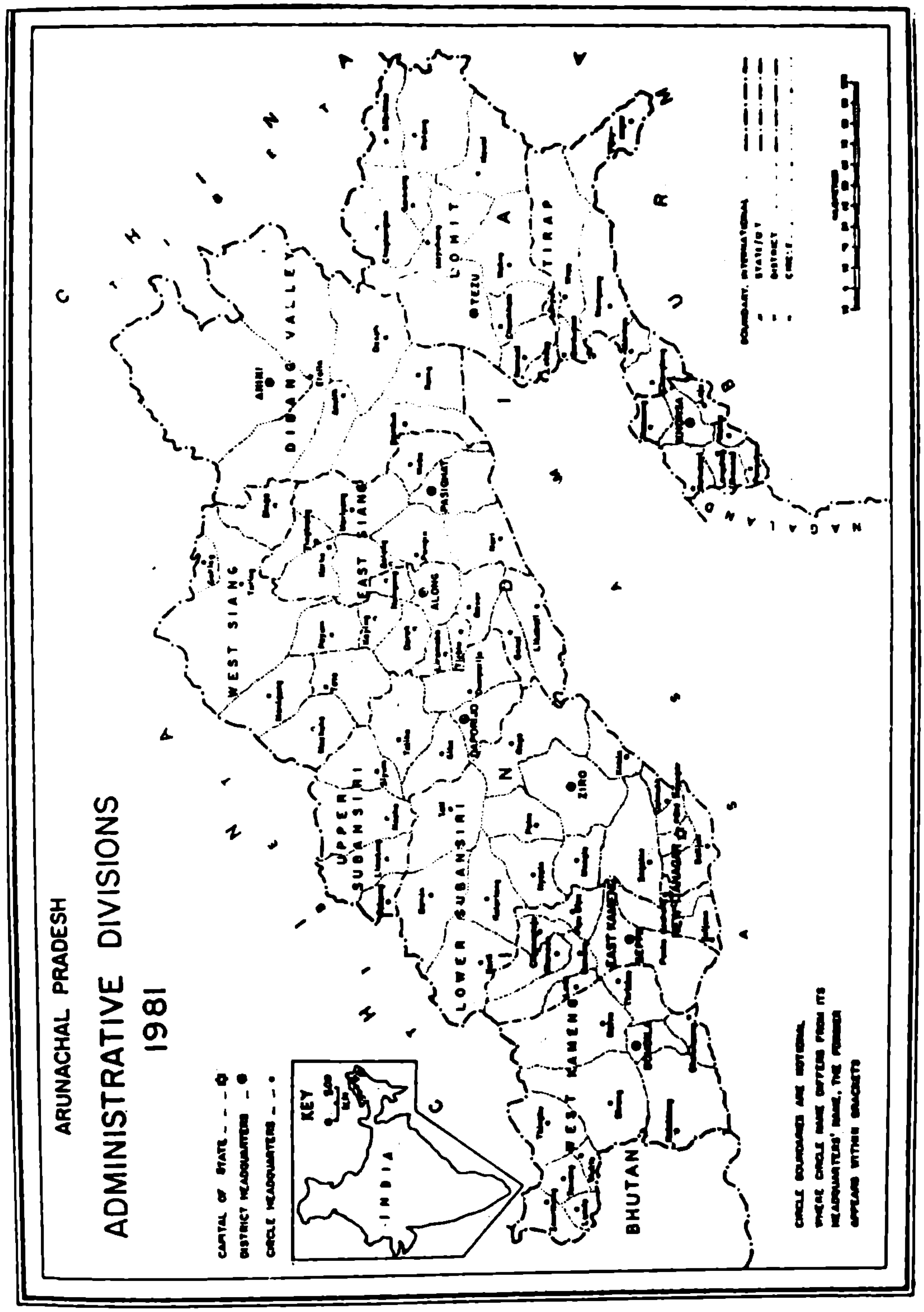
ARUNACHAL PRADESH
ADMINISTRATIVE DIVISIONS
1981
CAPITAL OF STATE
DISTRICT HEADQUARTERS
CIRCLE HEADQUARTERS
KEY
INDIA
BHUTAN
WEST KAMENG
EAST KAMENG
LOWER SUBANSIRI
UPPER SUBANSIRI
WEST SIANG
EAST SIANG
DIBANG VALLEY
LOHIT
TIRAP
ZIRO
DAPORIJO
ALONG
PASIGHAT
ANINI
TEZU
NAGALAND
CHINA
INDIA
BURMA
ASSAM

Fig. 31.1

cows, 136 yaks and 56 sheep. Out of the 100 households it was also found that 92 per cent of the families of the Pangchenpas were nuclear and this is largely true with most of the pastoral communities of the world. Tomka (1992:413) observed the same phenomenon in his studies on the pastoral communities of the southwestern Bilivia. It is relatively hard to support a higher number of family members with the economy of pure pastoralism. Agriculture and pastoralism together or agriculture alone could however provide for a denser population always.

The indigenous village political organization of the Pangchenpas is knwon as the *Mangma*. The *Mangma* constitutes of the village headman, the Anchal Samiti Member, assisted by three other officials known as *Ganjen* to run the smooth administration. In times, however, it becomes difficult for the *Mangma* officials to keep a track of the *Mrokpas* as these graziers abandon the village for long eight months and move from pasture to pasture. To enable the *Mrokpas* to lead a regulated life in the pasture the Pangchenpas select two officials known as *Dropn* or pasture leaders. *Dropn* is a Tibetan world (*Dro* - pasture, *Pn* - leader) and these officials remain in office for one year. *Dropns* form a part of the *Mangma* and are selected from time to time from each village. *Dropns* shoulder the responsibility of maintaining the order while the *Mrokpas* remain mobile. In addition the *Dropns* are also to find out and fix an auspicious date and announce the zero hour for marching for the summer pastures. The pasture leaders fix the date in consultation with the village *Lama* (Tibetan-Buddhist priest) after going through the Tibetan-Buddhist almanac. Subsequently, the prospective *Mrokpas* of the year meet the concerned *Dropns* to discuss and finalize the sex composition, age structure and the number of persons from each family that would remain in the stifling valley accompanying the herds. It has been found that from many families only women, young and old, and children leave for the mountain pastures while the old as well as the able bodied males stayed back to look after the fields and dwellings. This, however, is in contrast to the sexual composition observed among the most pastoral communities of the world. Animal herding is an occupation where the involvement of males is largely observed. Beals et al. (1977:221) in this context observed, "Herding tends to be an occupation largely restricted to males...". Among the Pangchens it has been found that the involvement of women of all ages in the different spheres of pastoral life is largely equal to that of the males. The Pangchen women and children move with the herds in the mountain pastures as their male counterparts do. They actively take part in milking the cattle and storing *Mar* (butter) and *Churpi* (a hard cheese-like substance) which are to be exchanged for food grain in the subsequent period. Both, Pangchen butter and *Churpi* are in great demand in the neighbouring Monpa tribal villages and also in Bhutan. This perhaps proves that there is a gap in the information regarding the participation and involvement of women in pastoral activities. The following observation made by Stenning (1959) would throw some light in the above context. Stenning (1959:103) observed, "The ignorance of the roles of women in pastoral society is perhaps due in large part to the fact that few women ethnographers have studies herders." Stenning (1959) in his monumental study of the pastoral Fulani of Nigeria has observed that Fulani women are responsible for marketing of milk and milk products. But among the Pangchenpas it is found that they work even hard and their involvement is much bigger compared to the Fulanis (women) of Nigeria. Bates and Conant (1981:94) observed a similar involvement of women among the pastoralists of Sinai mountains. They reported that in the mountains of Sinai women and children tend flocks while adult males work in agricultural projects.

With the development of educational infrastructure in the vicinity of the animal herders in different parts of the world the pastoralists are faced with the problem of the relative scarcity of the herding labour force. This happens as the children, that forms the herding labour force, remain busy in their studies. Thomas (1973:140) came across a similar situation among the Andean pastoralists. He observed, "Children a major part of the herding labour force throughout the Andes are in school during much of the day and a good part of the year." Thus, the pastoralists remain in constant search for school dropouts to carry out their herding activities. As the Pangchen country is one of the remote and inaccessible area the people and yet to face the problem of the dearth of tending labour force.

Stocking of Milk Products for Exchange and Paying Tax

Stocking of *Mar* and *Churpi* begins from *Dawa*

Gyeypa (September-October, the eighth month as the Tibetan-Buddhist calender). The Pangchen *Mrokpas* store *Mar* and *Churpi* in *Zoms* (wooden utensils with a capacity of about ten kilograms). The Mrokpas carry a number of *Zoms* along with the food grains as they move in caravans for the mountains pastures. They need to stock the milk products for two reasons precisely: (a) to be exchanged for food grains, especially, millet and (b) for the traditional payment of tax to the Tawang monastery. The Pangchens exchanges butter and *Churpi* for bags of millet from the neighbouring tribes. The Monpas and the Bhutanese keep on visiting the Pangchen villages throughout the year with horse-loads of millet to be exchanged for the milk products. The Pangchens never go out with the milk products to be sold or exchanged. Such instances of barter between pastoralists and agriculturists are reported from many other places. In the African situation such symbiotic relationship are reported between the dry land pastoralists and the farmers in the better-watered areas. Hjort (1981:35) while citing few examples mentioned about the Turkana of Kenya who traditionally bartered their pastoral products for maize or millet from the neighbouring Marakwet. With most of the herders it has been found that they herd animals for a number of reasons. They corral the animals for slaughter, they collect the hides to be sold or exchanged and of course the sell of milk and milk products. The Pangchenpa tend their animals solely for the milk products to be exchanged for millet which they need in every of their meals. They sell the products whenever they need cash money.

Since a few centuries, to be precise, since the seventeenth century the Pangchenpas, the Monpas and the other Buddhist tribes of the present day Tawang and the West Kameng District of the state of Arunachal Pradesh pay the *Khrei* (Tax) to the Tawang monastery. The Tawang monastery is one of the biggest of its kind in Asia. Since the inception of the monastery sometimes in the seventeenth century (Nanda, 1982; Rahul, 1971) the tribesmen group of Tawang and the neighbouring areas initially bound themselves voluntarily to pay a grain tax to the monastery for the upkeep of the *Lamas*. The officials of the monastery who were Tibetans till 1951 broke bed for centuries and often used force to collect the *Khrei* (tax). As the Pangchenpas used to do little or no cultivation opted to pay the *Khrei* in the form of butter instead of grain. This tradition is still maintained as a reverence towards the monastery. The Pangchenpas at present pay the *Khrei* twice a year in *Dawa Ngapa* (June-July, the fifth month) and again in *Dawa Chupa* (November-December, the tenth month). It is the responsibility of the respective *Dropns* to collect the *Khrei* from each family and handover the same to the *Lamas* from the Tawang monastery who set up temporary camps in Pangchen villages.

AGRICULTURAL OPERATION

The Pangchenpas are on the serious attempt to subsidise their age-old economy of pastoralism through marginal agriculture. Perhaps the people found that in the near future it might be difficult for them to survive on pure pastoralism due to certain social constraints and incapsulation. Instability of pure pastoralism has been reported by some anthropologists and social scientists in the past. Childe (1970:81) in this context observed, "Pure pastoralism and pure hoe-culture were originally practised independently by seperate peoples and that mixed farming resulted from their subsequent fusion, is irrefutable. Yet Forde has recently emphasized the instability of pure pastoralism. Many typical pastoral tribes today actually cultivate grain, though in an incidental and rather casual manner." In the context of Pangchen Agriculture Nanda (1982:7) observed, "The people are primarily yak graziers, but there is no taboo on cultivation which is extensive." The field situation is not in complete tune with the above observation. Census conducted in the 100 Pangchen households shows that apart from yaks the people graze cows and sheep and among the cattle the number of cows is the highest. Secondly, only some patches of cultivaion could be noticed in some suitable brae regions. Extensive cultivation is not, perhaps, possible in the terrain under study as most of the braes are too steep and rocky. It, however, remains a fact that though the Pangchenpas are relatively new in the field of grain production still they cannot be labelled as casual plots but all of these are permanent cites. Hjort (1981:137) has coined the term 'Take-a-chance' cultivation while he worked on some pastoral communities of Africa. He tried to justify the new term as he found that the pastoralists of the drier areas of Africa usually take opportunities to cultivate on the dried river beds and thus he termed it 'take-a-chance'. Such cultivations are the simplest and least labour demending form. Evans Pritchard (1940) cited another example of casual cultivation from the Nuers of Africa.The Nuers represent a people entierly dedicated to raising of cattle but reluctantly engaged in fishing or agriculture.During the rains the Nuers retreated to more or less permanent villages and each family cultivated on a patch of land behind their homestead. Unlike the Nuers or the other pastoral communities of the drier regions of Africa the Pangchenpas have not taken up the cultivation of grains reluctantly. Inspite of the fact that the terrain is unsuitable for extensive cultivation still the people take much care to grow millet, barley, mountain wheat, fox-tail millet and potato. The Pangchenpas require a large supply of millet as they regularly dine on porridge and beer and the quantity of millet they produce in insignificant.The Pangchenpas have a system of co-operative help meant for agricultural operation and is known as *Lole*. It is through *Lole* that each head of the family could seek community help in the fields in the seasons of the different crops. The Pangchenpas do not cultivate anything in their *Mros* and most of their fields are nearer to their villages. Table 31.1 shows the agricultural calendar of the Pangchenpas.

It could be observed from the agricultural calendar that the agricultural season peaks at monsson and *Dawa Ngapa* (June-July, the fifth month as the Tibetan-Buddhist calendar is the busiest *Dawa* (month). It is during *Dawa* Ngapa the people sow/ broadcast millet and harvest buckwheat, barley and potato. Though the pains of agricultre are shouldered by the family members that stay back but in time the younger *Mrokpas* come down from the mountain pastures to help in the fields.

Table 31.1 : Agricultural calender of the Pangchenpas

Local Name	*English Equivalent*	*Sow/Broadoast*	*Harvest*
Koh	Buch Wheat	Dawa Gupa (Oct-Nov)	Dawa Ngapa (June-July)
Nas	Barley	Dawa Dunpa (Aug-Sep)	Dawa Ngapa (June-July)
Khre	Millet	Dawa Ngapa (June-July)	Dawa Chupa (Nov-Dec)
Bremo	Foxtail millet	Dawa Drukpa (Jul-Aug)	Dawa Gupa (Oct-Nov)
Khe	Potato	Dawa Chungnyipa (Jan-Feb)	Dawa Ngapa (June-July)

There are some pastoralists who construct cattle shelters near their agricultural fields for the convenience of easy transportation of manure to the fields. During her course of study among the Tamangs of Nepal, Panter-Brick (1987,1989) found that the Tamangs construct temporary cattle sheds nearer to their fields for an easy supply of dungs. The Pangchenpas neither construct such sheds nor do they use the animal dungs as manure. They prepare a mixture of dried human excrets and oak leaves known as *Ninlon* as manure.

CONCLUSION

Pastoralism and agriculture together, generally, provide for a denser population than could be supported by hunting-gathering or livestock economy. The Pangchen pattern of subsistence, like that of any community living in difficult environmet, involved the use of all available technology to exploit any conceivable environmental niche in the vicinity. Population of the Pangchenpas is not that significant and thus their economy of pure pastoralism was well-enough to meet the ends meet. A question may be raised as to what made the people to switch-over to agropastoralism. It has been found that many pure pastoral communities adopted agropastoralism at a later stage. Rather, the circumstances persuaded them to do so, may be often to their dislike.

In the long past human population in a particular area was well below the maximum number of people the particular environment could support. Thus, a more or less stable relationship with the environment was maintained. Incidence of desease also with all probability was low. The difference was created as the human beings began to undergo a radical change some ten thousand years ago as the last ice age drew to a close. In the subsequent decades modern technological developments were noticed in the realms of transport and communication followed by the state formation with strict international boundaries. With the formation of the states the mobility of the pastoral peoples largely came to a halt with the politics of encapsulation. The pastoral people soon discovered the restrictions imposed on their movement to certain pastures due to the consolidation of control through military means. Such encapsulation often resulted in over-population. Thus, many a pastoral community of

Africa, Middle East, Latin America and other places switched over to hoe-cultivation, be it marginal or casual. It has been clearly mentioned in this paper that the Pangchens are yet to face the problem of overpopulation but then their transformation to agropastoralism from pure pastoralism is because of the restrictions they face on the extension of grazing lands due to the international border in their close vicinity. Perhaps, the people are afraid of the deterioration in the pasture qualities in the near future and to tide away the probable crisis the people have started hoe-cultivation along with herd management.

ACKNOWLEDGEMENT

I am indebted to the Director, Anthropological Survey of India for giving me a chance of work among the Pangchenpas of Arunachal Pradesh.

KEY WORDS AND ABSTRACT

KEY WORDS Agropastoralism. Agriculturists. Environment. Pastoralism. Herd.

ABSTRACT Pastoralists once depended on the neighbouring agriculturists for the supply of food grains that they used to exchange with their pastoral products. Subsequently, natural calamities, inter-group rivalry and various other factors persuaded the pastoralists to switch over to agropastoralism. This on the one hand could support a denser population and on the other subsidized and herd-management economy. The Pangchen pastoralists, a border tribal community of the Arunachal Himalayas, also converted themselves to agropastoralists not because of over population or natural calamities but due to encapsulation, which of course is a world phenomenon. The Pangchenpas are wise to realize quite before hand that they no more could extend the grazing grounds and they are afraid that this might result in deterioration of pastoral qualities in the near future.

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Author's Address : **Bibhash Dhar, Ph. D.** Anthropologist (Cultural), Anthropological Survey of India. N.E. Regional Centre, Shillong 793 001, Meghalaya, India

Incidence of Nasopharyngeal Cancer in The North Eastern States of India : Impact of Some Environmental Factors - Tobacco and Alcohol

A. Datta and R. Handique

INTRODUCTION

Environment plays a very important role in producing many diseases including cancer. Over a long period the relationship between cancer in different parts of the body and various environmental contaminants and pollution, have been increasingly observed. It is now generally accepted that between 60 and 90% of all cancers are directly or indirectly linked to our environment, that is related to factors in air, water, solar radiation, living and working environments and personal choices of diet and ways of life - such as tobacco smoking and alcohol consumption.

Viewing the world as a whole, the net effects of many known cancer causing factors remain substantial, though none is as prominent as tobacco. This is shown in table 32.1 (Kumar, 1987).

Table 32.1 : Relative importance of cancer causing factors

Factors	*% of all cancer deaths*	
	Best estimate	*Range of acceptable estimate*
Tobacco	30	25-40
Alcohol	3	2-4
Diet	35	10-70
Occupation	4	2-8
Pollution	2	<1-5
Industrial products	<1	<1-2

Tobacco smoke is a very important pollutant of the air which one breathes. The smoke which contains a wide variety of gases are extremely dangerous to health and passive smoking, and in particular, has been identified as a major air pollutant since it contains radio-active polonium which is dangerous to the smoker and to the non-smoker as well. This fact has also been supported by Hirayama (1981) in his experiments with passive tobacco smoke.

Nasopharyngeal cancer (N.P.C.) is one of such types where environmental factors are suspected to play a very important role. It is one of the most confusing, commonly misdiagnosed and poorly understood diseases and only a few references to the diseases were found before the beginning of the 20th century. N.P.C. has been found to be only prevalent among certain ethnic groups and races in some parts of the world and is low in some other countries and races. It is very common in the Chinese population but its incidence is quite high in the North Eastern states of India particularly among the population having Mongoloid ancestry.

A preliminary survey of the living and eating styles (the relationship with environment, in general) of 175 individuals with N.P.C. from the North Eastern states of India, particularly Nagaland and Arunachal Pradesh, has shown a difference from what could be expected from the people of the rest of the country. Most of them were found to live in ill-ventilated houses and use ill- preserved and poorly cooked food and were mostly illiterate. Smoking was a common practice among both the sexes while home made alcohol consumption was very common among the males. Keeping in mind the importance of environment on the causation of cancer, this work was undertaken to find out any impact of tobacoo and alcohol on the occurrence of N.P.C. particularly among the tribal people of North East India.

MATERIALS AND METHODS

This study was conducted on 175 (154-males, 21-females) histologically proven cases of N.P.C. They used to come to Assam Medical College for treatment mostly from Nagaland (57.1%) and Arunachal Pradesh (27.4%). The period of study was from 1989 to 1992 (Fig. 32.1).

Villages of Nagaland and Arunachal Pradesh were visited by the ethnographer and after studying their smoking, drinking and living habits, the data were noted down. The individuals with N.P.C. were interviewed personally to have an idea about their drinking and smoking habits.

Sampling of Tobacco smoke was carried by drawing the smoke through a glass fibre filter, and the extraction was done by Soxhlet apparatus. After reconstituting the sample in 45 ml of 4 nomral

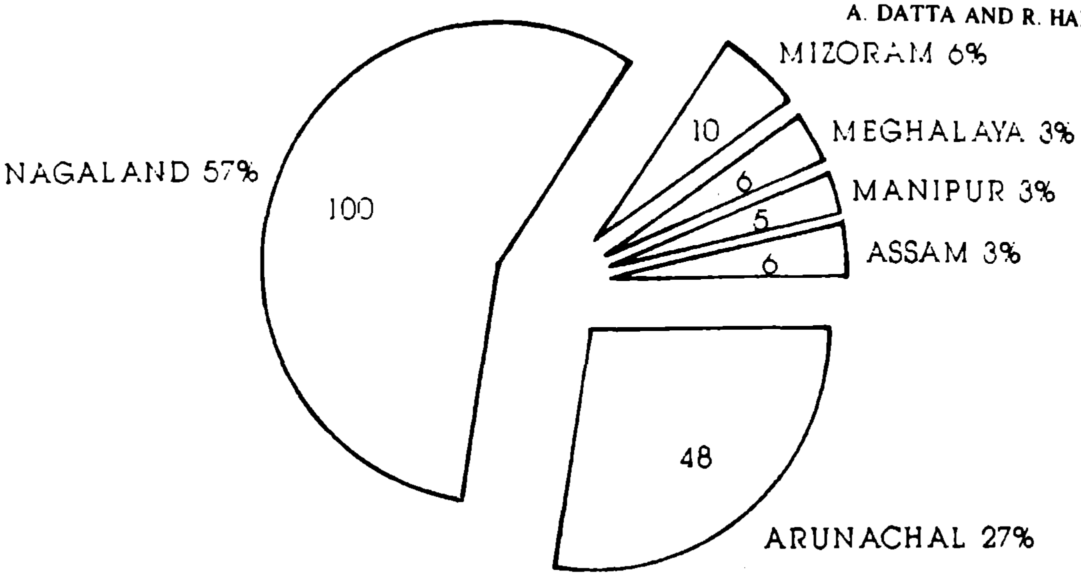

Fig. 32.1

HCl and adding 15 ml distilled water, the solution was analysed using D.C.P. Atomic Emmission spectometer and the results were expressed in μg/ml.

The data (Table 32.2) showed that smoking was a common practice among both the sexes. While 65% of the 175 individuals with N.P.C. were tobacco smokers, 34.5% were non-smokers. Of the 175 cases, 21 (12%) were female cases out of which 18 (10.1%) were tobacco smokers, 3 (1.7%) were non-smokers.

But there is a good deal of difference in smoking.

Table 32.2 : Smoking and drinking pattern observed in individuals with N.P.C.

Sex	*Individuals with N.P.C.*	*Smoking habit*		*Drinking habit*		*Smokers and Drinkers*		
		Smokers	*Non-Smokers*	*Drinkers*	*Non-Drinkers*		*% occurrence of N.P.C.*	*P*
Male	154	97	57	139	15	97	55.4%	P=5<1
Female	21	18	3	15	6	15	8.4%	P=0.8<1

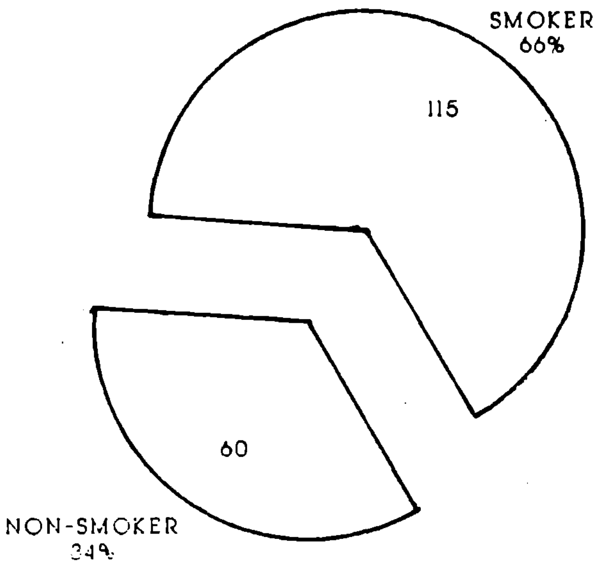

Fig. 32.2

A section of the people uses indigenous locally made 'bidis' that are wrapped up by ordinary papers. It has been noted that 42 persons out of 175 individuals (24%) smoke these indigenous 'bidis' that are made from leaves of a locally available plant called 'Mokotung' (available in Nagaland only). Smoke from such leaves were analysed and the result showed very low amount of Di-benzo (a, 1.) pyerene (0.0002 μg/ml) in 50 gms of leaves) and Di-benz (a,h) acridine (0.0001 μg/ml in 35 gms of leaves).

The study in the villages of Nagaland and Arunachal Pradesh has shown that even though tobacco smoking was a common practice among both the sexes, it was the males who were prone to N.P.C. (out of 175 cases studied, 154 were males).

Concerning alcohol consumption habit it has been observed that 88.4% of the people studied were alcohol addicts while the remaining 11.0% were non-alcoholics. It has been further noted that a large number of the addicts (83%) were used to home made liqueur. In case of females, 15 (8.8%) were alcohol drinkers while 6 (3.4%) were non-drinkers.

A survey conducted in the villages of Nagaland and Arunachal Pradesh with 500 male and 500 female normal individuals without N.P.C., however, showed a total of 410 males (82%) as alcohol drinkers against a total of 56 female (11.2%) drinkers (Table 32.3).

Table 32.3 : Smoking and drinking pattern observed in individuals without N.P.C.

Sex	*Individuals without N.P.C.*	*Smoking habit*		*Drinking habit*		*Smokers and Drinkers*		
		Smokers	*Non-Smokers*	*Drinkers*	*Non-Drinkers*		*% occurrence of N.P.C.*	*P*
Male	500	470	30	410	90	410	82%	P=0.8<1
Female	500	452	48	56	444	56	11.2%	P=0.1<1

Another fact noticed was that these individuals, especially the males were in the habit of drinking alcohol at random without having any fixed routine. Such individuals were considered as alcohol abusers in this study.

The most significant finding of this study is that females even with the habit of heavy smoking were less prone to N.P.C. than the males with a habit of smoking tobacco accompanied with alcohol abusing. The study showed that it was this heavy alcohol consuming and tobacco smoking males who were most susceptible to N.P.C.

DISCUSSION AND CONCLUSION

The present study shows that drinking alcohol has a serious impact on the nuritional status of the individual and this in turn may well be a factor in the association of alcohol consumption with cancer in the nasopharynx.

The present study has clearly shown that the individuals with N.P.C. were just not alcohol drinkers but alcohol abusers. Such abusers could be regarded as individuals consuming about 30% or more of their caloric intake as alcohol. It would probably not be proper to suggest that alcohol has a direct effect on tumour production, but a possible way of alcohol action could be that the drink could prove to be a powerful solvent to facilitate the transport of carcinogens across membranes. This was also observed by Fruend (1979) in his experiments.

Ethanol molecules which are intercalated in bilayer membranes between lipids could expand membranes and increase fluidity altering membrane function. In fact Fruend (1979) suggested that chronic or excessive alcohol consumption (as also observed in this study) could have effects on tumorigenesis which could be different from those occurring due to moderate use of alcohol.

The action of tobacco smoke in promoting or initiating carcinogenesis could be that the polycyclic aromatic hydrocarbons contained in the tobacco 'tar' may effect D.N.A. This was also demonstrated by Wynder (1966). It was also suggested by Wynder (ibid) that tumor promotion may be mediated *via* the mitochondria, the body which is engaged in cellular respiration. The mechanism therefore, by which tobacco 'tar' transforms normal cells may well include its effect on both nuclear D.N.A. and cell respiration. Another point to bo noted is that smoking tobacco accompanied with alcohol abusing could together prove to be a much more powerful means of cancer production than either smoking or drinking alcohol alone. The harmful effects of alcohol along with those of smoking could explain for the low incidence of N.P.C. in women. They smoke as much as the males but were not in the habit of drinking alcohol. Rothman (1972) has shown that the synergistic effects of alcohol and tobacco in cancer production is 2.5 times more than the expected effect of tobacco and alcohol alone.

From tables 32.2 and 32.3 it is clear that those individuals who were in the habit of abusing alcohol and smoking together were more susceptible to N.P.C. It is further observed that the males, who were more in the habit of drinking and smoking together than the females, were more prone to N.P.C. To conclude therefore, it would not be unscientific to say that even though a direct effect of tobacoo smoking or alcohol drinking alone on cancer production cannot probably be established, it is almost certain that the combination of both these two could have a direct effect on cancer production particularly N.P.C.

KEY WORDS AND ABSTRACT

KEY WORDS Nasopharynx. Tobacco. Alcohol. Cancer. North-East India. Glass Fibre Filter.

ABSTRACT This is a study on the impact of alcohol and tobacco among certain hill-dwellling tribesmen of North-east India. A study of 175 histologically proven Nasopharyngeal cancer (N.P.C.) cases comprising 154 males and 21 females showed maximum incidence of N.P.C. (57.1%) in the state of Nagaland. The habit of smoking 'bidis' made from the leaves of a locally available plant called 'Mokotung' and consumption of home-made alcohol may be contributing to large-scale incidence of N.P.C. especially among the males.

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R. Handique, Professor, Department of Life Sciences, Dibrugarh University, Dibrugarh 786 004, Assam, India

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Ramie - The Fibre From The East

Niloy K. Das

INTRODUCTION

Man has been using vegetable fibres since time immorial for his various every day use. With the development of clothes the demand for fibre has increased and at present man has devised techniques where he uses the 'man made' fibres. The various fibres that the tropics has given rise to, like cotton and other fibres. Ramie has been used in the East since the time man came to use nets for fishing and cordage and other uses.

The fibre is contained in the 'bark' of the stem which includes the pericycle (bast). Berger (1869) states that unlike jute the ramie fibre cannot be extracted satisfactorily by the process of 'retting' owing to the presence of a gummy and resinous material contained along with the fibre in the bark.

The plant belong to the botanical family Urticaceae under the tribe Boehmarie of the sub-order Urticae. It is chiefly tropical though is also found in colder climates in the Himalayas and also in Europe. It is interesting to note that the tribe follows closely the human habitats, and even in the temperate regions, it shows dense growth as is found in the tropical and subtropical countries.

Fibres are the most important economic products of the whole sub-order of the family Urticaceae. Numerous genus (*Urtica, Pouzolzia, Debregesia and Elestoma*) are eaten as pot herbs, and tubers of *Pouzolzia tuberosa* are also eaten. In the villages of Assam seeds of some of the nettles are cooked and eaten.

Various species of *Boehmaria*, more particularly *B. nivea*, yeild the ramie (rhea) fibre of commerce, which is said to be conviniently and cheaply separated from the bark and the gummy substance removed with the help of some contrivance (Watts, 1889). The fibre is one of the most valuable fibres of commerce used for various textile purposes. Allied species like the *Villebrunea*, the Bon reha of Assam, *Maoutia*, the poya fibre, *Girdinia* or Nilgiri Nettles and those from *Urtica*, the true nettles, also yield fibre.

Roxberg (1811) first drew attention to rhea fibre. Watts (1889) states that works on this fibre is paralysed due to (1) tenacity of the fibre against extraction (2) freeing the fibre from the gummy substance.

The main stress is given on the mechanical methods of extracting the fibre. About 18 forms of *Boehmeria* which includes 45 species in India, not less than 45 plants yielding fibres are popularly viewed as wild form of Rhea (Watts, 1889). There are 10 neetleplants and in addition 31 firbre yielding plants related to two great groups which may popularly be said to be represented by Rhea and Nettle.

The above is a short resume of the possibilities of the fibre yeilding that may be exploited from the wild state. The species *Boehmaria nives* has been widely utilized as a source of fibre.

Berger (1969) states that *Boehameria nivea* is native of East Asia and is grown in regions ranging from tropical to temperate countries. The principal producing countries are China (especially middle Yangtze region and southern China), the Philipines, Japan, Indonesia, Malaysia, India and Brazil. By far the largest producer in the world is China, where the fibre has been known since 2200 B.C. It is very difficult to obtain relative figures, but probably at least 100,000 tons of ramie fibre are produced annualy.

Ramie fibre is contained in the 'bark' ribbon of the stem. Unlike stem fibres such as jute, flex hemp etc, ramie fibre cannot be satisfactorily extracted by the usual retting methods due to the pectinesious or gummy substance found in the bark of the stem.

2 to 4% of the green plant is the crude fibre. The air dry stem, after harvest and after the leaves have been removed contain the "Chinagrass' of commerce. The average yield of 'Chinagrass' per hectare per annum varies widely, ranging from 700 to 1200 kg (Kirby, 1963). The ramie fibre contains the following :

Cellulose	*Hemicellulose*	*Pectin*	*Others**	*Lingnin*
about 68.6%	13.1%	1.9%	Moisture 10.5%	Ca 1.46%**

besides it also contains 0.22% fats and waxes.

The fibre is regarded as the longest (40-200 mm), toughest, most silky of all vegetable fibres. It has great strength, highly resistant to action of water but it has neither the elasticity of wool or silk, nor the flexibility of cotton. The spun thread is fibrous and hairy because the end of the stiff fibre projects out.

Traditionally the stem is decorticated by hand as found in India and in China or in America, for example, by machineries and the fibre is stripped-off. By treating the crude fibre with soap solution or lime the gum is removed. Steaming might also be resorted to. The degummed and clean fibre is called 'filasse'.

Watts (1884) mentions the following traditional processes which are being used from time immemorial by the natives of Asian countries. In these processes a microbial process may be involved :

In China

The stalks are left in still pools of water for several days and when retting has advanced sufficiently and it is judged as complete, the bark is easily separated from the wooden parts. The stalk bundles are removed from water. The stalks are then split in the centre, and inserting fingers between the wood and the bark, the stalk is stripped along the whole length of the stem. As a result of this operation the fibres come out in two - strips or ribbons. Subsequent exposure to dew at night complete the retting process. Some skillful workers again throw the fibres into the water for cleaning by a fresh process of retting. This second exposure to water is more effective than exposure to dew. After the second 'retting' the fibres are worked up and combed and thus prepared for spinning.

In Java

The stalks are divided into two halves lengthwise and the bark is peeled off. From the bark the epidermis and the adhesive portions are separated by scrapping with knife till the greenish white fibre is exposed. These are washed several times in water dried. The gelatinous matter adhere to the fibre even after cleaning in water.

In Borneo and Smatra

The stalks are collected in bundles and are exposed for 4/5 days to the action of water. The thin bark and the gummy substance is considerably softened and loosened and the fibres partially become separated. These are then taken out, dried and exposed to dew for several days.

In Upper Assam

An operator by a peculiar twist of the hand with the help of fore and middle fingres, breaks through the inner pith. After this by passing the fingers of the right and the left hand alternately and rapidly, towards each end of the fibre, it is completely separated from the stalk into two strands. After washing them in clean water, which possibly removes the Tannins and coloured matter, fixed to a pole at convinient height, the fibres are separated by scrapping with the help of knife and at this stage the fibre is ready for marketing. Even at this stage if the fibre is exposed to rains during summer or on the grass to a night of heavy dew, the appearance is improved.

Mathew (1947) who discussed the degumming of remie refers to the aforesaid process, stating that repeated processes of soaking, scrapping, washing and sun-drying are required for the degumming of the fibres. It is also stated that in some areas, lye made from ash or lime is used for keeping the material soaked in water. He is of the opinion that commercial degumming involves both bactoriological and chemical methods.

The whole of North East India, including Assam, has great future for ramie production. As ramie can be mixed with cotton, polyester and wool, it has bright commercial prospect in this region. Ramie cultivation is confined to a few regions in North East India. In Assam ramie is cultivated in some villages of the districts of Jorhat, Nagaon and Lakhimpur. If ramie cultivation is pursed scientifically, it could grow into a lucrative cottage industry.

KEY WORDS AND ABSTRACT

KEY WORDS Fibers. Retting. Extraction. Gummy Substances. Stalk.

ABSTRACT Remie is a commercially valuable vegetable fibre used for making clothes here and there in North East India. Geoclimatically the North Eastern region is eminently suitable for its large-scale commercial cultivation as the fibre can have industrial utility as a mix with other natural and synthetic fibres produced in the region. Though extraction of the fibre is a laborious process, it can easily be turned into a cottage Industry.

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Author's Address : **Dr. Niloy K. Das**, "Bepin Bhawan", Jasomonta Road, Panbazar, Guwahati, 781 001, Assam, India

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The Collapse of Indo-Tibetan Trade and Its Impact on the Demographic Structure of Border Area - A Case Study of Bhotiya Valleys of Kumaon

D.K. Dube and Harjit Singh

INTRODUCTION

In 1951, the sudden outbreak of the well armed "Red Army of Peoples Republic of China" into "the forbidden land" of Central Asia disturbed the spiritual tranquility and political silence of the 'land of Lamas'. After the small resistance in 1959 posed by the Khampa element of Tibet, "the Dalai Lama - the God king of Tibet" made a dramatic escape and took asylum in India. The subsequent major development was the Sino-Indian war of 1962 and the siege of Indo-Tibetan border. This resulted in the collapse of the on-going trade between the Shukas (Bhotiyas) and the Huniyas (Tibetans). After that "Tibet faced a determined Chinese campaign to 'transform' the traditional bond, outdated and fossilized character of the Tibetan social order by introducing large scale 'reforms'". While the Indian migrants, the Huniyas, after the sudden disruption of their mainstay of economy and adjunct of their socio-cultural life, were under obligation to seek alternative sources of livelihood and modify socio-cultural life in conformity with the changed environment.

Bhotiya is a generic term designating several socially unrelated groups of people along the Indo-Tibet border in the Great and Trans-Himalayan region. In the central Himalayan Zone comprising Garhwal and Kumaon, the northern, non-Tibetan Mongoloid-featured, high landers are referred to by this generic term

The study area comprises three Bhotiya valleys of Kumaon Himalaya. They are Darma, Byans and Chaundas. All the three valleys are situated in Dharchula Tehsil of Pithoragarh district of Uttar Pradesh (Fig. 34.1). The valleys are situated at an altitude varying between 2000 m to 7000 m.

Byans is situated on the upper reaches of the river Kali and its tributary, the Kuti Yangti'. Darma is situated in the valley of the river Dhauli, which lies parallel to the Byans valley. Chaundas occupies the valley of the river Kali below the Byans valley and comes under the Great Himalayan Range between the Zanskar range in the North and the Great Himalayan range in the South.

THE TRADE WITH TIBET : A HISTORICAL RETROSPECTIVE

The Bhotiya economy was an aggregation of many elements such as trade, agriculture, pastoralism, household industries etc. Out of these, trade has been a major feature and the other economic elements were largely dependent on and associated with it.

Trade with Tibet dates back to the beginning of the first century. The Bhotiya trade developed vigorously by the fourth century, when the Katyuri king took the region of Kumaon as descendants of Kushanas. The Mughal reign was a period of degeneration for Bhotiya traders. The trade once again showed the signs of recovery in the 16th century under the Chand Dynasty. The region was under British rule from 1815 to 1947. The British appointed trade agents in Tibet and worked for a better organised trade. After independence the traders got a lot of new facilities and the trade developed vigorously.

After 1962, the good days of Bhotiyas prosperity were over and the then richest community of Kumaon faced the severe blow of change. The impact was observed in all facets of their life. The adjustment with new situations was clearly reflected in the demographic structure.

THE CHANGE IN THE DEMOGRAPHIC STRUCTURE

The demographic structure and socio-economic set up are very much inter-related. Areas with better economic base are generally densely populated while poor regions suffer from out migration. In order to get a complete picture of demographic structure, it is essential to study the changes in

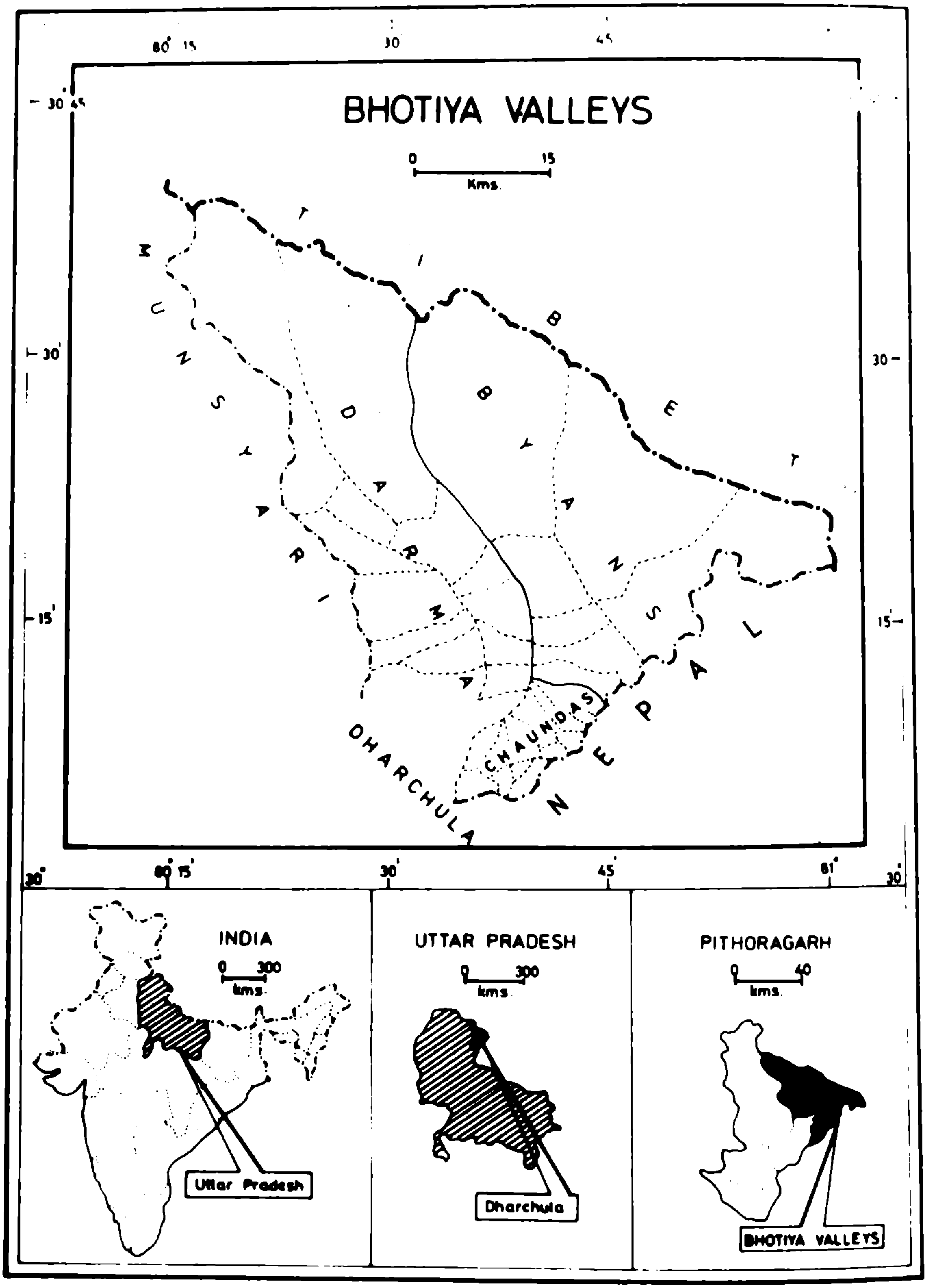
BHOTIYA VALLEYS
0 15
Kms
TIBBET
MUNSYARI
DARMA
BYANS
CHAUNDAS
DHARCHULA
NEPAL
INDIA
0 300
kms
Uttar Pradesh
UTTAR PRADESH
0 300
kms
Dharchula
PITHORAGARH
0 40
kms
BHOTIYA VALLEYS

Fig. 34.1

population distribution, migration, sex ratio etc.

Popultion Distribution

The distribution of population especially in areas having hostile environment and inhabited by simple societies is greatly influenced by the carrying capacity at land.

Table 34.1 shows that the largest population is in the 14 villages of Chaundas valley while the 7 villages of Byans constitute the smallest population. In the present situation, the comparatively favourable location of Chaundas for agriculture is very viable for it. On the other hand and cold dry climate with extremely rugged terrain of Byans and Darma is not able to support a large population.

Table 34.1 : Population distribution in 1991 in the three valleys

Population Valley	*Darma*	*Byans*	*Chaundas*	*All three Valleys*
Population	1547	1161	4620	7323
Percent of Total	21.13	15.85	63.10	100.00

After knowing the valleywise distribution of population, this is important to know the location and size of villages. (Table 34.2a and 34.2b)

Most of the villages having population less than 200 are situated either in the cold and dry valleys of Darma and Byans or in the rugged terrain of Chaundas. Most of the villages having more than 200 persons are situated in the Chaundas valley. The present size of population very much follows the potential of agriculture in the valleys. But a comparison of the population size of the villages of 1991 with those of the villages of 1961 shows an

Table 34.2A : Population size of villages (1991)

Population size	*Darma Valley*		*Byans Valley*		*Chaundas Valley*	
	No. of village	*Name of village*	*No. of village*	*Name of village*	*No. of village*	*Name of village*
<-25	1	Khimling	0	-	0	-
25-100	5	Sipu, Marcha Tidang, Dantu, Philam	1	Napalchyon	0	-
100-200	6	Geo, Dugtu, Baling, Chal, Nagling, sela	3	Kuti, Navi, Rong-Kong	3	Galagar, Rong Kong Dhar Pangu
200-300	1	Baun	3	Garbyang, Bundi Gunji	3	Himkhola, Jyunti-Pangu, Ronto
300-400	-	---	0	---	5	Bung-Bang, Jibti Takula, Sosa, Sirkha
400-700	0	---	0	---	2	Sirdang Jee
>700	0	---	0	---	1	Pangla (728)

Source : Census of India 1991

Table 34.2B : Population size of villages (1961)

Population size	*Darma Valley*		*Byans Valley*		*Chaundas Valley*	
	No. of village	*Name of village*	*No. of village*	*Name of village*	*No. of village*	*Name of village*
<-25	1	Khimling	0	-	0	-
25-100	0	---	0	---	2	Hyun Khola, Ronto
100-200	6	Marcha, Tedang Dantu, Chal Philam, sela	0	---	2	Galagar, Takula
200-300	3	Sipu, Baling Nagling	2	Rong-Kong Napalchyon	7	Jibti Bung-Bung Rung., Sirkha, Sosa Dhar Pangu, Pangu
300-400	2	Goe, Baun	1	Navi	0	---
400-700	1	Dugtu	3	Kuti Gungi	3	Pangla, Sirdang, Jee
>700	0	---	1	Garbyang (1023)	0	---

Source : Census of India 1991

interesting phenomenon. In Byans almost all villages suffered a tragic decline in the population size. The once importance trade marts namely, Garbiyang, Gungi, Kuti and Bundi are the worst affected. The trend is the same in Darma where in the imporant trade centers, namely Dugutu, Goe, Sipu, Baling are the main victims. In case of Chaundas, only a little and insignificant reshuffle is observed. It clearly indicates that in the last 30 years, a lot of change has been observed in the population of Bhotiya valleys. The trade centres are the worst victims of it. Now it is important to see the changes in the population.

Population Changes

An increase or decrease in population is the result of the three factors namely, fertility, mortality and migration. So far as the fertility and mortality rates are concerned the data with the district authorities do not show any significant change. The third factor namely, migration, seems more responsible for the change in the population in these valleys. The impinging situations mainly responsible for migration are the harsh climatic conditions and the poor economic opportunities.

Table 34.3 shows that the population of the Bhotiya Valleys is continuously declining. The total population of the valleys which was 9662 in 1961 has gone down to 1323 in 1991. The decrease is not the same for all the three valleys. Out of these three, only Chaundas shows an increase of 29.12 per cent in last 30 years. Darma shows decline by 47.72 per cent in the same duration and the worst affected valley is Byans where the population has gone down by 65.39 per cent. The valleywise decrease in all the three valleys over the decades shows a little fluctuation in case of Darma and Byans but in case of Chaundas the fluctuation is very high which indicates the present ongoing migration from the valley.

The change in the population also affects the valleywise distribution of population among the three valleys. In 1961 where the difference of the percentage of population in the three valleys was not very high, it has reached a contrasting situation by 1991. At Byans it has come down from 35.00 to 15.85 per cent, while in Chaundas, it has gone up from 37.00 to 63.10 per cent.

One most important aspect of population change is that in the last three decades, a large number of families have migrated from these valleys. During the field survey it was observed that a large number of houses have remained locked for decades. In this way, migration in these valleys is different from the migration in the lower hill areas where only working membres of the family migrate.

Table 34.4, adds a new dimension concerning decrease in the number of households in this area. It is important to note that joint families are not common or are rather rare in these valleys. In the last three decades, the number of hosueholds has declined by 16.27 per cent. At Byans and Darma a sharp decline has been in the number of households while at Chaundas, a gradual increase was seen. This data support the fact that after closing of trade, large number of household migration took place in the Byans and Darma valleys. It was neither male selective nor was it a working population outmigration. Due to lack of any hope of livlihood or better life, the families en masse were bound to leave their native villages. In case of the Chaundas valley, the data indicate that it was basically a certain age-or sex-based migration.

The earlier inferences suggest outmigration as the prime reason for the declining population. Yet to know the exact situation and its confirmation

Table 34.3 : Valley-wise population change

Year	*All three Total Valleys*		*Dharma*			*Byans*			*Chaundas*		
	Population	*Change in per cent*	*Population*	*% out of total*	*% Change Valley wise*	*Population*	*% out of total*	*% Change Valley wise*	*Population*	*% out of total*	*% change Valleywise*
1961	9662	-	2901	28.0	-	3355	35.0	-	3606	37.0	-
1971	9175	-5.04	3066	33.42	+11.90	2629	28.65	-21.64	3680	40.03	+1.49
1981	8587	-6.41	2216	25.80	-27.72	1825	21.25	-30.58	4546	52.94	+23.53
1991	7323	-14.32	1547	21.13	-30.18	1161	15.85	-36.38	4620	63.10	+1.63
61-71		-24.20			-42.72			-65.39			+28.12

Source : Cenus of India (1961-1991).

Table 34.4 : Change in number of household

Valleys/ Year	*Dhrama*		*Byans*		*Chaundas*		*All three valleys*	
	No. of household	*Decadel change in per cent*	*No. household*	*Decadel change in per cent*	*No. household*	*Decadel change in per cent*	*No. of household*	*Decadel change in per cent*
1961	562	–	832	–	701	– 2121		–
1971	656	+16.73	635	-23.67	825	+ 17.69	2116	- 0.23
1981	504	-23.17	556	-12.44	849	+ 2.90	1909	- 9.78
1991	414	-17.86	376	-32.37	986	+ 16.13	1776	- 6.9
From 1961-91		-26.33		-54.81		+ 40.66		- 16.27

Source : Census of India 1961-1991

primary data were collected from one sample village from each valley.

The highest percentage of outmigration out of the total population of the sample villages is in Napalchyon village of the Byans valley while the lowest is at Sirkha of the Chaundas valley (Table 34.5). Though overall percentage outmigration of male population is higher than that of the females, yet it is the highest at Sirkha in the Chaundas valley, and the lowest in the Byans valley. This proves that more females are left behind in the Chaundas valley while more females are coming out from the Byans valley. The reason is that there is no solid base for livelihood in the valleys of Byans and Darma. In the valley of Chaundas on account of having a relatively good agricultural base, a good number of females can find engagement in agricultural.

Though the primary data prove the male dominated outmigration yet the clear picture of sex composition is depicted in the table 34.6.

The overall trend of all three valleys shows a continuous increase in the female ratio and support the male dominated out migration. The highest being shown in the Chaundas as females are left behind for agriculture. In the Byans, a large chunk of females are coming out with their families or for education thereby maintaining a comparatively low sex ratio.

After going through all the important aspects of demographic structure over the last three decades, it's easy to find out the impact of collapse of trade on the demographic structure in these valleys. The overall picture is that the village population, number of households and the size of the villages are decreasing while the female sex ratio is increasing

Table 34.5 : Migration in sample villages in last 20 years

Village Dugter (Darma Valley)			*Village Napalchyon (Byans)*			*Village Sirkha (Chaundas)*		
Population migrated	*% of village*	*% of male/ female, total migration*	*Population migrated*	*% of village*	*% of male/ female, total migration*	*Population migrated*	*% of villaged*	*% of male/ female, total migration*
M 46	38.33	59.1	55	56.12	57.99	68	43.31	69.31
F 32	28.07	41.0	40	41.23	42.11	30	20.12	30.61
T 7	33.33	100.0	95	48.72	100.00	98	32.03	100.00

Source : Field Survey (Sept. 1994)

Table 34.6 : Sex ratio at valley level

Valley/ year	*Female per 1000 male*		
	1961	*1971*	*1991*
Darma	996	871	1001
Byans	886	898	938
Chaundas	892	953	990
All three valleys	917	912	983

Source : Census of India (1961-91)

drastically. These changes have been brought about mainly by the outmigration which is an outcome of closing of trade.

The socio-economic situation in the three valleys is far from being identical. In the Byans valley, the economy was very much dependent on trade, and agriculture could not support its large population. So it was the worst victim of the change. Here percentage of emigrant is very high. A large number of working individuals and females emigrated from this valley which sharply reduced the village population. This reduction was observed in the population size of the village and household level.

The Darma valley, where trade and agriculture were going hand-in-hand up to some extent was able to bear the shock of change. It was mainly due to a better agricultural base. The process of emigration gained momentum in the later decades as the cold and dry climate was not able to yield sufficient sustenance for the large population size of the villages and household level. As female emigration was not as high as in the case of Byans, it maintained a very high sex ratio.

The Chaundas valley located in the Great Himalayan range has a strong agricultural base. It had the least participation in the trade. Due to this, they were the least affected with the collapse of trade. The population change was not to be found negative, and no clear sign of large scale household migrations was observed. This valley was located close to the outer world. Here emigration has taken place basically for higher education and better life. This emigration was male-dominated, working population having outmigration. Females were left behind for agriculture. This led to a high female sex ratio in the valley.

So, the harsh fact is that after the collapse of trade, the demographic structure of the Bhotiya valleys has considerably deteriorated due to the large scale outmigration.

KEY WORDS AND ABSTRACT

KEY WORDS Bhotiya Valleys. Trade. Population Migration. Sex-Ratio Change.

ABSTRACT The Chinese invasion in Tibet in 1951 and the subsequent Sino-Indian war of 1962 resulted in the seize of the Indo-Tibet border and the collapse of the centuries old trade through it. Border areas of India were the worst affected and the impact on demography has been studied in three Bhotiya valleys *viz*., Byans, Darma and Chaunda. Out of these, the Chaundas has the maximum number of villages and highly populated because of comparatively mild climate and strong accessibility to the passes opening into Tibet and harsh physio-climatic conditions for agriculture, the natives of Byans and Darma valleys were more dependent on trade. The trade collapse induced population change in the three valleys where out-migration was more in the Byans and Darma and the lease in the Chaundas resulting in higher female populations in the first two valleys. The impact of trade collapse on population, number of households out-migrations and sex-ratio has largely depended on the climate and agricultural base and the Byans and Darma valleys were more adversely affected due to harsh climate and poor agriculture support.

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Authors' Address : **D.K. Dube and Harjit Singh**, Centre for the Study of Regional Development, School of Social Science (CSRD/SSS) Jawaharlal Nehru University, New Delhi 110 067, India

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Problems in Educating Gaddis : A Transhumant Population

Veena Bhasin

INTRODUCTION

Education is an indicator of various concepts. At the macrosocial level, the community level of education has been typically employed to index socio-economic developent since the earliest formulations of the demograhic transition theory. More recently, education has come to be regarded as a catalyst of "modernization" in innovation-diffusion theories (Carlsson, 1996; Cleland and Wilson, 1987). At the microsocial level, educated women are typically portrayed as "forerunners" of the fertility transition. Given the difficulty of collecting information on income, occupation and prestige, education is also used as a proxy for social class (Shoemaker, 1991). Similarly, education is the most commonly used indicator for the broader concepts of women's status, which positions women *vis-a-vis* men both in the family and society (Mason, 1984).

Education plays a crucial role in individual's well being and societies' economic and social progress. Over the past decades, the need to promote rural, especially women's education has been repeatedly advocated. Although education has been unanimously endorsed as a fundamental right and as explicit development objective. For poor people access to educational resources remains inadequate in India. A long historical neglect of womens educational needs has left a legacy of high illiteracy rates, especially among older, poor and rural women.

Education in India is plagued by structural and organisational distortions even after four decades of planned development. Poor and Scheduled Castes and Scheduled Tribes in India are at a disadvantage when it comes to quality education. Almost one half of all children and two thirds of girls in the age group 6-14, have either never joined school or are drop-outs in early primary year. The worst sufferers are those from the socially and economically weaker sections of society. Ironically, it is these segments that most needs the benefits of primary education. Education, may bolster the feeling of personal efficacy and develop a critical consciousness. Besides promoting cognitive and attitudinal change, education opens up economic opportunities and provides a vehicle for social mobility.

Because of its multifacted nature, education is not easily operationalized. Educational attainment is typically assessed through literacy status and years of school attendence. An important limitation of measuring education by number of years spent within school focuses exclusively on quantity as opposed to quality.

Wide differentials exist among socities regarding the average level of education. Socieities not only differ with regard to the abundance or scarcity of educational resources, but also regard to the allocation of those resources among various subgroups of their population. In India one of the most common sources of differentials access to education is gender. The historical gap between men's and women's educational attainment is still perpetuating in India. During the past decades, Government has made considerable progress in ensuring a more gender balanced enrolment at the primary level of schooling, but women remain underrepresented at higher levl of training. In some cases institutional division of labour, underlie existing gender differentials both in educational aspirations and in the realization of those aspirations. Daughters are mainly regarded as contributors to domestic labour who, once married, will become part of the (re) productive labour force of another household. The gender gap in school enrolment varies broadly by region.

Another source of differential access to education derives from the place of residence. Rural areas are typically more deprived of educational faciliities than urban areas. The type of residentials setting also determines differentials in cultural values, family structure and patterns of child labour, which inturn influence educational attainment. The third important source of differential access to schooling in India derives from the place of subgroup in social hierarchy. In sum, access to education varies not only across but also within societies. Three important sources of differential access to schooling are gender, place of residence and position of subgroup in social hierarchy.

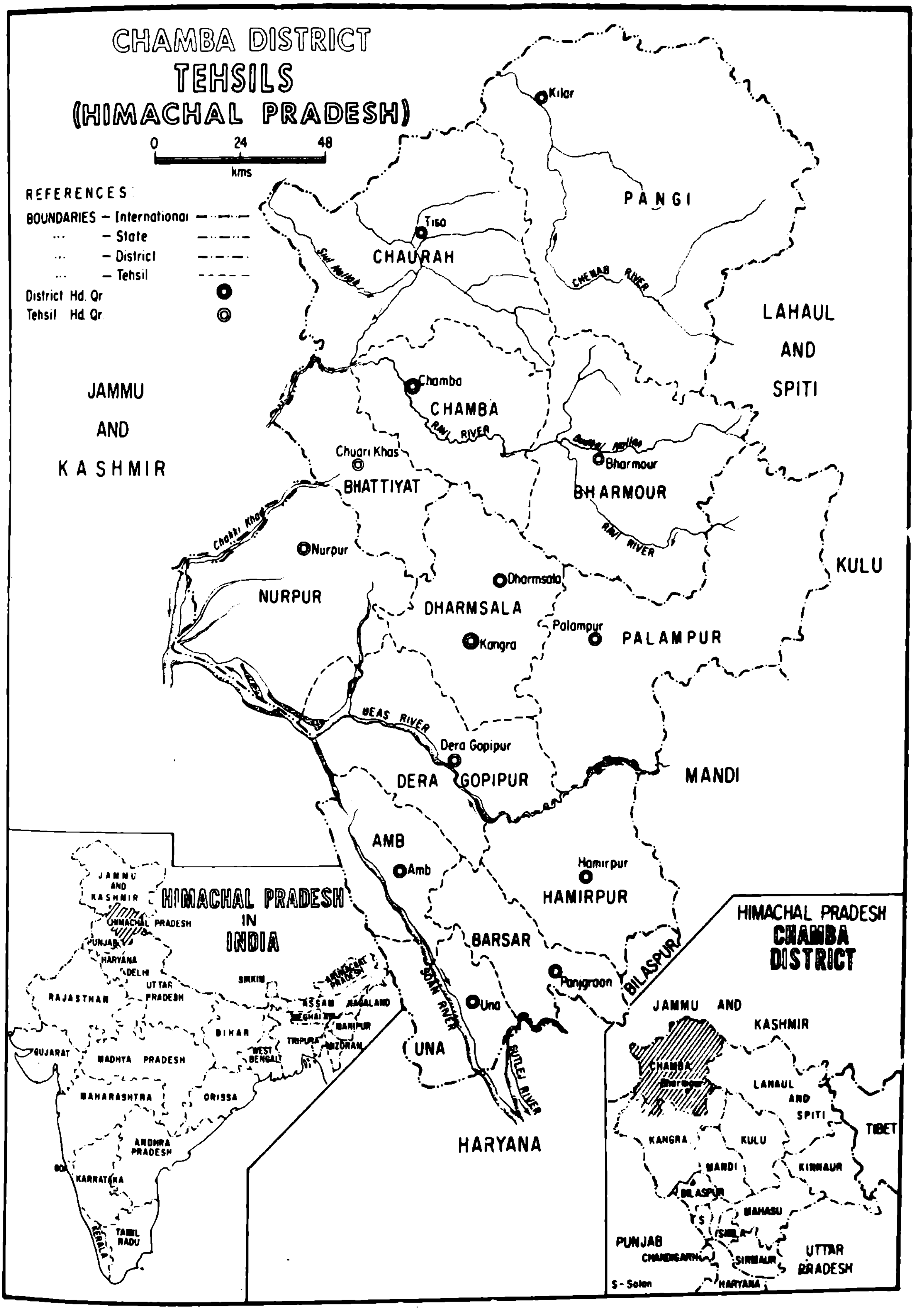
Educationally Himachal Pradesh is very backward. Although the percentage of literacy has risen from 1951 onwards, low educational attainment still stands as a major obstacle to area's prosperity and people's welfare. Government's effort to increase school enrolment need to counteract the inertia of centuries old prejudices and social attitudes. This study presents educational trends in transhumant Gaddi population of Bharmour Tehsil in District Chamba, Himachal Pradesh.

AREA AND PEOPLE

The field work for the present study was conducted between the years 1976-79 in Bharmour Tehsil, Chamba District, Himachal Pradesh (Fig. 35.1). The Bharmour Tehsil lies approximately between the north latitude 32°-11' and 32°-41' and the east longtitude 76°-22' and 76°-53'. The lowest altitude is about 1340 metres and the highest about 5900 metres above mean sea level. Bharmour Tehsil is remarkably mountanious; level and flat pieces of land are exception to be met with. Cultivation ranges, approximately, between 1400 metres and 3700 metres. Because of the steepness of the slopes, in the rainy season the good soil cover is lost and soil conservation becomes a real hazard. Land slides are a common feature in this area. Depending on altitude which determines the length of the growing season, the soil is suitable for maize, wheat, coarse cereals, pulses, millets, potatoes, temperate fruits, tobacco and certain spices. Depending upon the altitude the climate varies a good deal.

The area is inhabited by Gaddis, who are transhumants. Gaddis transhumance is materialized as a vertical movement with herders having a permanent base located at mid-altitude. Transhumant Gaddis residing in mid-Himalayan zone spend summer in their permanent homes in Bharmour Tehsil and cultivate their lands, and in winter because of heavy snowfall they migrate to lower hills along with their sheep and goats in and around Kangra Hills. This transhumant way of life nurtured by ecological factors has effected their socio-cultural life. The population in the Bharmour Tehsil, Chamba District, Himachal Pradesh has been stable in the area for a quite a long time. It has not been dominated or strongly influenced by the Muslims, Gorkhas, Tibetans or British. There have been no recent changes in the technology or economy great enough to bring about rapid changes in social organisation. The area remained comparatively isolated till the 7th century. Although the physical environment is discouraging, Bharmour saw a large influx of the Gaddis around the 7th and 8th centuries. The Gaddis caste is a result of the union of Rajputs, Khatris and Thakurs over several hundred years. Historical events suggest that they came from Lahore and Delhi. Whatever the origin of these groups, they now form a single caste. Immigrants into Bharmour area adopted the local customs, caste, kinship, marriage and religion - thus indicating that ecological adaptations mould social relations to adapt to the local conditions. The local inhabitants draw a distinction between the three castes : The Brahmans, the Rajputs (formed by the union of Rajputs, Khatris, Thakurs or Ranas over several hundred years), and the Scheduled Castes. The term Gaddis is a caste term in Bharmour, but there is some confusion now-a-days as Brahmans and Scheduled Castes are also calling themselves Gaddis, because the Scheduled Castes and Scheduled Tribes are entitled to financial benefits. Gaddis have become a tribe by circumstances and not due to any particular natural characteristics. Anthropologically, the Gaddis can hardly be called a tribe. They have been declared as a tribe mainly for the purpose of development in view of their social and economic backwardness. The Gaddis are Hindus and worship Lord Shiva, Devi Durga and other minor gods.

Land, live-stock and considerable knowledge of the skills necessary to exploit them effectively are the principal economic resources of the Bharmour Tehsil. Supplementary but nonetheless of considerable importance, is the income from non-traditional sources. The economy of the Bharmour Tehsil is agro-pastoral. Although agriculture provides the bulk of the staple food, Gaddis themselves give major importance to sheep and goat rearing. From this source they obtain additional food in the form of meat and milk and wool for clothing. Due to heavy snow-fall for about three or four months during winter, the Gaddis generally migrate to lower hills and plains along with their flocks of sheep and goats. During this period the main source of livelihood is sale of wool and employment of their children and women as domestic servants. A small per-


CHAMBA DISTRICT
TEHSILS
(HIMACHAL PRADESH)
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REFERENCES
BOUNDARIES — International
— State
— District
— Tehsil
District Hd. Qr
Tehsil Hd. Qr
Kilar
PANGI
Tisa
CHAURAH
CHENAB RIVER
LAHAUL
AND
SPITI
JAMMU
AND
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Chamba
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RAVI RIVER
Bharmour
BHARMOUR
Churi Khas
BHATTIYAT
Nurpur
NURPUR
Dharmsala
DHARMSALA
KULU
Palampur
PALAMPUR
Kangra
BEAS RIVER
Dera Gopipur
DERA GOPIPUR
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HAMIRPUR
BARSAR
Panjgraon
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PUNJAB
HARYANA
DELHI
UTTAR PRADESH
RAJASTHAN
SIKKIM
ASSAM
NAGALAND
MEGHALAYA
MANIPUR
TRIPURA
MIZORAM
BIHAR
WEST BENGAL
GUJARAT
MADHYA PRADESH
MAHARASHTRA
ORISSA
ANDHRA PRADESH
KARNATAKA
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centage of population is left behind to look after the cattle and fields and spinning and weaving of woollens. The migration is necessitated because the pastoral and grazing lands are covered with snow, and it is difficult to maintain the large number of sheep and goats, and secondly, for the selling of raw wool which is available in large quantities without market facilities. Other secondary traditional pursuits in the area are collecting minor forest produce, various kinds of household industries such as spinning and weaving, tailoring and beekeeping, and specialised occupations such as carpentry, iron-smithery, medicine, religious and para-religious activities. More recently, the increase in mercantile and government activity has created new sources of income in transport, road building, construction, whole-selling and retailing. Horticulture, while not yet significant, may become a major source in income in the coming years (Bhasin, 1988).

Educational Trends

Among the Gaddis of Bharmour, the literacy is low (24.6 per cent). The male literacy rate is 34.3 and the female literacy is 12.2 per cent. Majority of the population is unable to read and write. Among the Scheduled Caste males; the illiteracy is as high - as 72.8 per cent followed by Rajput males (64.3 per cent) and Brahman males (61.2 per cent). The illiteracy among females of all the three groups is very high 92.3, 82.6 and 81.3 per cent, respectively for the Scheduled Castes, Rajputs and Brahmans. The higest percentage of people are educated up to primary school (12.2 per cent). The Gaddis show the lowest literacy rate (24.6 per cent), as compared to Himachal Pradesh's 42.5 per cent, Kerala's 70.4 per cent and India's literacy rate of 36.1 per cent. Limited access to schooling and high drop-out rates account for most of the literacy deficit. Illiteracy contributes to women's marginalization within the family, the work place and public life. Lack of educational credentials, perpetuate unequal gender roles in society; Gaddis are affected by ecological and socio-economic stresses. Within a complex social structure, issues of gender, age and caste all affect Gaddis and provides a frame work of analysis. A study of the organisation and control of the household work helps to define the specific work burdens of children and the perceptions of this work by the decision makers, their elders. Gender analysis is relevant to all the different types of social organisation, as women's and girl's exposure to the outside world and their relative freedom is often determined by wealth and caste group. Attitudes to women and girl effect their ability to control their lives and as their status is generally lower than men, they have little influence over decisions made about their education, marriage or family size. Girls do the hardest work, have the least say and the fewest education options. Their main contributions is in the home workplace, and community are overlooked and undervalued. Women often derive status only from child-bearing and child-rearing; yet even in these roles they are given minimal support. Women's access to positions of influence and power is limited; their occupational choices are narrower, and their earnings lower than those of men. Education, together with reproductive health, is one of the most important means of empowering women with the knowledge, skills and self confidence necessary to participate in the development process. Educated women are more receptive to new ideas regarding health, nutrition, family planning, technology, marketing and political participation.

While education is essential for both boys and girls, the benefits of educating girls tend to be greater. Female education has been found to have a more significant impact on poverty reduction, and the promotion of sustainable development. Education also enhances a woman's sense of her own health needs and perspectives, and her power to make health and family planning decisions. It enables her to be more assertive and questioning in her dealing with health care and family planning personnel, which commensurate personal and family benefits.

Despite the near-universal advantage of female education, however, parents tend to prefer to educate their sons, given women's role in the household economy and the perceived disadvantage of investing in a girl child who will marry into another family and take with her the advantages she has gained. This applies to all the households in the area and relates closely to parents attitudes to gender voice and preferences. On the whole, households where girls were given more opportunities appeared to be better off. However, this also seemed to vary with caste group and exposure to the outside world. It is their style of life, as a part of culture, is strongly determined by social and environment factors (WHO, 1988) and the health status is more related to education than to income and occupation (Winkleby et al., 1992).

In the earstwhile hill state of Chamba of which Bharmour forms a part, there were no official centres of learning. Whatever education was imparted, it was through the *Guru-Chela* (teacher-student) tradition. Young men desirous of learning, which usually related to the fields of religion, astrology and medicine etc., became desciples of experts in these lines.

In 1863, a regular primary school was started in Chamba town. By 1906, the town had an anglo-vernacular middle school maintained by the Church of Scotland Mission, a high school, run by the state, a state girl school and two girls schools run by mission. In the mission run girls schools, in addition to reading and writing, girls were taught sewing and embroiding. Though the organised teaching situation had improved in the town, the rural areas lagged behind, till 1922.

In 1948, at the time of merger of the state into Himachal Pradesh, there were 46 primary schools, one boys high school and one girls middle school. By 1960, the position of educational institution in Chamba improved considerably (Table 35.1).

In Bharmour Tehsil, the educational scene was still not bright. At the time of merger, the Tehsil had two primary schools for boys, one at Bharmour and the other at Rahun Kothi and one primary school for girls at Bharmour. By 1960, the Bharmour Tehsil had one high school with 236 scholars, two middle schools with 89 scholars, one primary traditional institution with 19 scholars and 15 junior basic schools with 380 scholars. Education for the girls was almost non-existent. Whatever school did exist were generally housed in dingy, dilapidated buildings. There was hardly any equipment and schools were poorly staffed. Although about half of the population of Chamba practices one or other form of transhumance,transhumance based on goats and sheep with an equal emphasis on agriculture is practiced by Gaddis and other residents of Bharmour. Their seasonal migration and economic activities make education a difficult proposition. The literacy rate was very low. It was a gigantic task to organise an educational programme in this area. Because of the difficult terrain and the rigrous climate, trained teachers were not attracted to this area. It was necessary to appoint teachers from outside by providing incentives in the form of extra pay, residential and medical facilities etc. During the past decades, Government has made conscious efforts to expand educational facilities, reduce the incidence of illiteracy, raise enrolment rates, and narrow social and gender based differentials in the access to schooling in Bharmour. Although the achievement of universal education in Bharmour at primary level remains an elusive goal, nevertheless, a significant progress towards this direction has begun.

According to the Census of 1981, the Bharmour Tehsil is inhabited by 29944 persons (in 1971, they were 27067-District Census Hand Book, District Chamba 1971) out of which 3975 are Scheduled Castes and 24639 Scheduled Tribes. The density of population per square kilometre is 16 (Tables 35.2, 35.3). Sex-wise distribution of population is males 16012 and females 13932. The percentage of the female population to the total population is 46.5 and the number of females per 1000 males is 870 (Table 35.4). The literacy rate is rather low. Out of

Table 35.1: The position of educational institutions in Chamba

Institutions	*Boys*	*Girls*	*Total*
College	1	-	1*
Higher Secondary Schools	1	1	2
High Schools	10	-	10*
Middle Schools	23	2	25
Senior Basic Schools	2	-	2*
Traditional Primary School-	9	-	9
Junior Basic Primary Schools	148	-	148*
Total	194	3	197

* Co-educational Institutions

Table 35.2 : Area and population of Bharmour Tehsil, Chamba District, Himachal Pradesh

Year	*Area sq km*	*Population*	*Density per sq km*
1981	18183	29944	16
1971	18183	27067	15

Table 35.3 : Number of Scheduled Castes and Scheduled Tribes in Bharmour Tehsil, Chamba District, Himachal Pradesh

Year	*Population*	*Scheduled Caste (S.C.)*	*Scheduled Tribe (S.T.)*	*Percentage S.C./S.T. in total population*
1981	29944	3975	24639	97.18
1971	27067	3599	19809	86.48

Table 35.4 : Sex-wise distribution of population in Bharmour Tehsil, Chamba District, Himachal Pradesh

Year	Population		Percentage of female population to total population	No. of females per'000 males
	Male	Females		
1981	16012	13932	46.5	870
1971	14367	12700	46.9	885

the total population 6737 persons are literate (5479 males and 1258 females). Only 22.50 per cent of the total population is literate (Table 35.5). The number of literate males per 1000 males is 342, while the number of literate females is still less; it is 90 per 1000 females. The rate of population growth in Bharmour Tehsil in 1961-71 and 1971-81 is quite low as compared to Chamba, Himachal Pradesh and India (Table 35.6) (District Census Hand Book, District Chamba, 1981).

boys than girls attending schools.

Inspite of a rise in the absolute number of schools and teachers, the number of schools and teachers per ten thousand persons has decreased. The prevailing curriculum is inflexible and unresponsive to the local needs and environment; devoid of the component of skill formation; lacking in social and cultural inputs from the community. Educational programmes in Bharmour are severly constrained by lack of facilities, trained teachers and equipment. The length of school attendance provides only an indirect indication of the amount of knowledge acquired (Heyneman and White, 1986; Vaspoor, 1989).

One of the most common source of differential access to education is gender. Until recently, women have been universally underrepresented at all levels of education. This situation still prevails in Bharmour. During the past decades, Government has made efforts in ensuring a more gender balanced enrolment at the primary levels of schooling, but institutional barriers or cultural norms related to the traditional division of labour restricts the efforts. In Gaddis family, daughters are mainly regarded as contributors to domestic labour who, once married will become the part of the reproductive force of another household.

Table 35.5 : Literate persons in Bharmour Tehsil, Chamba District, Himachal Pradesh

Year	Literate Persons			Literate percentage	No. of Literate	
	Male in total population	Female per 1000 males	Total per 1000 females		Male	Female
1981	5479	1258	6737	20.50	342	90
1971	2621	230	2851	10.53	182	18

Table 35.6 : Decennial growth rate of population of Bharmour Tehsil, Chamba Disctrict, Himachal Pradesh (H.P.) and India

Census year	Population of Bharmour	Decennial Growth Rate			
		Bharmour	Chamba	H.P.	India
1951	19379		0.08		13.31
1961	25625	32.23	23.72	21.78	21.51
1971	27067	5.63	16.34	23.04	24.80
1981	29944	10.63	23.86	23.71	25.00

At the end of the third plan there were about 15 teachers and 1374 children in the study area (Tables 35.7, 35.8, 35.9). Only 9.66 per cent of the total population above the age of seven years was literate. The percentage of school going girls as compared to total school going children is only 5.13. Education does not go beyond the eighth class generally. Only five per cent of the children up to the age of 17 years are going to school. In the study area the percentage of non-enrolled children is far higher than the official statistics. There are major gender disparities in education with 1.5 times more

The male-female gap in educational attainments in Bharmour still remains wide. Only 12.2 per cent of females against 34.3 per cent of middle and only 1.2 per cent high school level. As it is true with

Table 35.7 : Enrolment in Bharmour

Particulars	*1974-75*	*1975-76*	*1976-77*
a. Class 1-5 (6-11 years)			
Boys	377	872	891
Girls	125	192	203
	502	1064	197
b. Class 6-8 (11-14 years)			
Boys	137	134	177
Girls	36	20	20
	173	154	197
c. Class 9-10 (14-16 years)			
Boys	82	75	76
Girls	2	5	7
Total	84	80	83
Grand Total	759	1298	1374

Table 35.8 : Teachers in Bharmour

Category	*Primary schools*	*Middle schools*	*High schools*
Male	80	58	33
Female	4	7	3
Total	84	65	36

Table 35.9: Average number of students per teacher in Bharmour

Category	*No. of student*	*No. of teachers*	*Student per teacher*
Primary	1094	84	13
Middle	197	65	3
High	83	36	2
Average	1374	185	7

males, education is more common among younger females of high castes. Few females in the older age-groups are attending school and no female has yet appeared in the higher secondary board examination or gone to college. Girls are often not allowed to continue their education if they have to travel away from home. Gaddis concept of education is different. During field work, when asked about educational standards, Gaddis replied affirmately even if they had not cleared any examination or had read few books, or had taken year's schooling either as a child or in adult education classes that are being conducted in the adult education centre. In the information given on education Gaddis had tendency to exaggerate about literacy but not up to high grade levels which were known by all. A check on enrolment figures countered peoples claim. This may be their wishful thinking, that either they had desire to study themselves or want to send their sons to schools as it is prestigious to do so. Most of the families do not want to send their daughters to school as they do not understand the advantages of educating a daughter. People are reluctant to send their daughters to school as they would loose a hand in family labour pool. According to Gaddis, girls should know about household chores and agricultural activities which would help them in their lives. Even if the family heads are educated, female education is not encouraged. Lack of labour in the area does not favour development of education. As Gáddis have to depend on an array of activities for their living. For diverse economic activities all hands are needed. Even if government provides stipends, free books and uniform, Gaddis are reluctant to loose additional labour hands even though they would like to send their children to school.

In India, literacy rates are 39 per cent among women, and 64 per cent among males. Girls and boys have edged to parity in primary school enrolment around the world except in Africa, in Asia especially South Asia. In most regions, the higher the level of education, lower the proportion of women to men. A survery in India found that while approximately 60 per cent of rural children were enrolled in school, only 15 per cent of the girls remained after 5 years, compared to 35 per cent among boys (UNDP, 1991).

In Peru, a study found that girls were three times more likely to enrol in school if textbooks were provided free of charge, no corresponding changes in male enrolment were noted (Bellow, R. et al., March 1992). In Bharmour, even the free books, stipends and other incentives have not led to any increase in female enrolment. The socio-economic realities of the area are responsible for this. Among Gaddis large number of households are at subsistence level. They subsist on their produce and barter with the surplus for essential goods. Wealth does not necessarily correspond to high caste. 93.53 per cent Scheduled Castes, 71.72 per cent Brahmans and 61.47 per cent Rajputs came under income group of less than Rs. 5000/- per annum. The Rajputs are better off than both the Scheduled Castes and Brahmans. However only 1.43 per cent Rajputs are under the income bracket of Rs. 20,000/- and 25,000/- per annum. For the Gaddis (Total), 35.21

are with no income, 38.21 per cent with less than Rs. 5,000/-, 12.21 per cent with less than Rs. 10,000/-, 9.3 per cent with less than Rs. 15,000/-, 4.2 per cent with less than Rs. 20,000/- only 0.17 with less than Rs. 25,000/- (Bhasin, 1990).

The harsh realities of poverty often find children shouldering disproportionately large and unfair burden of work and responsibility at both household and community level. These children who go to school 'assist' their parents in the house and in the fields. They help out when they come home from school, and in peak agricutural season, they may come out of school. Other tasks are not generally their responsibility. The majority of the children actually attending rather than just enrolling in school are boys. Therefore, there are more boys than girls who 'assist' in the household livelihood activities, rather than do work. 'Work' concerns the activities of boys and girls relating to the livelihood of the household. Much of this work may be necessary to the survival of the household and even if children are enrolled in school, they may have to stay away to work. Non-school going children therefore bear the burnt of the responsibility for this type of work, alongside their parent.

Children are involved in many different kinds of activities. Children work may actually increase at certain times of the year. For example, school going children may have to work in peak season rather than study. Even when a child is not directly involved like this, the indirect effects are often to place an extra household work burden on the children, particularly on girls when their parents are working elsewhere. Some of the work that children do is year round, such as cutting fodder, looking after siblings and livestock, and for girls, helping in the house.

Gaddis economic condition and transhumant way of life hinders development of education in the area. Previously, the Gaddis children used to get admission in local schools at the place of their migration (from Bharmour Tehsil to Kangra district and other places). No tuition and examination fees were charged. Now, they have adjusted the holidays in such a way that the children do not have to get the migration certificate and children are exempted from the operation of the Punjab Primary Education Act, 1961.

Another source of differential access to education in Bharmour derives from the position of different castes in regional social hierarchy. Table 35.10 illustrates the magnitude of different caste groups differentials in male-female educational attainments.

Caste and education are positively related among males and females in Bharmour as in other parts of India. The data lead us to conclude that males and females of high castes are benefitting more from educaiton, than the lower caste males and females. Why low castes are lagging in education when relationship between education and landownership is not similar to that between education and castes, for low cates families are not landless. In Bharmour where, agriculture is one of the mainstays of the economy, land which is a basic asset, besides determining the socio-political relations, does not determine the local zeal for education. In Bharmour, the position of various caste groups according to the possession of cultivable land does not signify anything as there are no big landowners and cultivable land is little in proportion to the number of people residing in the area. In the area under study all land owners have small holdings. Historically speaking, the situation was more or

Table 35.10 : Specific literacy (in percentage) among Gaddis of Bharmour Tehsil, Chamba District, Himachal Pradesh

Population	*Sex*	*Illiterate*	*Literate*	*Primary*	*Middle*	*High*	*Graduation*
Brahmans	M	61.2	38.8	12.8	15.3	8.7	2.0
	F	81.3	19.7	12.1	5.4	2.2	-
Rajputs	M	64.3	35.7	24.7	12.6	7.4	1.0
	F	82.6	17.4	10.7	4.8	1.9	-
Scheduled Castes	M	72.8	21.2	15.2	4.2	1.8	-
	F	92.3	7.7	7.7	–	-	-
Gaddis	M	66.7	34.3	14.0	12.0	7.3	1.0
(Total)	F	87.8	12.2	7.6	3.4	1.2	-

M = Male F = Female

Education Primary = up to 4 years, Middle = up to 8 years, High/Higher = 10 to 12 years, Graduate = up to 15 years less the same in the days of *Rajah* (king) who gave only as much land to a family as it could cultivate. This meant an equitable distribution of land-holding. The landless people are equally distributed among all the castes.

Among the Scheduled Caste Males the illiteracy is as high as 72.8 per cent followed by Rajput males (64.3 per cent) and Brahman males (61.2 per cent). The illiteracy among females of all three caste group is very high - 92.3, 82.6 and 81.3 per cent, respectively for Scheduled Castes, Rajputs and Brahmans (Table 35.10).

In Bharmour, high caste families are better educated than low castes and this educational difference between high castes and low social may increase in future. The landless people in all the castes are gradually educating their children for economic considerations and the desire to escape some of the disadvantages of the low social status. The lower literacy rate among lower caste is due to the lack of articulation in 'Hindi' - the medium of instruction. Their non-verbal communication is average and verbal communication below average.

primary school within the habitation. Students have to walk long distances to reach the school. 30 per cent of the school going children have to walk more than four kilometres to reach the school. As the terrain is hilly and difficult, much time is consumed in the way. Fifth All India Education Survey (1996) found that 94 per cent of the rural population was served with a primary school within one kilometre and, 85 per cent had a middle school within three kilometre. The 'official norm' of physical assess to school is based upon the assumption of what is considered a 'walking distance', regardless of difficult terrain and socio-cultural realities. The Acharya Ramamurti Committee Report shows these norms are not applicable in the case of girls who are engaged in work both within and outside the home. At home parents also require their help in domestic chores, so little time is left for study resulting in bad performance in examinations. In the study area; there are 17 primary schools, two middle schools and two secondary schools Children have to walk between two to four kilometres to avail of the education facility (Table 35.11). Apart from this, all

Table 35.11 : Educational facilities available in the study area of Bharmour Tehsil, Chamba District, Himachal Pradesh

S. No.	*Valley*	*Educational Institutes*					
		Primary	*Middle*	*High*	*Higher Secondary*	*Adult Education Centre*	*Industrial Training Centre*
1.	Kugti	4	1	0	0	0	0
2.	Tunda	3	0	0	0	0	0
3.	Bharmour	3	1	0	1	0	0
4.	Holi	4	0	0	1	0	0
5.	Samra	3	0	0	0	0	0
	Total	17	2	0	2	0	0

They have problem in pronouncing Sanskritic names. In Bharmour, a child is most likely to be educated if the head of the family is educated or understands the advantages of education. Since education usually preceded employment, Gaddis associate education with employment.

Another source of differential access to education derives from the place of residence. The type of residential setting also determines differential in cultural values, family structure and patterns of child labour which in turn influence educational aspirations for children.

The schools are mostly not in the vicinity of villages. All Gaddi children do not have access to a

the villages in Bharmour Tehsil are not electrified, and most of the people cannot buy kerosene for lamps. They usually burn *Jagni* (torchwood) at night, light of which is not bright enough for reading.

DISCUSSION

The villages of Bharmour Patwar Circle are still traditional villages in the initial stages of responding to Community Development Programmes. The Gaddis are not overwhelmed by these influences. They value their traditional way of life. Despite cherishing their traditions and way of life, they recognise that improvements in their socio-economic conditions are necessary and desirable. Gaddis think that they have capacity and capability of selecting innovations that they think are good for them while rejecting those which interfere with their traditional mode of life. Changes are entering their life slowly and are tolerable to even those villagers who believe that they are being threatened by it. The changes are tolerated by villagers as long as they do not interfere in their religious and family life. However, like most other tribes which have increasingly adapted to and adtopted modern culture, technology and education, the Gaddis still, by and large, zealously cling to their traditional mores. But this does not mean that these people have not felt the thrust of economic development at all. Changes can be seen in many aspects of Gaddi life.

The most encouraging changes in the Gaddi way of life is the new enthusiasm for education in the younger generation. When the first school in the area was started, people were afraid to send their children to school They vehemently resisted for fear that the children would learn English and forget their own language and culture. The other reason for not sending their children to schools was the fear of the emigration. There is still a keen tussle between the conservatives and progressives among the Gaddis. While the traditionalists insist on keeping the old ways intact, the progressives emphasize that only way they can survive in today's world is to move with the times, and imbibe and integrate change into their culture without loosing their identity.

Education has given them choices. Before they had access to education, they were pretty much relegated to occupation that already existed like animal husbandry, agriculture, trading and crafts. But education has opened up new fields for them. They recognized education as the path to Government employment and therefore value it highly, but this does not necessarily imply a rejection of Gaddi's occupation or Gaddi way of life in general. Although Gaddis do not mind their sons working in the government offices, they nontheless cherish that they should combine it with village life. The Gaddis love their homeland, its environment and have special preference for '*Thanda Pani*' (cold water) of the area during summer months. Gaddis in general do not emigrate permanently from Bharmour and landowners rarely severe their village ties, only landless people favoured government jobs. The Gaddis working outside Bharmour are usually members of the joint families, who have a residential house and fields in the village. Regular visits are paid to share economic activities of the family. Families usually remain in the villages to look after the property. Sometimes, low castes people prefer education to gain status in society. Economic considerations and desire to escape some of the disadvantages of low caste status provide the major motives for education. Just as economic consideration are motives in emigration, so also are they the main influence for Gaddis to retain their village ties. Even landless people derive economic advantages from village life that are not available outside the village. The village provide a free house site, free fuel, free fodder for animals, free food on certain occasions, free cremation and work opportunities during certain periods. In one's own village, one is sure of minimal existence. Mostly land ownership help to stabilize the village population and that is in a way hindering the development of education.

Communication gap between adults of the area and teachers warrants extension lectures to increase adults' knowledge about advantages of education. Changes in syllabus and education pattern with more emphasis on education of adult males and females to reorient their social attitudes should be made. The teachers in the schools are from outside Bharmour areas, usually from other parts of Punjab. This hinders intimate contact between parents and teachers, which is an essential factor in these parts.

Since the educational status of the Gaddis, living in a transhumant stage is low, they suffer from problems of malnutrition, high morbidity and mortality rates and high infant mortality rates. Their ignorance of modern methods of Child Health Care, specially vaccination, leads them to rely on magic and rituals rather than take the help of modern medicine. Insantiary conditions in their habitat are also ignored by them leading to greater susceptibility to disease. General population trends in the area can be seen in the table 35.12.

Of particular concern are high infant and child deaths, and high incidence of diseases. The infant-mortality rate among Gaddis is high 170.1. It is higher than Himachal Pradesh's IMR of 90.0 and India's 104.0. The Gaddis IMR is higher than that of some countries of South Asia (Nepal = 135;

Table 35.12 : General population trends for Gaddis, Himachal Pradesh, Kerala and India (Bhasin, 1990)

S. No.	Population Tends	Gaddis H. P.	Himchal Pradesh	Kerala	India
1.	Total Population	29544	4280818	25454000	685185000
2.	Sex Ratio	870	973	1032	933
3.	Density, per sq km	16	77	655	216
4.	Crude Birth Rate (CBR)	28.4	30.8	22.9	33.9
5.	Crude Death Rate (CDR)	14.0	10.3	6.4	12.6
6.	Infant Mortality Rate (IMR)	170.1	90.0	29.0	104.0
7.	Neonatal Mortality Rate (NMR)	80.2	52.6	21.0	65.8
8.	Postnatal Mortality Rate (PNMR)	45.3	27.5	7.7	37.2
9.	Perinatal Mortality Rate	62.1	42.9	22.9	53.8
10.	Foetel Death Rate (FDR)	13.0	-	6.4	-

Source : Census of India 1981, Series 1. India Paper 2 of 1983 Sample Registration System 1984. Vital Statistics Division, Registrar General of India, Ministry of Home Affairs, New Delhi (1987)
Sample Registration Bulletin 1985. Registrar General of India, Ministry of Home Affairs, New Delhi

Bangladesh = 124; Burma = 67; Pakistan = 115; and Sri Lanka = 36).

While education is generally negatively related to the fertility level it is not clear why it is so. Quite possibly, the most powerful effect of education is its role in bringing fertility within the sphere of conscious choice by affecting traditional values and attitudes, relating the individual to a culture in which personal choice rather than unseen forces govern events. The measurement of this effect is difficult, but it is certain that education changes parents' perceptions of smaller or larger families in many ways.

Although it is moderate, education does exert an independent effect on fertility and the variables that intervene between education and fertility, even when such related factors as economic status, mass-media exposure and women's work status are controlled. The control for socio-economic variables diminishes the size of education differentials, but the independent effect of education consistently exceed that of any other socio-economic factor. The level of female education appears to be closely related to economic status and to mass-media exposure than to such other aspects of female status as work and domsetic autonomy. It is generally accepted that autonomy enhances aspects of education. But among Gaddis, rather than education, cultural and kinship norms continue to shape autonomy and decision-making.

Among Gaddis, the effect of education is by no means uniform. The little education has only a marginal effect on fertility itself, or as factor affecting the supply or demand for children. The threshold is quite unambiguously a middle school education (5-7) years, at which point expected effects on fertility and intervening variables become evident.

The number of children born to men and women with different educational attainments show a progressive trend in all the endogamous groups. One of the reasons for this could be that men and women in higher age groups had the lowest level of education (primary and middle) and therefore the number of children more. The Gaddis of Bharmour show low averages at the illiterate level (5.5), whereas at the primary level they show a little higher average (5.0). The averages go on increasing

Table 35.13 : Number of children born among Gaddis of Bharmour Tehsil, Chamba District, Himachal Pradesh with different educational attainment among husband (Bhasin, 1990)

Population	Education (Husband)				
	Liiterate	Primary school	Middle school	High school	Graduate
Brahmans	5.6	4.8	4.7	3.8	3.2
Rajputs	5.2	4.6	4.2	3.7	3.0
Scheduled caste	5.8	5.6	5.2	4.5	-
Gaddis (Total)	5.5	5.0	4.7	4.0	3.1

Primary = up to 4 years, Middle = 8 years, High/Higher = 10 to 12 years, Graduate = 15 years

Table 35.14: Number of children born among Gaddis of Bharmour Tehsil, Chamba District, Himachal Pradesh with different educational attainment among wives (Bhasin, 1990)

Population	*Education (Wife)*			
	Literate	*Primary school*	*Middle school*	*High school*
Brahmans	5.4	5.0	4.5	3.5
Rajputs	5.0	4.5	4.5	3.1
Scheduled castes	5.8	4.8	–	–
Gaddis (Total)	5.4	4.8	4.5	3.3

Primary = up to 4 years, Middle = 8 years, High/Higher = 10 to 12 years, Graduate = 15 years

with the education levels of husbands and wives as can be seen from the tables 35.13 and 35.14.

The result show that the inverse effect of education on fertility is largely the result of inadvertent factors rather than volitional changes.

The age at marriage exhibit particularly pronounced difference by education. The mean age at marriage with a primary school education is almost two years higher than that for uneducated women. Hence, it is no surprise that most of the observed differentials in fertility by education results from delayed marriage.

The extent to which observed differentials in fertility reflect education - specific differences in the number of children desired and the values and expectations attached to children is an important issue. Though, fertility desires are consistently associated negatively with educational attainment, even after the socio-economic factors are controlled, these differences are rather small. A woman with primary school education wants in all about half a child less than an uneducated women, but she nevertheless wants about the same number of sons; this suggest that even education has not yet proved powerful enough to crack the cultural preference for sons in the society. Among Gaddis, the education of women has not eroded some of traditional values attached to children. They still rely on their childrens' labour when the children are young and for economic and residential support in old age. Sons continue to be an important source of old-age economic security and the focus of co-residential expectations. This accounts for the relatively most negative effect of education on both family size preferences and fertility.

Despite governmental measures to educate people on the advantage of family planning, the age-old preference for a large family is still prevalent because the status of women is enhanced by the number of children they have. Large numbers of children also ensures a labour pool at family source, as labour is scarce in this region. Every hand is needed during the agricultural season. It was seen that there was not much difference in the number of children born to women among different caste groups. This apparently shows that there is virtually no differential fertility in Bharmour according to caste groupings. Comparing the figures of India and Kerala, it is seen that at every stage the average number of children is more in the present study.

Parents in areas with high infant mortality rate typically produce more children than they desire because they want to ensure the survival of a minimum number as observed among the cultivators. Subjected to repeated pregnancies these women suffer from an almost continuous nutritional drain which exposes both mother and child to high mortality risks that show a definite increase from one pregnancy to the next. The pressure of the population growth is felt more by the large families at low income levels. It has been shown by various studies that the larger the family size, the greater is the occurrence of common illness in the family. The health of the family is affected by nutritional deficiencies. The health of a mother in a large family with limited income is affected by the low nutritional level and also by the physical and material pressures associated with child-bearing and child-rearing. The larger families, moreover find it difficult to provide adequate medical facilities to its members.

The Gaddi population faces a great challenge in seeking to improve the health status of its people especially its child population. Forces directly involved in the causation of ill health include poor nutrition, insanitary conditions, high fertility, lack of awareness and education. In Bharmour Tehsil, the health problems are related to lack of education which has resulted in insanitary conditions of area, prolification of diseases, ignorance about nutrition, vaccination and medication. To bring about overall change in the area, educational levels among Gaddis must be improved upon.

As part of the creation of opportunities for Gaddi children and improving their quality of life, formal and non-formal education options for children will be an important step. Education, however, should not be imposed from an external view point, but should be made relevant to the lives, works and aspiration of girls and boys themselves. Children who have to work to survive need education which can be combined with working. This means –education at times when they can attend and education in the work place for those who cannot otherwise get to classes.

Formal schools need to be made more flexible in terms of curricula, innovative teaching methods and time tables to take into account the work of children. There should be means of re-integrating enrolled children who periodically drop-out owing to their work. These children are sometimes scared to rejoin classes. There should be means to provide an educational opportunity for the children who cannot attend school. Classes should be held at most appropriate time. This process should be sensitive to the different needs of the girls and boys of different social status and wealth. In addition, discussions can be held with parents about educating girls, and with women and men in Adult Education Centres about how they might cope without the help of children.

Centralised planning cannot produce school time-tables which can adapt to the different agricultural and pastoralists work load in the region. There should be a positive attempt to table school holidays to coincide with the peak agricultural season. While keeping the common core of the national curricula framework in mind, the school should have the option to reorganize the curriculum. The school should have the option to choose the timing of holding the classes, organize the classes in one or more clusters, locate the classes in one or more parts of the locality. Adequate physical facilities must be provided to the school along with a full complement of teachers.

In Rajasthan, in the Lok Jumbish Programme radical decentralization has taken place by setting up village education committees who make decisions about appropriate timetables and curricula. This has had the positive effect of enabling villagers to change school time tables following times of crisis or natural disaster. Children take holidays during the time rather than dropping out of school. There is a need to diversify curricula into vocational training.

It was found that in Bharmour: (i) about one-third to one-half of the out of school children found school either boring, irrelevant or threatening (*i.e.* failures of examination); (ii) Almost 40-45 per cent of the out of school children have to stay away from school due to economic compulsion as well as the demand of home of family life. The children in the first category could be expected to be attracted by and retained in the school system if the curriculum and learning process are re-organised. However, the children of the second category may still not respond unless socio-economic factors are addressed. The involvement of children in supplementing family incomes as well as in gathering fuel, fodder and water and attending to younger siblings have a direct bearing on education.

When the formal schools have to function amidst pressures such as general apathy of parents, irregular attendence of children, the fludity in the implementation of curriculum, teaching of multiple classes by one or two teachers, low motivational levels among teachers etc., it is impossible to develop knowledge and skills in and attitudes towards health and hygiene. If the young children are to be taught about health and hygiene, there should be change in their habits. This is possible only through carefully planned and creatively implemented activities which involve more of the child's effective domain. Due to the prevailing pressures in school, teachers concentrate on language and maths and sacrifice other subjects like health and hygiene. Therefore, effective health education does not take place in most primary schools.

In order to provide suplementary education to Gaddi children, schools should operate with flexible timings and with an enriched and learner oriented curriculum. The supplementary school system will provide special inputs which would help them to develop a strong educational foundation and also in the long run to cope with the government schools curriculum. The focus of these schools should be on developing literacy, numeracy and self confidence through learning centres which should run for two hours daily in the morning and/or the evening. All subjects including health and hygiene, should be taught through activities connected to the topics and teaching and learning of some basic health habits.

Access to education alone is insufficient. The quality of education - what girls learn and how they learn it - determines the impact of education on behaviour (Sadik, 1994). Gender bias must be eliminated in all types of educational materials that enforce and reinforce - existing inequities. The stereotypical portrayal of women in such materials undermines girl's self esteem and hinders their educational advancement.

KEY WORDS AND ABSTRACT

KEY WORDS Himalaya. Ecology. Literacy. Health.

ABSTRACT Education in India is plagued by structural and organisational distortions, even after four decades of planned development. Educationally Himachal Pradesh is very backward. Although the percentage of literacy has risen from 1951 onwards, still much remains to be covered. The education of tribals in Himachal Pradesh has been a particularly difficult task because of the cultural diversity of the people. This study presents education status of a transhumant Gaddi population who travel from one ecological zone to another. Due to heavy snowfall for about three or four months, during winter, the Gaddis generally migrate to the lower hills along with their flocks of sheep and goats. In this migration they are accompanied by their families. This transhumant way of life nurtured by ecological factors has produced shortfalls in basic education and adult literacy, particularly among girls and women. This continues to be major obstacle in progress in every sphere, especially in the health structure of the Gaddis. Better health is one of the bases for social and economic development. The prevailing curriculum is inflexible and unresponsive to local needs and environment, devoid of the component of skill formation; lacking in social and cultural inputs from the community.

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Author's Address : **Veena Bhasin,** Research Scientist 'C' U.G.C. (Professor Grade), Department of Anthropology, University of Delhi, Delhi 110 007, India

The War Khasi of Meghalaya : Implications of Variation in Adult Body Dimensions

R. Khongsdier

INTRODUCTION

One of the central themes of physical anthropology is the study of human variation with a view to understanding the processes of human evolution and the causes of such variation. "Genetically, human evolution may be conceived as occurring through changes in the frequency of genes in the human gene pool" (Motulsky, 1960). It is also considered "changes in the morphology of organism through time "(Buettner-Janusch, 1966). Morphological characters include anthropometric measurements and somatoscopic observations. According of Oliver and Howells (1957), "these traits (anthropometric traits) constitute a whole field of human variation in size and shape, furthermore involving modification by environment as well as the relationship and differentiation of populations - in short all the processes of micro evolution". Accordingly, anthropometric traits and/or body dimensions are associated not only with genetical, but also with environmental factors. In fact, several studies have revealed that adult body dimensions such as height, weight, etc. are associated with nutrition, urbanisation, migration and other socio-economic factors (Shapiro, 1939; Lasker, 1954; Roberts, 1969; Harrison et al., 1977; Rao and Sastry, 1977; Eveleth, 1985; Roberts and Dann, 1985; Bharati, 1989; Rao et al., 1990, etc.).

In India, a study carried out by Ganguly (1974) has revealed that adult males of higher economic groups are heavier and taller than those, belonging to the lower economic strata. Similarly, Bharati (1989) has observed that the values of body size measurements, skinfold thickness, body fat, and anthropometric ratios and indices increase with the increasing income level. Rao et al. (1990) have also found that both male and female adults, belonging to the upper middle income groups, are taller and heavier than those, belonging to the lower income groups. It may, however, be mentioned that Majumder et al. (1986) have not found any significant relationship between occupation and adult body dimensions in some Himalayan populations.

The present paper deals with some morphological characters of adult males in the War Khasi, one of the sub-groups of the Khasi matrilineal tribe of Meghalaya. It may be noted that Das (1978, 1979, 1985) has already reported that there are differences in anthropometric traits between the sub-groups of Khasi, *viz.*, Khynriam, Pnar, Bhoi and War; indicating a micro-evolutionary trend in this population. In this study, an attempt has been made to show inter and intra variation in adult body dimensions according to villages and economic condition.

MATERIALS AND METHODS

The War Khasi are mostly found in the southern slope of the East Khasi Hills district of Meghalaya. The area of their main concentration is known as 'Ri War' or War country (Betwen 25°08 N' and 25°25' N and 91°20' E and 92°E), consisting of more than 250 villages. Method of selection of villages was based on a 2% systematic random sampling (Khongsdier, 1994a, 1995) . For the present analyses of data, we have taken into consideration four villages, namely, Mawsiangei (MA), Nongla (NA), Wahumlein (WA) and Lapalang (LA). Data on socio-economic condition were based on complete enumeration of households. It may be mentioned that the primary occupation of the War Khasi is agriculture and/or horticulture. Agricultural labour, services and other business activities are their secondary occupation. Considering some aspects of economic condition such as housing condition, type of occupation, land holding, etc., a given household having per capita monthly income of Rs. 300.00 seems appropriate for being a minimum of the subsistence income level and to delineate poverty line in the present study. This per capita monthly income of Rs. 300.00 is found to be more or less equivalent to $\overline{X}$ - 4SD. Accordingly, the War Khasi of the present study were broadly classified into three economic groups, using the interval estimation based on standard deviation, which is as follows :

Above $(\overline{X} + 4SD)$ = High income group (HIG)
$(\overline{X} - 4SD)$ to $(\overline{X} + 4SD)$ = Middle income group (MIG)
Below $(\overline{X} = 4SD)$ = Low income group (LIG).

As per our study, the average per capita monthly income of 366 households was found to be Rs. 342.53 with a standard deviation of Rs. 195.26. Applying the above method, we get,

$$(\overline{X} - 4SD) = \text{Rs. } 342.53 - \frac{4 \times \text{Rs. } 195.26}{\sqrt{366}} = \text{Rs. } 301.70$$

$$(\overline{X} + 4SD) = \text{Rs. } 342.53 + \frac{4 \times \text{Rs. } 195.26}{\sqrt{366}} = \text{Rs. } 383.36$$

The above economic classification is certainly arbitrary. It may, however, be noted that the main purpose of such classification is to make out the probable effect of economic condition on adult body dimensions.

No statistical sampling of individuals was adopted for collection of anthropometric data, owing to operational difficulties in the field. Instead, an attempt was made to include in our sample all those individuals who were willing to cooperate in carrying out the present study. Ten selected anthropometric measurements such as height, weight, sitting height, biacromial diameter, bi-iliac diameter, mid upper arm circumference, chest girth (exhaled and inhaled) and skinfold thickness at biceps and triceps; were taken on 202 adult males (aged 20-55 years), following standard techniuqes (Weiner and Lourie, 1981). The exhaled and inhaled chest girths were measured with a steel tape at the level of fourth rib. (Bharati, 1989). Ponderax skinfold caliper was used for the measurement of skinfold thickness as suggested by Sloan and Koeslag (1973).

Besides the above measurements, the following ratios/indices and/or estimates were also computed : (1) Weight/height ratio, (2) Weight/height^2 Index, (3) Weight for height, (4) Ponderal index, (5) Cormic index, (6) Chest (exhaled)/height ratio, (7) Log of skinfold thickness at biceps and triceps, (8) Surface area (S.A) = $W^{0.425} \times 74.66$, where W stands for body weight (Sen, 1979), (9) S.A./ weight ratio, (10) Body fat = F (%) x Weight (Kg)/100, where F(%) = (4.201/D - 3.813) x 100, and D = 1.0890 - 0.0028 x Triceps skinfold thickness (mm), as suggested by Sen (1979), (11) Total upper arm area, Upper arm muscle area, Upper arm area, and Upper arm fat index, as proposed by Frisancho (1990).

In order to understand the magnitude of variation in adult body dimensions among the War Khasi villages, we have followed the T-square method suggested by Sanghvi (1953).

RESULTS

Variation in Adult Body Dimensions Between Villages

Table 36.1 shows the means and standard deviations of anthropometric measurements according to villages for the adult males of the War Khasi. It is seen from table 36.2 that the LA males differ significantly from the MA males with regard to sitting height, bi-iliac diameter and mid upper arm circumference. The value of T^2, which accounts the magnitude of variation between the LA and MA males with respect to all measurements, is found to be 12.62. On the other hand, the differences between the LA and NA males are statistically significant in respect of weight, height, sitting height and bi-iliac diameter, and the value of T^2 is found to be 11.42. A more deviation is found when comparison is made between the LA and WA males. Table 36.2 shows that the differences between the LA and WA males are statistically significant in respect of height, sitting height, biacromial diameter, bi-iliac diameter and chest girth (exhaled). The sum total of differences between them with regard to all measurements is found to be 11.71.

In comparison with the NA and WA males, the MA males do not show much deviation in body dimensions, except with respect to bi-iliac diameter. It is found that the sum total of differences in body measurements between the MA and NA males is 2.05, and between the MA and WA males 6.99. With respect to differences between the NA and WA males, it is found that the value of T^2 is only 3.38. So, it shows that the three villages, *i.e.* MA, NA and WA do not show much deviation from one another with regard to body measurements. However, adult males of these three villages show a greater magnitude of variation when compared with the LA males.

Anthropometric Variables by Economic Condition

It is seen from the comparison between villages that the LA village differs significantly from the three villages with regard to some anthropometric

Table 36.1 : Anthropometric measurements by villages (Males)

Body measurements	*Lapalang (N=77)* *Mean age (years) =34.50±7.32*		*Mawsiangei (N=48)* *Mean age (year) =35.33±8.64*		*Nongla (N=42)* *Mean age (years) =33.23±9.01*		*Wahumlein (N=35)* *Mean age (years) =36.01±9.98*	
	X̄	*SD*	*X̄*	*SD*	*X̄*	*SD*	*X̄*	*SD*
Weight (kg)	51.30	5.02	50.23	4.76	49.05	5.01	50.26	4.71
Height (cm)	158.67	4.81	157.51	4.32	156.58	4.44	156.09	5.41
Sitting height (cm)	83.78	2.80	82.00	2.78	81.45	2.96	80.78	2.87
Biacromial diameter (cm)	36.83	1.68	36.31	1.71	36.18	1.72	36.13	1.63
Bi-iliac diameter (cm)	27.65	1.13	26.12	1.30	26.67	0.98	27.15	0.78
Mid upper arm cir. (cm) (L)	24.68	1.70	24.09	1.20	24.29	1.77	24.45	1.52
Chest girth (inhale) (cm)	84.75	3.18	84.04	3.54	83.96	3.57	83.51	3.86
Chest girth (exhaled) (cm)	80.83	3.09	80.08	3.53	80.55	3.49	79.20	2.55
Log of Skinfold Thickness:								
Biceps (left)	0.5393	0.1111	0.5422	0.1049	0.5415	0.1012	0.5385	0.1292
Triceps (left)	0.8201	0.0907	0.7945	0.0951	0.7868	0.1117	0.8115	0.1442

Table 36.2 : Statistical differences between villages with regard to anthropometric measurements[b]

Anthropometric measurements	*LA va MA*	*LA vs NA*	*LA vs WA*	*MA vs NA*	*MA vs WA*	*NA vs WA*
Weight	1.19	2.34*	1.06	1.14	0.03	1.09
Height	1.40	2.38*	2.42*	1.00	1.28	0.43
Sitting height	3.49*	4.18**	5.17**	0.90	1.94	1.01
Biacromial diameter	1.68	1.99	2.09*	0.36	0.49	0.13
Bi-iliac diameter	3.32*	4.93**	2.71*	2.28*	4.49**	2.40*
Mid upper arm circumference	2.27*	1.16	0.72	0.63	1.16	0.43
Chest girth (inhaled)	1.13	1.20	1.66	0.11	0.64	0.53
Chest girth (exhaled)	1.21	0.44	2.93*	0.64	1.32	1.96
Log of Skinfold Thickness :						
(a) Biceps	0.15	0.11	0.03	0.04	0.14	0.11
(b) Triceps	1.51	1.67	0.32	0.35	0.60	0.82
Sanghvi's T^2	12.62	11.42	11.71	2.05	6.99	3.38

* $P < 0.05$; ** $P < 0.001$

b. As suggested by Sanghvi (1953)

measurements. Therefore, anthropometric data collected from LA village were presented separately, with a view to having a better understanding of the probable effect of economic condition on anthropometric variables. However, data collected from other three villages, *i.e.* MA, NA and WA, were pooled together, since there were not much differences between these villages with regard to body measurements.

The relationship between anthropometric variables and economic condition is shown in table 36.3. It is seen that the mean values of anthropometric measurements are higher in the high income group (HIG), when compared with those either in the middle income group (MIG) or in the low income group (LIG). The analysis of variance also shows that the income group differences are significant in respect of many anthropometric measurements, except in the case of height, bi-iliac diameter and chest girth (exhaled). Similarly, the F-ratio indicates that the differences in anthropometric ratios and indices are highly significant excepting cormic index and chest/height ratio.

Regarding the LA males, table 36.4 shows that the income group differences in anthropometric variables are also significant, except in the case of sitting height, bi-iliac diameter, ponderal index, cormic index and upper arm fat index.

In view of the above findings for both the groups of villages, it may be inferred that the per capita income of households seems to be highly associated with variation in adult body dimensions.

Table 36.3 : Anthropometric variables for adult males by income groups (MA+NA+WA)

Anthropometric measurements	*LIG (N=49)* *Mean age (years) =35.12±10.78*		*MIG (N=51)* *Mean age (years) =36.37±7.39*		*HIG (N=25)* *Mean age (years) =36.42±7.39*		*F-value*
	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	
Absolute Measurements:							
Weight (kg)	48.14	5.39	49.76	3.48	53.24	4.72	9.49**
Height (cm)	156.81	5.49	157.12	4.35	158.34	3.52	0.88
Sitting height (cm)	82.28	3.05	81.54	2.90	83.35	2.59	3.23*
Biacromial diameter (cm)	35.94	1.42	35.98	1.63	37.42	1.90	7.98*
Bi-iliac diameter (cm)	27.00	0.83	27.17	1.17	27.54	1.39	1.99
Mid upper arm circum. (cm)	23.54	1.46	24.30	1.76	25.51	1.17	13.27***
Chest girth (inhaled) (cm)	83.55	3.32	83.67	3.74	85.52	3.99	2.71
Chest girth (exhaled) (cm)	79.27	3.22	79.98	3.44	81.64	3.96	3.79*
Log of Skinfold Thickness :							
(a) Biceps (left)	0.4958	0.1367	0.5533	0.0735	0.5856	0.1017	6.54**
(b) Triceps (left)	0.7456	0.1116	0.8174	0.1132	0.8673	0.0854	11.50**
Indices and Ratios :							
Weight/height	0.3066	0.0281	0.3172	0.0226	0.3369	0.0270	10.86**
Weight/height^2	1.95	0.16	2.04	0.15	2.12	0.17	10.31**
Weight for height	82.21	6.93	85.13	6.46	89.45	7.13	9.28**
Ponderal index	43.19	1.31	42.75	1.46	42.22	1.20	4.25*
Cormic index	0.5236	0.0137	0.5175	0.0189	0.5237	0.0119	2.00
Chest girth (exhaled)/height	0.5058	0.0193	0.5104	0.0251	0.5167	0.0234	2.00
Surface area	1.51	0.10	1.53	0.06	1.59	0.08	6.71**
Surface area/weight	3.17	0.20	3.09	0.14	2.99	0.21	8.24**
Body fat	5.02	1.24	5.63	1.05	6.46	1.29	12.48**
Total upper arm area (TUA)	44.26	5.56	47.01	6.79	51.89	4.76	13.23***
Upper arm muscle area (UMA)	37.68	4.70	39.12	6.11	42.75	4.34	7.55**
Upper arm fat area (UFA)	6.72	1.96	7.80	2.31	9.13	2.04	10.66**
Upper arm fat index(AFA)	15.06	3.61	16.61	4.29	17.60	3.44	3.95*

* $P<0.05$; ** $P<0.01$; *** $P<0.001$

DISCUSSION

With respect to the present analyses, it is observed that there are differences in some anthropometric characters between villages. Moreover, it is also found that there are difference between income groups with respect to certain anthropometric traits. As regards the Khasi population as a whole, Das (1978) has reported that "among the Khynriam, War and Pnar, there were differences with regrad to morphological characters and not in genetic traits." However, the Bhois deviate from the others in all respects". In this connection, he (Das, 1979) has pointed out, "It is very difficult to offer an explanation of such behaviour of the Bhois, as not only one, but a large number of factors may be related to it". Considering the geographical distribution of the Bhois, he is of the opinion that "there is a possibility of gene inflow to the Bhois from the neighbouring populations". As far as the present study is concerned, we are not in a position either to support or to refute the contention made by Das (1979), since we have no data on the mating pattern and marriage practices of the Bhoi. However, it may be agreed to what Das (1979) says, "Whatever may be the causes, a comprehensive picture of the nature and range of variation in metric and genetic parameters in the Khasi population suggests a micro-evolutionary trend".

Among the War Khasi, it has already been reported that there is a strong tendency towards village endogamy (Khongsdier, 1994b). Such a strong tendency to village endogamy may lead, if not already, to the formation of several 'Demes', or small sub-endogamous groups within the blanket War Khasi population. As a result, there could be many social and biological variations between villages within this apparently bigger endogamous group. From a genetical point of view, there is a strong possibility that each of the villages or groups of

Table 36.4 : Anthropometric variables for a adult males by income groups

Anthropometric measurements	*LIG (N=25) Mean age (years) =37.42±10.14*		*MIG (N=29) Mean age (years) =38.02±11.20*		*HIG (N=23) Mean age (years) =37.79±10.33*		*F-value*
	$\bar{X}$	*SD*	$\bar{X}$	*SD*	$\bar{X}$	*SD*	
Absolute Measurements:							
Weight (kg)	48.60	5.37	51.90	4.03	53.48	4.42	6.80**
Height (cm)	156.90	5.33	159.85	4.44	159.12	4.04	2.76
Sitting height (cm)	82.10	2.99	83.04	2.26	83.06	3.17	1.40
Biacromial diameter (cm)	36.01	1.50	36.90	1.62	37.62	1.52	6.23**
Bi-iliac diameter (cm)	27.02	0.83	27.41	1.20	27.63	1.22	1.88
Mid upper arm circum (cm)	23.52	2.05	25.01	1.03	25.52	1.19	11.62***
Chest girth (inhaled) (cm)	83.56	3.36	84.62	2.27	86.22	3.39	4.55*
Chest girth (exhaled) (cm)	79.59	3.17	80.69	2.32	82.35	3.20	5.29**
Log of Skinfold Thickness :							
(a) Biceps (left)	0.4944	0.1389	0.5614	0.0701	0.5745	0.1051	3.85*
(b) Triceps (left)	0.7758	0.0973	0.8233	0.0753	0.8641	0.0775	6.44**
Indices and Ratios :							
Weight/height	0.3092	0.0276	0.3248	0.0248	0.3364	0.0244	6.43**
Weight/height^2	1.97	0.15	2.04	0.17	2.11	0.15	4.68*
Weight for height	82.79	6.50	85.39	7.52	89.11	6.33	4.92**
Ponderal index	43.06	1.06	42.91	1.57	42.28	1.06	2.41
Cormic index	0.5235	0.0170	0.5204	0.0151	0.5220	0.0132	2.00
Chest girth (exhale)/height	0.5085	0.0176	0.5062	0.0153	0.5177	0.0209	3.00*
Surface area	1.52	0.10	1.58	0.07	1.60	0.08	6.41**
Surface area/weight	3.14	0.15	3.09	0.18	3.00	0.14	4.29*
Body fat	5.38	1.15	5.88	0.87	6.43	1.11	6.28**
Total upper arm area (TUA)	44.34	7.84	49.86	4.09	51.91	4.88	10.81**
Upper arm muscle area (UMA)	37.43	6.59	41.60	3.59	43.19	4.73	8.13**
Upper arm fat area (UFA)	6.91	1.92	8.26	1.57	8.72	1.27	7.89**
Upper arm fat index (AFA)	15.52	3.06	16.72	3.16	16.88	2.51	1.54

* P<0.05; ** P <0.01; *** p< 0.001

villages must have a separate gene pool, which may result in variation between villages with regard to genetic systems. The present findings, with respect to anthropometric characters, seem to support the above observation. However, we need data on genetic markers (like blood groups, serum protein, red cell enzymes, etc.) to strengthen the above contention.

From an environmental point of view, morphological characters are polygenic traits, but they are also subject to the influence of environmental factors (Shapiro, 1939; Oliver and Howells, 1957). Whatever it may be, recent genetic studies have revealed that there is an increasing variety of polymorphisms, "first of all the blood groups, followed by the serum and other proteins, enzymes, immunogenetic variables", etc. (Roberts, 1991). It clearly indicates the long term effect of natural selection on the above discontinous traits. Previously, these traits were considered to be non-adaptive. Pointing out to this problem, Das (1979) says. "All these works suggests that the blood groups are not free from influence of natural selection and their gene frequencies in a population may be altered. Thus if a change in genetic composition of population is regarded as evolution, then evolution has been taking place". So, what we like to point out here is that changes in gene frequencies or morphological characters of a population are not completely free from the environmental influences. However, body dimensions are more sensitive to environmental influences than qualitative traits like hair form, or nasal contour (Shapiro, 1939), or discontinous traits like blood groups, serum protein, etc.

To make this point clear, it is found in the present population that there is significant relationship between anthropometric variables and per capita income of households within the same villages in which the members are supposed to share a common gene pool. So, it suggests that the anthropometric variables are more sensitive to environmental factors (which include nutrition, socio-economic conditions, etc.). This pattern of intra variation in anthropometric characters has also been revealed in other studies (Bharati, 1989).

In the light of the above discussion, it shows that the anthropometric characters are associated with various biological and environmental factors. It seems that they are not completely free from either genetical or environmental factors. As far as the present study is concerned, it suggests that the intra village variation with regard to some anthropometric traits are mainly due to economic inequalities and other environmental factors like nutrition, etc. On the other hand, the differences between villages might have associated with both genetic and environmental factors, since there is a strong possibility that each village or a group of few villages might have possessed a separate gene pool (Khongsdier, 1994b). Moreover, differences in physical environment might have also exerted their influence on the processes of differentiation and modification in morphological characters. As a result, natural selection might have played a different role in the present population. It may be worthwhile to mention here that the intensity of natural selection with regard to differential fertility and mortality has already been reported for the Christian and Non-christian War Khasi (Khongsdier, 1994a). It is found that selection pressure is slightly more relaxed among the Christians (I = 0.36) than that among the Non-christian (I=0.45). These findings are undoubtedly in confirmation with the observation that selection pressure varies with varying environmental conditions (including socio-economic conditions) of the population (Johnston, 1973). The variation in some anthropometric traits between income groups in the present population may be associated with relaxation of selection pressure, if we take into consideration that selection is not only a process which eliminates the trait(s), but also a process which regulates viability and well-being of individuals.

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KEY WORDS AND ABSTRACT

KEY WORDS Anthropometric Traits. Inter and Intra Variation. Tribals.

ABSTRACT The present study deals with some morphological characters of adult males in the War Khasi of Meghalaya. The War Khasi, one of the sub-groups of Khasi matrilineal tribe, are mostly found in the southern slope of the East Khasi Hills district of Meghalaya. It is observed that in this population there are differences between villages as well as between income groups within the same village with regard to some anthropometric traits. In this population, there is a strong possibility that each village, or group of few villages may, if not already, have possessed a separate gene pool, taking into consideration the strong tendency towards village endogamy and the inter village variation in anthropometric traits. Further, the existence of intra village variation, *i.e.* variation in anthropometric traits between income groups of the same village, suggests that selection pressure varies with varying environmental conditions (including socio-economic conditions).

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Author's Address : **R. Khongsdier**, Anthropological Survey of India, North East Regional Centre, Upper Lachumiere, Shillong 793 001, Meghalaya, India

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Declining Youth Dormitory : A Case of Culture Among The Adis of Arunachal Pradesh

C.J. Sonowal

INTRODUCTION

Among the tribal people of the world, the institution of youth dormitory has been traditionally one of the most important social institutions. Youth dormitory is a place where the youth, usually those who have entered into adolescence (boys and girls), become member mandatorily. Youth dormitories have been reported to exist in different parts of the country. Roy (1915) has reported the presence of youth dormitories, *Jonkherpa* for boys and *Palerpa* for girls, among the Oraons. He mentions the function of youth dermitories as 'an effective economic organisation, ... a usual seminary for training young in their social and other duties and an institution for magico-religious observances. Lowie (1920) has depicted the important functions of youth organisations and age-grade systems of different tribal people. Haddon (1924) surveyed several tribes of India and described the functions of the youth dormitory as the central spot in the social, political and cultural life of man. Mill's (1926) elaborate description of tribal societies of North East India, including the Nagas, shows that peer-group feeling and social adjustment is very significant in age-grade system and dormitories. Greigson (1938) has described the dormitory life of the Maria Gond youth by saying that it shapes every aspects of tribal life. Majumdar (1956) has discussed in details the roles played by youth dormitories among different tribes and he found that "...the precise significance of the dormitories lies in the training they provide to their members". He also points out that the sex life in dormitory is channelled and well controlled by their cultural tradition. He has reported the existence of youth dormitories among the sub Himalayan Bhutiyas (*Rang-Bang*), Bhuiyas (*Dhangar bassa*), and among the South Indian tribes *i.e.*, the Muthuan, the Mannan and the Paliyan etc. He also reviews the youth dormitory *giti-ora*, of the Munda and the Hos. Elwin (1959) has reported the functioning of youth dormitories, *ghotul* of the Raj Gond. He has pointed out the beneficial roles of youth dormitories by saying that there is lack of promiscuity among these tribes and they have freedom and opportunity to chose one's own life partner in an effective way.

Mill's (1926) description of the tribes of North East India was followed by Elwin's (1959) elaborate study on the tribal people of Arunachal and Nagaland. Haimendorf (1962) has reported the youth dormitory *patang* among the Apa-Tanis of Arunachal Pradesh. Sachin Roy's (1966) comprehensive report on the Adis (Padam and Minyongs) of Arunachal Pradesh establishes the vital roles played by youth dormitories *mashup* and *dere* (for boys) and *rasheng* and *resheng* (for girls).

The literary data show that youth dormitories once absorbed the whole youth of a tribal society, *i.e.*, the total potential work-force and future generation of the society. But tribal people have faced tremendous pressure from external forces on their entire socio-cultural life. The youth dormitories are consequently fast disappearing. Reports of several scholars, *e.g.*, Haimendorf (1982), Roy Burman (1987), Majumdar (1985) show that the youth dormitories in North East India have been replaced by modern youth clubs and students' unions among many tribes. Majumdar (ibid) shows that shift of economic pursuits from hunting-gathering and jhuming to wet and settled cultivation led the Garo Hills' people of Meghalaya to desert the youth dormitory *nokpante*. It is also found that in North East India, the security forces and missionaries are largely responsible for their demolition. They also mention that though the institution of youth dormitory is disappearing, the core spirit of it is not entirely lost.

The changing aspect of traditional youth dormitory has been reported by several authors. Horam (1975) has reported the decaying and disappearing youth dormitories among the Nagas. He reviews the once widespread and colourful dormitory life of the Naga tribe, *i.e.*, *longsim* of the Tangkhul Nagas, *areju* of the Ao Nagas etc. Decaying youth dormitories among the Garos of Meghalaya has been reported by Shashi (1978) and Majumdar (1984).

Dormitory life and age-grade systems are, most often, intimately related to each other. Usually, initiation to the adolescence age-grade is the initiation to dormitory life also. In dormitories, training and roles are strictly divided among its members according to age-grades (Roy Burman, 1987).

Arunachal Pradesh is the home land of more than one hundred tribal groups with their colourful traditional life. The state was far from the reach of colonial influence especially in the remote areas. Till independence, most of the tribal traditions were in existence among the people. Compared to other hilly states of the region, the state was out of the reach of the Christian missionaries' influences. The state is still far from better road communication for which the pace of development is very slow. Report on youth dormitories among the tribal people of the state is very scanty.

It was assumed that rapid urbanisation, development activities, education etc., has played influential role in changing the functioning of traditional youth dormitory in the state. Thus, to examine the factors three categories of places, *viz.* rural, semi-urban and urban areas were taken for data collection. It was expected that a comparative analysis of the situation of three places would provide insight in to the problem formulated for the study. The present study highlights the role played by the traditional youth dormitory in past and the effect of its disappearance in their society, especially among the youth in terms of socialisation.

THE LAND AND THE PEOPLE

The Land

Historical Background : The Adis occupy the central region of Arunachal Pradesh. They are the inhabitants of East and West Siang district. The region is lying between 93°.11'E and 95°.35'E longitudes and 27°.20'N latitudes. The entire region is a hilly area except a few places near Assam plains. Height increases to the north of the region.

The state was known as North East Frontier Agency between 1954-72. The Abor Hill District was formed soon after independence with its headquarters at Pashighat. In 1954, the name of the Abor Hill district was changed to that of the Siang Frontier Division with its headquarters at Along. From first September, 1965, the North East Frontier Agency went under the control of the Ministry of Home Affairs, and consequetly, all the Frontier Divisions were renamed as districts. On 20th January, 1971 the North East Frontier Agency was declared as Union Territory with its new name 'Arunachal Pradesh'. Under the Arunachal Pradesh Reorganisation of Districts Act, 1980, the then Siang District was divided into two districts, *viz.*, West Siang and East Siang district. The erstwhile Pashighat Sub-Division was upgraded to the status of a district and was named as East Siang district. The district headquarters of West Siang remained at Along. The name of the region Siang was derived from the Siang river. This union territory was given a status of a state on 20th February, 1987.

Climate : The climate of the region can be divided in to four seasons: (i) Winter season, (ii) Pre-Monsoon season, (iii) S.W. Monsoon season, and (iv) Post-Monsoon season. The annual rainfall and temperature very greatly from place to place based on elevation.

Forest Area : The state is rich in vegetation. Both deciduous and evergreen forests are seen in the state. The total forest area accounts for 5154 thousand hectors of total 8374 thousand hectors of land area of the state. Some of these forests are reserved, some others are owned by the forest department and some are privately owned by the local tribal people.

The People

*Name Origin of the Tribe :*Till few years back, the Adis were known as 'Abor' to the plains people of the Brahmaputra valley. But at present they are known as 'Adis'. Several scholars have tried to establish the history of name origin of the Adis. Among them mention may be made of Hutton (1946) who tried to link the term 'Abor' to the term 'Aborimon'. He had the base for this link in the fact that the Assamese people used for word 'Aborimanuh' or 'Abor manuh' to refer to the 'Abors'. Some are of the opinion that this term has an indigenous origin.

The common belief regarding the origin of the name 'Abor' is that it was coined by the people of Assam valley only. The meaning of the word is *'one who does not submit'*. But during the British period a few writers wrote the name 'Abor' in the sense derogatory meaning of that term. Nevertheless, the people preferred to call themselves as Adis, meaning the people living in the hills.

Mythological Description of the Origin of the Tribe : Elwin's (1960) collection syas that at first there was no light, there was only night. There were no man but *Wiyus* (spirit). There appeared Kayum, a form, and his descendants are as follows: Kayum → Yumkang (son) → Kasi (son) → Siang (son) → Abo (son) → Bamuk (son) → Mukseng (son) → Sedi (son) → Diling (son) → Litung (son) → Tuye (son) → Yeppe (son)→ Pedong Nane (daughter) → Doni or Tani (the first man).

Demography : There are 11 administrative districts in the state. Panchayat system was introduced in the state and there are 781 Gram Panchayat present in the state along with 48 development blocks. According to the 1981 census data there are 3,257 inhabitant villages. There is no town complex in the state according to the population status. But there are 10 census towns in the state.

Total population of the state is 858,392 among them 461,242 are males and 397,150 are females. The state occupies a total area of 83,743 square kilometers with a population density of 10 persons per sq km. Sex ratio of the population is 861 per one thousand males. Total decadal growth between 1981-91 is 35.86. The rural decadal growth is 27.64 whereas it is 152.98 in urban areas. This is much higher than all Indian urban growth which is 35.97. Thus it shows high immigration of people from rural to urban areas in recent past.

Total rural population in the state is 753,586 and urban population is 104,806. According to 1991 census data 12.21 per cent of the total population are urban dwellers. This number was 6.56 per cent in the 1981 census.

Demographic record of the district West Siang shows that there are 89,778 people in the district of which 78,680 persons live in rural areas and 11,098 persons live in urban areas. The percentage of the urban population to the total population is 12.36 per cent.

East Siang district consists of 99.985 persons of which 85,460 are rural dwellers and 14,525 are urban dwellers. The percentage of urban population to the total population is 14.53 per cent. The district head quarter of East Siang is Pashighat. 14,525 people inhabit the town of which 8,233 are males and 6,292 are females. In Along, the district head quarter of West Siang district, total population is 11,098 and among them 6.461 are males and 4,637 are females. Population growth rate in Pashighat during the decade of 1971-81 was 78.64 and in 1981-91 is 58.93, and that for Along was 67.58 in 1971-81 period and 37.45 in 1981-91 decade. Thus the data show that migration to the urban place in last decade is less than that in the previous decade.

Literacy rate in the state is lower than the literacy rate of the country as a whole. The total rate of literacy is 32.87 per cent of the total population. Among them 42.26 per cent are male and 23.03 per cent are females. Total rural literacy in the state is 29.41 per cent. Among them 37.95 are males and 19.68 per cent are females. Urban literacy rate is 57.73 per cent in total and among them 64.16 per cent are males and 49.20 per cent are females. There is only one University in the State at Doimukh, four colleges, 45 Higher Secondary Schools, 68 High Schools, 254 Middle Schools, 1,122 Primary school, 2 Polytechnic Schools in the state.

Distribution of the People : The Adis have two main sub-divisions, the Padam-Minyongs and the Galongs. The differences between these two subdivisions are based on some minor material cultures and some other social institutions. The Padam-Minyong group has ten sub-tribes and the Galongs have four.

Relation with Indian Continent : Captain Bedford was the first European to visit a part of the Adi country in the year 1825. He was followed by Father Krick who visited some Padam areas around the year of 1855. Adi country was known for political disturbance and hostile raids during the British periods and the colonial government had to send several punitive expeditions to the area. The last expedition to the Adi country was conducted in the year 1911 after the killing of two top British officials along with most of their followers near Komsing area. The Adis were made to submit in that expedition. But the entire Adi hill never came under the colonial administration at any time except the relatively accessible areas. After independence development works have been introduced in the area and at present the people have become a part and parcel of the country.

Administration System

Among the tribal groups of the region the administrative system of the Adis is known to be one of the well maintained one right from remote past. They have several legends regarding the origin of the Kebang (council) system in their society.

The Kebang : Every Adi village locally known as *dulung*, is run by a council called *Kebang*. All the adult members of the village are its members. The elders of the Kebang are called as Kebang-abus. Thus the Kebang has collective leadership. It is acquired by means of skill, intelligence, wealth and personality. At present all the experienced and matured elders, orators (nyikoks) and gams (village heads) of the village are the kebang-abus.

The *dolung-kebang i.e.*, the village council is the earliest and the smallest administrative institution of the Adis. It is held at *dere* or *moshup*. The colonial administration introduced two more higher *kebangs* among the Adis, the *bango-kebang* councils of villages and *bogum-kebang* council of the whole Tribe.

Economic Life

I) Hunting and Fishing : Hunting was one of the earliest means of livelihood of the Adi people and it remained as a necessity in their society even after the acceptance of agriculture as their livelihood. Skill in hunting and success in it signifies one's high status and position in the society at present also in the interior villages, as in older days.

Among the Padam-Minyongs the collective hunting is called *ampi*. This is an annual affair, and it is planned and organised in the *moshup*. The games in the hunting are distributed among the participants and the catches *ampi-kiruk*, are deposited in the moshup or distributed among the old men *mijings*, of the village. In return the *mijings* throw a feast called *dorung*. Fish is taken on all occasions with rice and rice beer. Any surplus catch is smoked and dried and are taken in the lean period. Fish is also given to the parents-in-law as a part of the bride price.

ii) Agriculture : Jhum or shifting cultivation is a tradition of the people. They cultivate rice, maize, tubers etc. Both men and women are engaged in this throughout the year. Task Force Report on shifting cultivation (1983) shows that 700 square kilometre of land is under shifting cultivation. Fallow period ranges from three years to ten years. Number of families practising shifting cultivation are 54000.

The land of a settlement can be grouped in three categories according to nature of utilisation namely, land for residential purpose; land for games and hunting and; land for the agriculture. In shifting cultivation the people clear new patches of land called *patat*. The first plot is called *rikmam*, the second is called as *riga* and the third one is called *aabe*.

Art and Craft : Weaving remains a tradition for Adi women. All sorts of clothes are produced at the domestic loom. Further various appliances and implements are made of bamboo and wood for household use.

Clan Organisation : The Adis maintain a strong clan identity and a lot of socio-cultural observances are regularised by clan identity only. The clan or the exogamous group of the Adis are known as opins or ali. Each clan and its sub-clans trace their descent from one common ancestor. The Minyongs are divided into two moieties the kumuing and the kuri. The former has 15 sub-clans and the later has 16 sub-clans. The Galos are also divided into two groups-nyiji and nyira.

Ceremonies and Festivals : Solung is one of the main festivals of the Padam-Minyong groups of the Adis. It is the manifestation of Adi's fertility cult. Another important festival of the Adis is Mopin. This is the main festivals of the Galo Adis of Arunachal Pradesh. This is celebrated to get rid of natural calamities, disease, effect of evil spirits and for good harvest, health, wealth etc. Mopin is the goddess of welfare and peace. The Mopin festival is celebrated in the month of April. There are other festivals too among different groups of the Adis. These are Aran and Cluing (new years festivals), Lutor or Etor, Solu, Pine and Yage, Pambi and Doring.

Life Cycle : The responsibility of fatherhood is observed by potential Adi father by observing certain taboos. The expectant mother also observes certain taboos during her pregnancy. Usually the people like to have the delivery at home only. After the child birth the people present there are offered *apong*. In general the name is given to a baby by the aged member of the family. Usually the name of the male child is prefixed by 'Ta' such as Tadar and for a female 'Ya' is prefied, such as 'Yapi'. Names vary according to the physical appearance of the child, birth order, attitude of the parents to the child etc.

The Adi children are addressed according to their age groups. Children up to the age group of three years are called *unga*. Children of four to ten years are called *ome* by the Galos and *ko* by the Padam-Minyongs. Boys between the age of ten to fourteen are called *yapa* and girls of that age are called *jirpa*. Commonly boys from ten up to twenty five years of age are called *yame* or *Yameng* and girls of that age group are called *nyijir* or *mimum*. At the end of the *ome* or *ko* stage, the Padam-Minyong unmarried boys and girls enter the dormitory life.

Marriage : In traditional Adi societies in past years, marriage was channelled through Dormitory life of the young boys and girls. Whatever the relation between two partners may be, marriage occurs only through social sanctions in the society. A lot of social relationships are established just after engagement between the two families.

Bride price is common in the Adi society. Among the Padam-Minyong groups the payment of bride price is made in terms of kind. It is a continuous process among them. The son-in-law has to give his share of hunt and any other kill preferably to his Parents-in-law. Other relatives of the boy also give a part to the new relatives. Monogamy is common among the Adis but polygamy is also prevalent.

METHODOLOGY

Formulation of Hypotheses

On the basis of the literary data and the theoretical background some working hypotheses were formulated. These are read as follows:

1. The greater the extent of modern education and contractual relation with outside world, the greater is the possiblity of extinction of youth dormitories.

2. The greater the extent of (a) exposure to urban area and (b) development, the greater is the extent of cultural disintegration and loss of cultural values.

3. The greater the extent of cultural awareness and self-respect among the people, the lesser is the impact of westernization on the cultural tradition. Moreover, the greater the stress on the traditional cultural life of the people, the higher is the possibility that people will restructure their socio-cultural institutions compatible to new environment without loosing its core spirit.

Thus the variables encountered for data analysis were identified as follows :

(A) Accessibility to Ubran Components Which Contains

i) Communication facilities
ii) Presence of Mass media
iii) Non-traditional recreational facilities
iv) Modern educational institute
v) Marketing facilities
vi) Infrastructural facilities for contractual relations with non-traditional world.

B) Socio-economic and Cultural Components

i) The existing physical environment and demand of fulfilling socio-economic requirements.
ii) People's perception and action to magico-religious spheres.
iii) Nature-culture relationship and the way people mould inmates for various social needs.

C) Contemporary World and Youths' Perception of Traditional Culture, Ethnic and Political Identity

i) Opinion and perception of educated and uneducated youth towards traditional and modern world.
ii) Awareness towards ethnic and political identity and cultural reconstruction.

Selection of Specific Locality

On the basis of the accessibility to the urban environment three areas were selected–rural, semi urban and urban in each district. For the purpose of the study in West Siang district Along was considered as urban place, Kaying was selected as semi-urban area and Pakam area was selected as rural area. In East Siang district, Pasighat was considered as urban, Mebo as semi-urban and Boleng and Damro was selected rural area. A brief delineation of these areas are given below.

Along, the district Head quarter of West Siang District, is one of the 10 census towns of Aurnachal Pradesh. It is a small township inhabited by 11,098 people of which, 6,461 are males and 4,637 are femals. Population growth in the town during last decade was 37.45%. The town is connected *via* road with Lakhimpur district of Assam. The town is about 250 km away from Silapathar, a connecting urban rail head in Assam. On the other hand the East Siang District Headquarter town is inhabited by local tribals as well as non-tribal non-indegenous people coming from other states of the country for the purpose of business and services.

In West Siang district Kaying Circle was selected as semi-urban area. The place is 54 km away from Along and is connected by a narrow road constructed by GREFF. A state transport bus and a private bus occasionally run in between Kaying and Along.

The area near the Pakam Bridge was selected as rural area for the purpose of the study. Distance of this area from Along is about 12 km. Due to lack of direct road communication, this area remains hardly accessible to urban components as the area is detached by a river, and there is only one hanging bridge in poor condition. The road connecting Tuting with Along is situated at a distance of three kilometres from the place. People come to Along walking along with their commodities on back for selling and also for buying their essentials. Traders from Along go to their place to collect local products. Thus the people maintain their economy.

Pasighat is one of the oldest townships in the state. It is the Head quarter of East Siang district. The area is numerically dominated by the Padams. But Minyongs also contribute a large part of the population. The town is only 3 km away from Assam border and hence it is well communicable with other parts of the state. Compared to Along this town is more urbanised in terms of presence of modern elements. The Circle HQ in Mebo was considered as semi-urban area. The area is 40 km away from Distirct HQ Pasighat. A CPWD made narrow road connects the area with Pasighat. The area is inhabited by the Padams. They are numerically dominant over the Minyongs and the Pasis. Boleng is the Circle Headquarter of East Siang district. It was considered in the study as a rural area owing to the lack of accessibility of urban components in the area. This area is attacthed to the border of West Siang district. The Circle HQ is connceted with Along and Pasighat *via* motorable roads. But transport services are very scare. It is 54 km away from Along and 125 km from its district HQ Pasighat.

The study was basically qualitative in nature. Household survey schedules and schedules on activities of the youths were used to collect data along with case studies and interviews.

FINDINGS

Roles of Youth Dormitory

From the study it could be learnt that the traditional socio-cultural life of the people was very much shaped by the code and conducts and the working of the youth dormitory. The roles of youth dormitories, which were present in the area till recent past, were very much important in the socio-cultural and economic life of the people. Among the Padam-Minyong group the origin of the dormitory is attached with several mythologies.

The dormitories were used as the sleeping house by all youngsters of the village. Usually a boy attaining ten years of age (approximately) was initiated to the dormitory life. Initiation ceremony is accompanied with a feast and singing and dancing in the dormitory. The inmate continued to be a member of the dormitory till his marriage. These inmates of the dormitories were known as *Moshup-ko* or *dere-ko*. The next grade was *moshup-yapa* for boys and *rasheng jirpa* for girls. There was age-grade difference in such terms. The elder one, eligible to attend girls' dormitory were termed as *moshup-yameng* and the matured girls are called *raseng-mimum*. All the aged people were termed as *mijeng*. The young members used to fag for the elders. They would carry firewood to the dormitory before the arrival of the elders. The select elders of the dormitory used to teach the novices the art of using bow and arrow, the skill of hunting and warfare. Some elders were engaged in narrating traditional myths and folktales and also in reciting and teaching folk songs and dances to the juniors. The elders also used to teach the juniors the art of love making theoretically up to a certain age. Thus it is seen that the people did learn a major part of their socio-cultural life in the dormitories only. The most vital role of the dormitory life was of channelling the sexual life and the art of love making in an effective way among the youth. The elder boys used to go to the girls' dormitories of different clans at night. Girls who attained puberty used to attend dormitory till thier marriage or mate selection. The girls in the dormitory had every right to select inmates of different clans for courting and also for love making. Such intimacy paved the way for selection of spouse for marriage. When both the partners were satisfied at each other's quality and temperament, finally they agreed to marry and negotiation started from the parents' side. Next to this the group feelings and co-operative nature among the dormitory members was unquestionable and this was reflected in group works in and outside the village in different socio-cultural spheres like cultivation, observing rituals and ceremonies and several other activities of life. Dormiroty life was directly related to village protection, group work including hunting, teaching of art and craft and oral tradition to the new comers. Thus it shows that significant part of the formative ages of the people was imbibed and influenced by the rules and teachings of dormiroty life.

Present Situation of Youth Dormitory

It has been learnt that the traditional youth dormitory system has almost disappeared in recent years. Not a single dormitory was reported to be existence in the traditional form even from the interior places. However, every village has one house which the people still call as dere or moshup. But these are not functioning as in the past years. These are now community halls. Village level meetings (*kebangs*), social gatherings and fectivals etc. are held in these places. At times young people, sometimes the elders also attend to gossip in the community hall during day time. In some villages nearer to urban area such buildings have been constructed by the state administration. Several factors were found responsible for eliminating youth dormitory among the Padam-Minyong group. Among these factors some are prominent and some are partial. But not a single factor can claim absolute influence in eradicating the traditional youth dormitory system among the Adis. Rather the causes were multidimensional and the process of change was gradual.

Influence of Education and Contractual Relations

The test of the hypothesis was done in the light of the field data. The first hypothesis says that the spread of education and contractual relation to outside world was one of the several factors for extinction of the yough dormitory in the region. It was found that spread of education and relation with outside world was intimately related. Post-independent era has brought in a lot of changes in the economic sphere of the people in that the traditional barter system has almostly disappeared. The inflow of the monetary economy led the people to accept some jobs which were non-traditional. One of the most reliable sources of earning was to be office employees. For that they needed some amount of education. Thus schooling was popularised day by day among the people. Governments' assistance to educate the tribal children free of cost and also provision of scholarship etc., attracted attention of the people to schooling. This school going process had great effect on the attendance in the dormitory in that school going children had to prepare their lessons at home. It is also learnt that the teachers were mostly outsiders and that they did not like the tradition of coming of the boys and girls from the dormitories to school. Compulsory home work and teachers' incongenial opinion and behaviour towards dormitory girls and boys played an important part in keeping them off from the dormitory life. Those boys and girls who had to visit the urban areas and had contractual relation with the non-tribal outsiders had experienced derogatory comments on their tradition of attending the dormitory and coming from dormitory to the urban places. It is also learnt that the tribal people were very much impressed with the sayings and the life ways of the outsiders. Therefore, most of the people who had direct or indirect relations with the people outside their traditional domain were interested to rethink about their traditional life ways and ultimately they left the dormitory life in due course of time. It is not simply the influence of the content of education that debarred the youth from attenting the dormitory life. Rather it was the introduction of the residential schools in several interior as well as urban and semi-urban places that gave a strong dissension to the dormitory life. The residential school drew young girls and boys from different localities and they were thus kept away from their traditional life ways. Data based on a close observation and indepth interviews shows that the young people staying in hostels get a lot of opportunity to continue their tradition of courting as the rules and regulation of the hostels are frequently violated by the students. The teachers in the charge cannot intervene with a bold step on the ground that they are the persons mostly from outside the state and there is every possibility of physical and psychological harassment if such steps are taken. Going to lonely places, going for adult movies etc. are common in urban hamlets among the boys and girls. Basically the youngsters from the urban and semi-urban areas go to urban places in Assam and other areas where they have maximum opportunity to see the non-traditional life ways of the non-tribal people. The teachers, the governmental officers and other office bearers, the business men and such other non indigenous people serve as the media for contractual relation to the world outside their traditional domain. Thus it becomes clear that education itself had great effect on the extinction of the dormitory system among the Adis; the contractual relation to the outside world being an addition to the cause of extinction of the age old tradition.

Development and Urbanisation

The second hypothesis says that exposure to the urban life and the workings of the development agencies had influence on the functioning of youth dormitories. In this regard it could be learnt that contemporary Adi people are very much attracted towards the urban life ways. A lot of people have migrated to the urban areas in search of good living condition, job and other opportunities. Rapid migration towards urban areas resulted in breakdown of the kinship and lineage structure of the society and this ultimately resulted in disintegration to the traditional culture. This was the case of several present day villages established in urban, semi-urban and road side areas. Introduction of modern elements like household implements, dresses and attire etc. had a good deal of influence on traditional art and craft of the people. Thus traditional skills at present deserve a little demand. Urban exposure also has impact on their dance, music, songs and mode of recreation. The traditional spirit and skills are getting less importance especially among the youths having urban exposure.

One of the most important developments in the area is the construction of roads reaching far away and difficult places. People now a days can easily visit urban places by these roads and this has opened up to the people the opportunity to come closer to the urban areas. The Government have established several administrative Circles in interior places and the Circle headquarters has become to some extent commercial place for the local tribal people. Introduction of village Panchayat system, grant of loan for economic benefits of the local people, supply of cheap rate rice etc. have led the people to come forward to participate in developmental works and thus become familiar with several non-traditional life ways.

It was found that wet rice cultivation was supported by mechanical infrastructures like pipes and pumps for irrigation. This remains an important factor in changing the involvement of labour force and group work.

Socio-ecological factors also played certain roles in obliterating the Youth Dormitory besides the factors encountered in the hypothesis. It is learnt that decrease in the forest products, the decreasing value of the traditional products in the contemporary market etc. had a good deal of influence on the existence of the dormitory system among the people. The most important and determining effect is the ecological change in the tribal habitats. Youth dormitory deserved great importance in an environment where group works were essential in economic, political and defence and security purposes. The collective co-operation in youth dormitory was suitable for traditional. Adi habitats and culture. As a place of collective training and instruction in moulding inmates for a life full of danger, challenge and skill requirement, group solidarity, community feelings and co-operation, youth dormitory had undeniable importance in past years. The present situation not necessarily requires the same sort of service from the youths. Reduction of forest areas, less requirement of group work in cultivation, elimination of fear from tribal raiders and from wild animals, inflow of monetary economy, urban exposure, and new outlook and world view of the tribal people totally disregard youth dormitory in the present day context. The better road communication system has increased the ineraction between the people of different tribal groups and thus there has appeared a good deal of understanding among them. Under these circumstances the importance of youth dormitory diminished day by day and finally it disappeared to be a traditional dependable trait of life.

Psycho-social Bearings of the Contemporary Adis

The third hypothesis tries to establish some relationship between psycho-social aspects of the Adi society with the changing environment. Extensive interviews with the youths and also with some elderly persons who are generally having leading personality in the concerned area reveal the following. Attachment of the present day youths to their traditional culture is somewhat loose as compared to their parental group.

The young people, especially in the urban area, know a little of their oral tradition, religious codes and conduct and customs. Their opinion and attachment to traditional cultural aspect is not encouraging, rather most of these are out-moded for them.

No ogranisation in the studied area was found to be attached with cultural revivalism or preservation. Contrary to this, the rural youth's attachment to traditional life-ways are greater than that of the urban youths.

Emerging cultural disintegration among Adi youths have not yet eliminated or reduced the basic sense of ethnic identity. Rather the notion of a separate identity is growing more and more among the youths. Thus there appears a strong feeling of territorial identity, instead of cultural identity. This idea of territorial entity among the youths has created a lot of concern to the people coming from outside the state. The local tribal youths raise a lot of objection regarding the presence of the outsiders in the state and many a time hostile activities have been reported. Threatening the outsider, may it be service holder or businessmen, is a usual event in the area now.

It is seen that in urban and semi-urban areas local tribal people perform their main traditional festivals *mopin* and *solung* colourfully. Youths are mainly involved in it. All the outsiders earning in the area are bound to pay certain amount of money for the celebration as the local tribal youth demand it every year. The way of celebration would lead a close observer to conclude that the traditional spirit not present in it. Rather it is a means of gaining political recognition. Several old persons of the tribe say that they do not find any religious importance of these fectivals in the sense that the organisers do not give emphasis on the religious goal of the festivals.

The youths are now interested to construct youth clubs with all the modern elements. The members of the youth clubs participate in traditional festivals performed colourfully in urban places.

The consequences of the extinction of the youth dormitory among the Adis are several. Some of the important influences are as follows:

Loss of dormitory life has resulted in the extinction of several age-old oral and magico-religious tradition of the people. Because the dormitory itself was the only place where the youth got the training and the learning of their traditional myths, dance, songs and the art and craft.

Unlike in the past years the youths are not burdened with the obligation of community service. They hardly get attached with any common interest which could have helped them to develop oneness among themselves. Modern youth clubs are not based on socio-cultural requirement of the traditional society. The way of having recreation and entertainment has changed now.

The relation between unmarried boys and girls are now not similar as it was reported to be in past years. There was a lot of trust and confidence in those days between boys and girls as there existed a social code of sex life. But at present the boys see the unmarried girls as a means of enjoyment only and go for elicit behaviour. This seems to be one of the negative consequences of the disappearance of the youth dormitory that has become quite acute being combined with the influence of non-traditional life-ways and media-role including the adult English movies that are available and have easy access to the young generation at urban and semi-urban places. It was reported that this sort of elicit behaviour creates anxiety and problem of unknown fatherhood. The Padam-Minyongs still have a loose sexual relation between unmarried youths. Courting is practised at times at the girl's house, and usually the affair consummated at lonely places like the crop fields and the jungle. There appears no strong social control over elicit sexual relations among the Minyongs. It was also found that the school dropout youths having urban exposure basically indulge in such behaviours. Several parents express their inability to control the immoral behaviour of their sons and daughters.

There appears to be present a distinct generation gap between the parental and descendant group with regard to the world view and tribal traditional outlook. The youth having urban exposure and contractual relation with non-traditional world live in two contrasting worlds - the traditional and modern. Thus there appears a lot of psycho-social confrontations among the youths and the older generations. In the familial life also the educated boys and girls are now almost disinterested to involve themselves in traditional work spheres. But girls' participation in domestic as well as in farm work is still prevalent to some extent. It is found that the illiterate and rural parents do not have good control over their educated children. The young people get maximum care-free life now a days and this is very true in urban areas. This escape from parental and social control resulted in a lot of deviant behaviour among the youths in urban areas.

To conclude it can be said that the Adis of

Arunachal Pradesh have been experiencing a lot of changes in the socio-cultural life ways as a result of introduction of urban elements by means of different agencies. Among them the road communiction, mass media, school education, etc., are prominent. There appears some psycho-social problems among the youths of the region as a result of the disappearance of certain traditional institutions including the youth dormitories. The people are loosing their traditional art and craft and life ways as a consequence of the disappearance of youth dormitory. However, the process of disappearance was a gradual one and the immediate effect to the extinction was never felt by the people. Because several activities of the dormitory were loosing importance in the changing socio-ecological background. Changes were accepted by the people as an adaptive mechanism to the changing environment physical as well as cultural.

The emerging political awareness and ethnicity are mainly the influence of the workings of the present day students' union. Call for bandh, agitation and movement on certain political and social issues did a lot to create socio-political awareness among the people. Thus along with such awareness a strong notion of ethnicity has emerged among the youths of the region which also helped them to increase social solidarity among the Adis.

KEY WORDS AND ABSTRACT

KEY WORDS Youth. Age-grade. *Aborimanuh*. Gram Panchayat. Sexual Relations.

ABSTRACT Youth Dormitory was one of the most significant social institutions of most of the tribal societies world-wide. Its vital roles were found in enculturation of the younger members of the society and preparing them to perform the socially defined roles. Arunachal Pradesh, one of the seven states of the North East India, is inhabited by 26 major tribes and more than one hundred sub-tribes having their colourful traditional practices. Due to the influences of changing political set-up, rapid urbanisation, exposure to the non-tribal culture etc., a lot of changes have taken place in their cultural life ways. Youth dormitories were prevalent among the Adi tribes of the state which encompassed a lot of social functions till recent past. But as a consequence of the changing socio-political and socio-ecological environment, this age old tradition has already disappeared from their social scene. A field investigation was made to find out the process of enculturation among the traditional Adi tribes through Youth Dormitory and consequences and factors of its disappearances from their society.

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Author's Address : **Dr.C.J. Sonowal**, Lecturer, Unit for Child and Youth Research, Tata Institute of Social Sciences,Bombay 400 088, Maharashtra, India

Conserving Livestock Genetic Resources : A Case Study of Kinnaur in Himachal Pradesh

Hans Raj Negi and Madhav Gadgil

INTRODUCTION

The world over, the more remote, hilly, arid regions that were till recently isolated from the larger economy and society are being drawn into the mainstream. A breakdown of self-sufficiency is the inevitable consequence of this integration; a development which has both positive and negative implications (Jodha, 1990; Swanson, 1995). The negative implications, in particular, include non-sustainable use of renewable resources such as water, forests and pasturelands, and an erosion of biological diversity. It is clearly important to understand the broader social and economic forces driving these undesirable changes and to suggest policy measures that they may help in correcting these distortions (Jansson et al., 1994).

It is in this context that we attempt to present here a case study from the district of Kinnaur, (31°95' to 32°05' N lat. and 77°45' to 79°00' E long.), a dry mountainous tract of 6553 sq km bordering Tibet in the state of Himachal Pradesh (Fig. 1). With an annual precipitation of aroung 600 mm, only 1.7% of the land area of the district with an altitudinal range between 2000m to 6050m is under cultivation, while 1.2% of the area is under forest cover. In contrast, as much as 44% of the area is under grazing and 53% under barren rocks and snow cover (Gadgil et al., 1989). Naturally, livestock has been a vital component of the traditional subsistence economy of the district. Apart from cattle, sheep, goats, donkeys and horses, the livestock also included Yak. Adapted to the high altitude, this livestock undoubtedly harbors genetic resources of considerable interest (Mason, 1988; Smith, 1984). As with rest of India, there is however very little documentation of this important component of India's heritage of genetic diversity (Acharya, 1992).

Following the China war of 1962, this district has seen a rapid development of modern means of transport, a cessation of trade with Tibet, an intensification of agriculture and horticulture and a monetization of economy. All of this has led to a neglect of the livestock wealth, a fall in the population of Yak and an erosion of their genetic diversity. We provide here a preliminary account of the livestock genetic resources, try to outline the forces driving the decline of these resources, and suggest some concrete policy measures. This account is based on extensive personal observations by one of us (Negi) over a period of 29 years. Negi was born in a Kinnaura tribal family with a tradition of maintaining livestock. He has personally grazed such herds and accompanied them to high altitude pastures. The first 18 years of his life were spent entirely in Kinnaur; he has subsequently been regularly visiting Kinnaur for at least a few weeks every year.

THE SETTING

Kinnaur is a region of narrow valleys and high hills, rising from the Sutlej valley in the neighbouring district of Shimla at an altitude of 800m, to peaks such as Kinner Kailash with an altitude of 6050m bordering the Tibet plateau (Fig. 38.1). With only 1.7% of its area under cultivation, it is a sparsely settled district with human population densities of 11 people per sq km. The cropping season is restricted to the months of May to October (Fig. 38.2), the major traditional crops being potato (*Solanum tuberosum*), amaranthus (*Amaranthus sps.*) finger millet (*Eleusine coracana*), buck wheat (*Fagopyrum sps.*), wheat (*Triticum aestivum*), barley (*Hordeum sps.)* and pulses (*Phaseolus sps.*). These are now supplemented with cabbage (*Brassica oleracea* var. capitata), cauliflower (*Brassica oleracea var. botrytis*), tomatoes (*Lycopersicum esculentum*), red chilly (*Capsicum annum*) and sweet pea (*Lathyrus odoratus*) and a few other introduced crops. Traditional horticultural crops include apricot (*Prunus sps.*), walnut (*Jugalans regia*) and neosia pine (*Pinus gerardiana*). They are now supplemented by apple (*Pyrus malus*) and almond (*Prunus amygdalus*).

Livestock husbandry has naturally been a significant component of the economy of this district

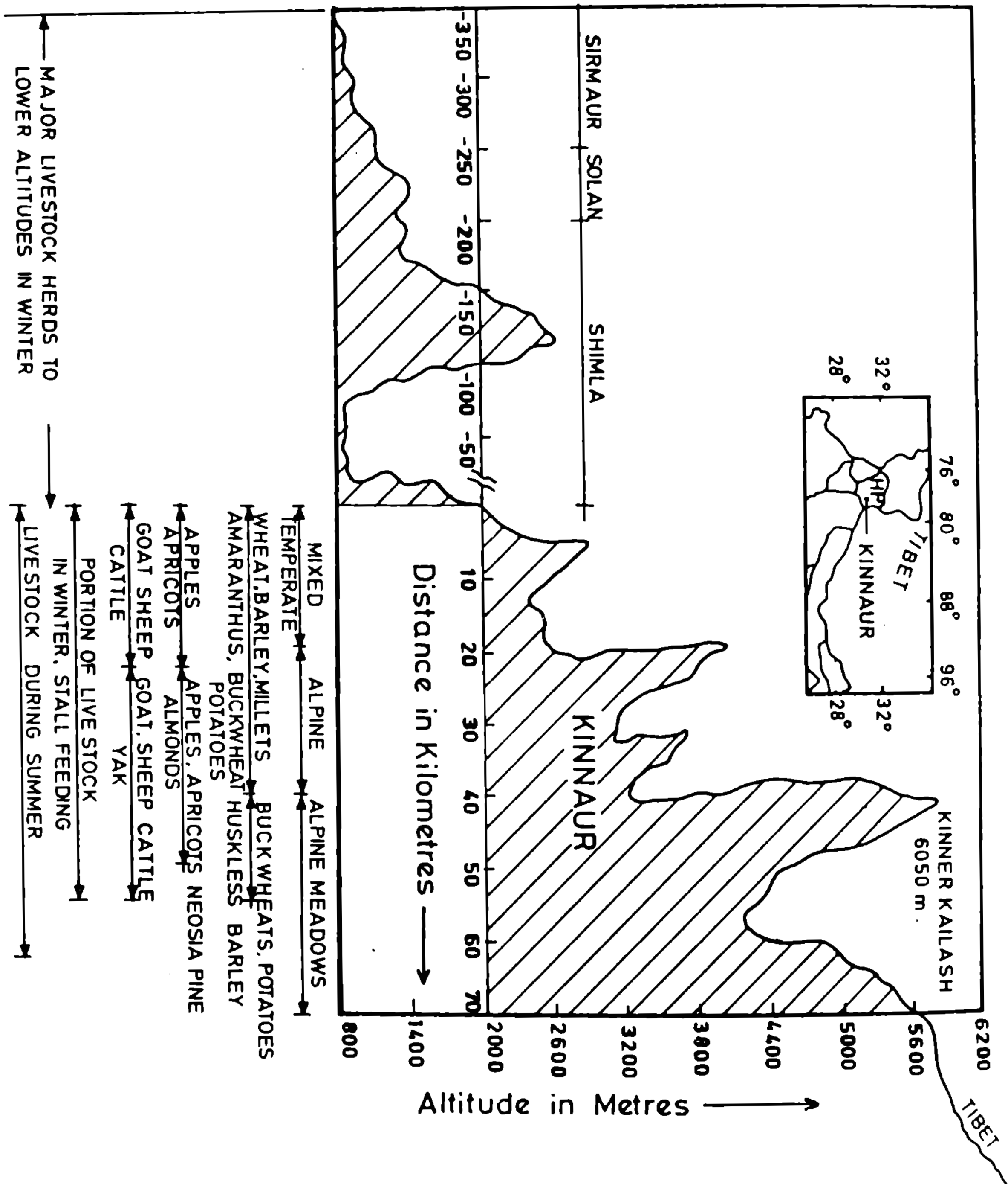

Fig. 38.1. Schematic cross section of Kinnaur and adjoining districts

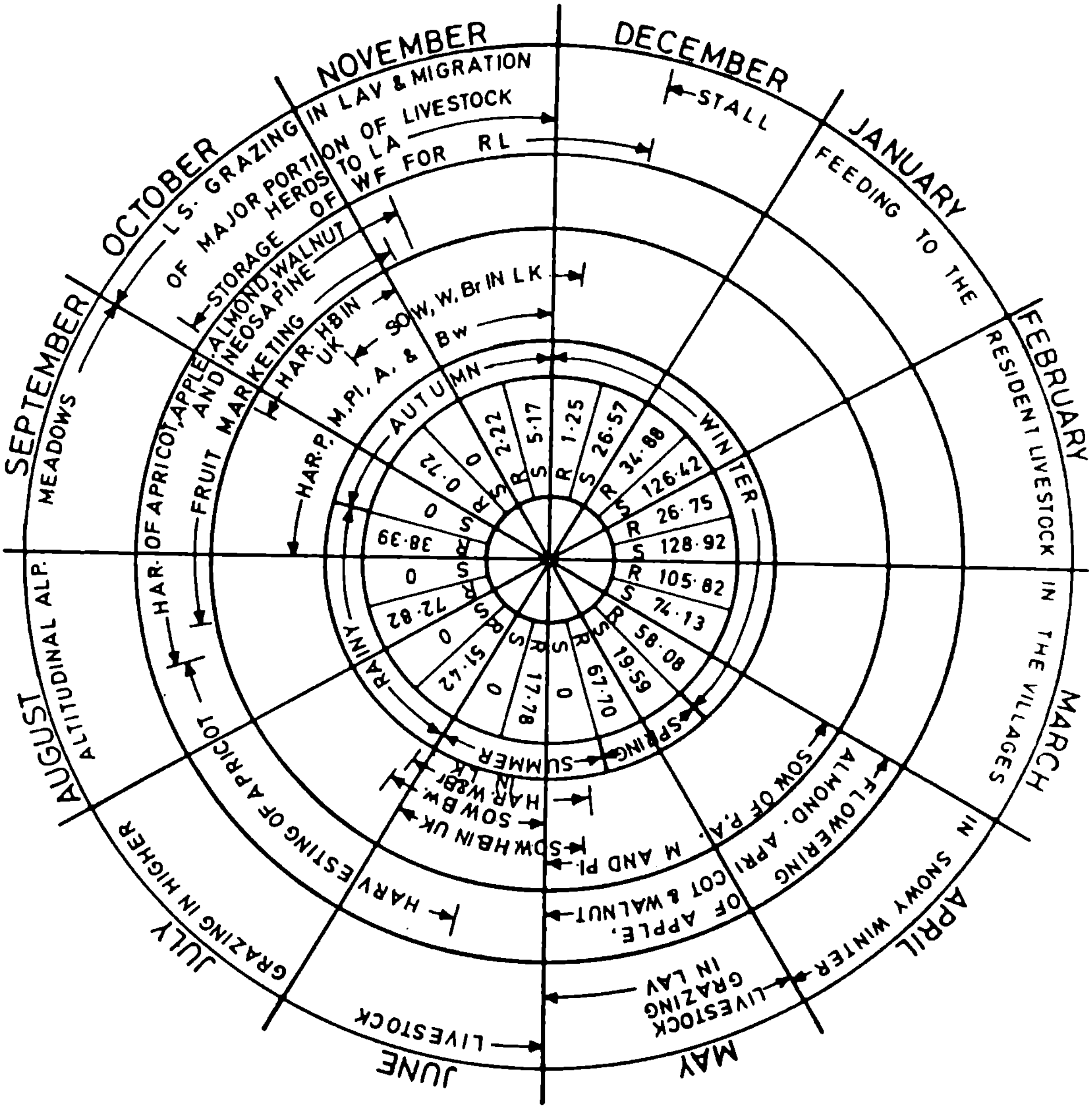

Fig.38.2. Calender of seasonal activities in Kinnaur.
A=Amaranthus; Alp. = Alpine; Br=Barley; Bw=Buck wheats; HB=Huskless Barley; HAR=Harvesting; LA=Lower altitude; LK=Lower Kinnaur; LS=Livestock; LAV=Lower altitudinal valley; M=Millets; P=Potatoes; PL=Pulses; R=Rainfall (mm); RL=Resident livestock; S=Snowfall (cm); SOW=Sowing; UK=Upper Kinnaur; W=Wheat; WF=Winter fodder

given the severe limitations on agriculture. However, the fodder resources in this cold, dry region are highly seasonal in availability (Fig. 38.2). Pastures at the high altitude range of 3000m to 5000m provide excellent grazing during the months of June to September; but severe cold dictates that people and livestock must leave them by end of September. Even at the lower altitudes of 2000m to 3000m where cultivation prevails, no grazing for livestock is available in the months of December to March. Most livestock must therefore migrate to lower altitudes of 800m to 1500m in the neighbouring districts of Shimla, Solan and Sirmaur during the winter months of December to April (Fig. 38.1, 38.2). Only a small proportion of the livestock is retained in Kinnaur during the winter months and mostly fed on stored dry fodder of grasses and crop residues supplemented by green leaves of evergreen Oak (*Quercus sps.*). This livestock is housed on the ground floor and serves to warm the upper storeys occupied by people during the winter months. Management of the livestock is thus a highly labour intensive operation for the Kinnauras, in particularly requiring a number of people spending time away from the base villages in both summer and winter.

THE ANIMALS

Buffaloes are absent from this dry cold region; but the other domesticated animals occur at animal: human ratios much higher than in the rest of the country (World Resources Institute, 1992-93; Govt. of Himachal Pradesh, 1991).

(a)Cattle (*Bos indicus*) (local names : Cow : Huj, Bull : Tee Damass or Tee Damess)

Kinnaur harbors 22192 cattle, implying a cattle: human ratio of 0.31; the ratio for India as a whole being 0.23. The hill cattle are smaller in size, with a less prominent hump. They are predominantly black in colour. Cows provide milk and manure, the bulls provide manure, traction power for agricultural operation and are also maintained as breeding bulls.

(b) Yak (*Bos graunniens*) (local names : female: Breme, male : Yag)

There are around 500 of this hardy, cold adapted species. It is mostly black and white in colour with a very short tail having long hairs. It has long upright horns with pointed, curved ends. Yak serves

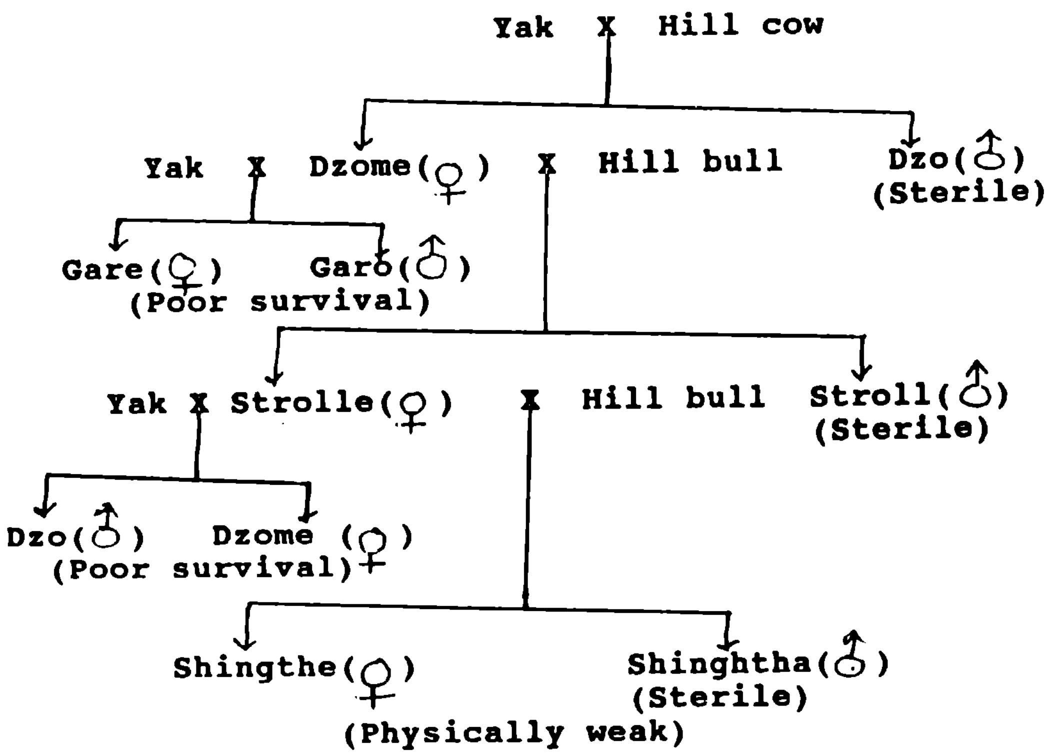

Fig. 38.3. Nomenclature of cross breeds of Yak and cattle in Kinnaur

for transport, traction, fibre and manure production and for cross breeding with the hill cow. Figure 38.3 gives details of these crosses.

(c) Sheep (*Ovies aries*) (local names : female : Khaas, male : Hullas or Hooles)

Kinnaur harbors 73603 sheep; implying a sheep: human ratio of 1.04; that of the country as a whole being .06. The sheep, mostly brown, black and white in colour produce a coarse wool fleeced twice a year. Rampur Busheri is reportedly a local Kinnauran breed. Additionally Marino Russion, Marino Rambullet and Marino cross breeds have been introduced since 1962.

(d) Goat (*Capra hircus*) (local name : male : Bolu, female : Bakhor)

Kinnaur harbors 33331 goats, implying a goat: human ratio of 0.47 compared with .13 for India as a whole. Kinnauran goats are larger in size in comparison to those of the plains and are fleeced twice a year. This wool is extensively used locally to fabricate mats and ropes. They also provide milk, meat and manure. Two improved breeds; Jama Pari and Alberi are reported to have been introduced to Kinnaur.

(e) Horse (*Equus caballus*) (local name : male and female : Raang)

Kinnaur has 886 horses, implying a horse : human ratio of 0.01, compared to .001 for all of India. Kinnauran horses are similar to those of plains, but are more efficient in carrying loads. Kinnaur reportedly has a special horse breed named Chamurtti.

(f) Donkey (*Equus asinus*) (local name : male and female : Foach, male : Giabong foach)

Kinnaur has 2905 donkeys, implying a donkey: human ratio of 0.041, compared to .002 for all of India. Kinnauran donkeys are larger in size, have longer hair and are very efficient carriers of load. Mules were introduced to Kinnaur after 1962 following the formation of mule tracks.

(g) Dog (*Canis familiaris*) (local name : Kui)

Dogs perform an important function of guarding livestock as well as homestead in Kinnaur. There are three breeds of Kinnauran dogs, locally known as Kim Kui, Habsu and Niyam Kui. Kim Kui is a large, robust, fierce breed, brown and black in colour and with a hairy thick tail. Habsu is somewhat smaller in size, with less hair on tail and large whiskers around the nose and face. Both these guard livestock as well as houses, the former can be effective against snow leopards as well. Niyam Kui is a much smaller breed, black in colour, with long hair on the back and serves as a house guard.

Three other domesticated animals of Kinnaur are the cat (*Felis catus*) (local name : Pishi), the honey bee (*Apis indica*) (local name : Wass Yang) and the chicken (*Gallus Gallus*) (local name : male : Kukarass or Kukaress, female : Kukari). Cat and honey bees are domesticated for rodent population control and honey production, respectively whereas chicken which produce only 12-18 eggs twice a year are primarily reared for meat. Recent years have seen the introduction of White Leghorn, Rhode Island Red and Broiler breeds. The European honey bee, *Apis mellifera* has also been recently introduced to the district.

CHANGING SCENARIO

Kinnaur has changed rapidly following the Indo-China war of 1962 and the development of transport and communication facilities (Fig. 38.4). This was accompanied by the closure of the border trade with Tibet. These changes led to much greater links for Kinnauran society, almost all belonging to the Scheduled Tribal group Kinnaura with the Indian society and economy. A large number of Kinnaurans secured Government jobs. The agriculture was transformed by the increasing availability of chemical fertilizers. Extensive tracts, that often served as pastures were brought under apple orchards. Many Oak forests which provided green fodder for livestock in the winter were felled to produce charcaol for the growing markets. These changes have meant a reduction in the demand on livestock for production of organic manure and for transport. It has also meant reduced availability of fodder for the livestock with the shrinkage of pastures and oak forests. These processes of modernization have also led to a breakdown of joint family structure. Such joint families provided the manpower to accompany the migratory livestock. Nuclear families cannot readily provide for such migrations (Fig. 38.4).

All these changes have led to a decline in interest in management of the livestock. While total number of livestock seems to continue to increase, that of the special component, Yak has gone down (Fig. 38.5). Local annual trade fair of LAVI which was reported earlier to involve extensive trading of livestock is now restricted to trade in woolen products and dry fruits on a smaller scale. Rather the

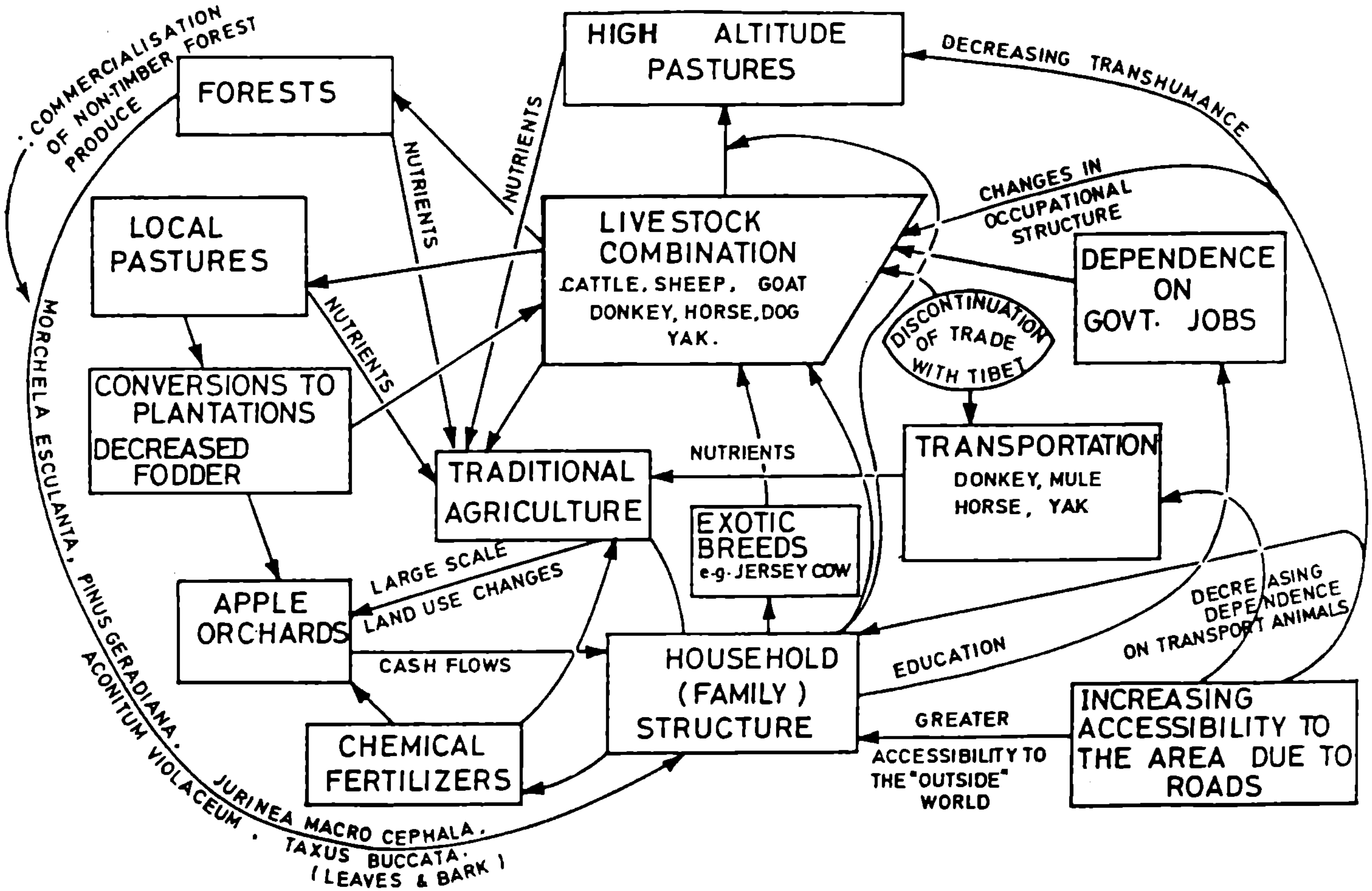

Fig. 38.4. Socio-economic forces impacting management of livestock in Kinnaur

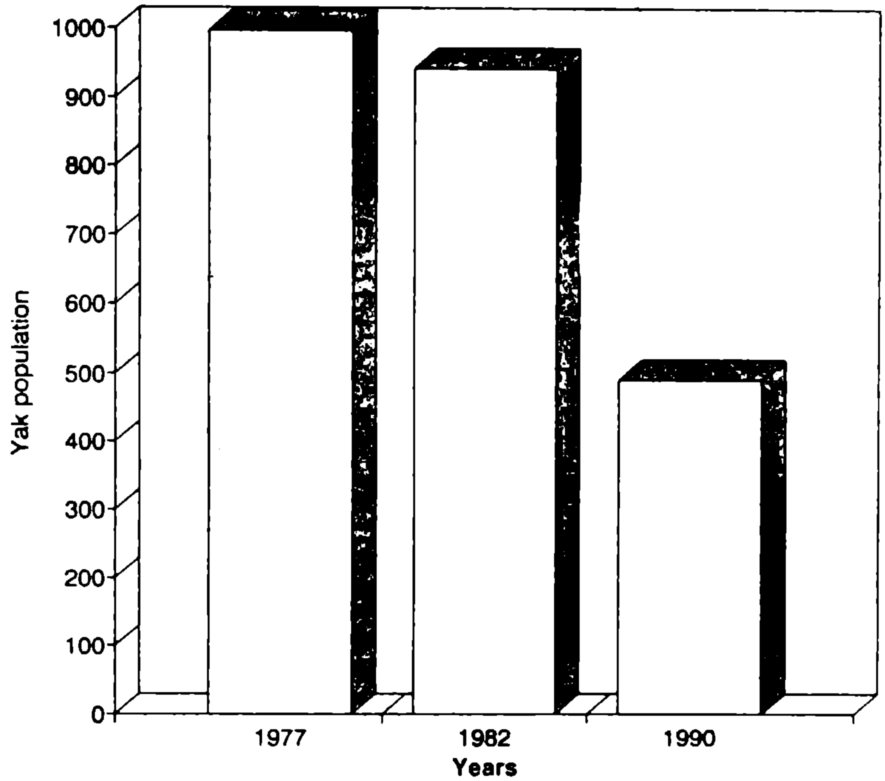

Fig. 38.5. Yak population in Kinnaur

fair is now dominated by the trade of products from outside the district.

POLICY CHANGES

There is thus every reason to believe that in Kinnaur processes have been set in motion that would lead to an erosion of the genetic diversity of several species of livestock adapted to the peculiar environmental conditions of this district. Such an erosion of genetic resources is part and parcel of the larger process of non-sustainable development of agriculture based on excessive dependence on subsidized chemical fertilizers.

It would be worthwhile examining the whole agricultural development policy and bring it on to a sustainable path by phasing out subsidies on external inputs. This would once again encourage people to value organic manure and reinforce their interest in maintenance of livestock. It is also important to initiate steps to halt felling of oak forests for production of charcoal. This could be attempted in several ways : by establishing better community control over oak forests, by taxing charcoal manufacture, by promoting alternate sources and more efficient utilization of energy. Along with these measures it would be worthwhile encouraging the still vigorous community level leadership, now primarily engaged in organizing political activity and apple co-operatives to take a lead in sustainable use of natural resources and conservation of biological diversity. In particular this may be promoted by giving special awards to local communities for *in situ* conservation of crop and livestock genetic resources (Gadgil and Rao, 1994).

ACKNOWLEDGEMENTS

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KEY WORDS AND ABSTRACT

KEY WORDS Himalayas. Animal Husbandry. Livestock. Joint Family System. *In situ* Conservation Sustainable Development.

ABSTRACT Livestock has been an important component of the traditional economy of Kinnaur district, with its large tracts of hilly lands, many at high altitudes unsuitable for cultivation. Kinnaur has a number of varieties of cattle, yak, sheep, goat, horse and donkey which have served for transport, for traction in agriculture, as producers of wool, milk and meat and as a source of organic manure. The traditional joint family system of Kinnaur facilitated maintenance of large livestock herds with many animals being taken to higher altitudes during summer and to lower altitudes during winter months. The recent introduction of roads and motorized transport, discontinuation of trade with Tibet, replacement of organic manure by chemical fertilizers and the opening up a new job opportunities are leading to a considerable neglect of animal husbandry. The break up of joint family system is also adversely affecting the maintenance of livestock. A number of measures are required to preserve the rich genetic wealth of livestock of the Himalayan tract with its special high altitude conditions. It could be helpful if the subsidies on the supply of chemical fertilizers are reduced so that manure (and livestock producing it) again become a significant component of sustainable agricultural practices.

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Authors' Address : **Hans Raj Negi,** Centre for Ecological Sciences, Indian Institute of Sciences, Bangalore 560 012, Karnataka, India.
Madhav Gadgil, Biodiversity Unit, Jawaharlal Nehru Centre for Advanced Scientific Research, Jakkur P.O. Bangalore 560 064, Karnataka, India and Centre for Ecological Sciences, Indian Institute of Science, Bangalore 560 012, Karnataka, India

Citrus Wealth of The North Eastern Himalayas and Its Post Harvest Fungal Deteriorations

Paran Baruah, P.C. Sarma, A.K. Bordoloi, R.S. Singh and Anil C. Ghosh

INTRODUCTION

India is one of the leading Citrus growing and exporting countries of the world. As third largest fruits industry in India, Citrus occupies a place of considerable importance in the fruit economy of the country. The North-Eastern region of India comprising seven states occupies an area of about 17,000 hectares and produces about 200,000 tonnes of Citrus per annum (Barooah, 1987).

Literature reveals that India is the natural home of the great majority of the citrus species of the world, and North-East region can justifiably be considered to be the "Crater Centre" of the species. Citrus varieties are grown in India right from Arunachal Pradesh to Rajasthan and from Karnataka to the Himalayas upto an altitude of 1500 metres above mean sea level. This signifies the great genetic diversity for this crop within the country comprising different species and their varieties. Most of the Citrus species and their natural hybrids are well distributed throughout North East India comprising a vast genetic potential of this region.

There are about 17 different species of Citrus with 52 varieties available in this region to date (Table 39.1). *Citrus indica, C. ichangensis, C. macroptera, C. latipes* are found growing in wild to semiwild State. *Citrus aurantium, C. megaloxyparpa, C. jambhiri* and one variety of *C. reticulata* are also indigenous to this region (Konwar, 1987). The most important variety grown in this region is Khasi mandarin (*C. reticulate blanco*), the fruit per excellence of commerce. *C. aurantifolia* (Chrisum) Sw. is indigenous to Eastern India. The normal Kagzi or sour lime has round fruit but Abhayapuri lime of Assam is elliptical. Both Abhayapuri and Karimganj limes of Assam are heavy bearers. Two species of the subgenus *Eucitrus viz. C. indica* and *C. assamensis* and three species of the *subgenus Papeda, C. ichangensis, C. latipes* and *C. macroptera* originated in Assam (Barooah, 1987).

North Eastern region mostly possesses the hill lemon (*C. limon* var. *documene*) which may be grouped into two : sour and sweet lemons. Nayan changney, Soh-long and Soh-synteng belong to the sour type and Pani-jamir, to the sweet types. Nayanchangney is commonly found in the hills upto 1200 metres elevation as a wild type and the fruits contain very little juice. Soh-long and Soh-synteng are found in Khasi and North Cacher hills and are prolific bearers.

Various types of citrons are found in this region which include Bira jora or Bakulkhora tenga, mitha jora is found in the Brahmaputra valley; Jaare-jamir in the Barak valley; Soh-madeh or Soh-monong in the Khasi hills; Tume-hauthour in the Karbi Anglong and Jaijange in Manipur. Bira jora of Assam is the real citron and is grown throughout the region. Karun-jamir is found in Khasi hills and some pockets of Assam. The vigorous Gondh-huntra is mostly found in the Assam plains and which is very juicy and fragrant.

Mandarins of this region exhibit enough variations in respect of fruit surface, colour of rind, fruit size and taste. The important cultivars include Soh-niamtara, Kapura-tenga, Narangi, Naga-santra, Soh-umkdait and Soh-siem are found extensively in Khasi hills and throughout the region. Fruits and seeds of the variety Mitha-kagzi found in this region are bigger in size. Bor and Hukuma tenga are found in Assam plains and Khasi Hills; the fruits are big, juicy but very sour. Jamir tenga is found both in the hills and plains of the region; fruits are very acidic with medicinal properties.

Citrus covers a very large range of highly nutritious furits and citrus industry is one of the largest among the fruit industries in the world. These fruits are very rich in Vitamin-C which is an essential health promoting substance in human diet. The essential oil obtained from the peel is used for flavouring beverages, confections and certain bakery products. Citric acid derived from the juice is used in pharmaceutical preparations, soft drinks, food, candies, jelly making and in the form of sodium-citrate, as an emulsifying agent for processed chees.

Citrus being a very important and common fruit of North-Eastern Himalayan region also suffers from spoilage due to certain fungal attacks during

Table 39.1 : Species and varieties of citrus occurring in North East India.

S.No.	*Species*	*Varieties*
1.	*Citrus medica* Linn	Bira-Jora; Soh-Manong; Mitha-Jora
2.	*Citrus limon* (Linn.) Burm. f.	Naya-Changncy; Assam Lemon; Pati-Lebu; Jora Tenga; Godha-Pati-Lebu; Kata-Jamuri; Elachi-Lebu; Soh-Long; Soh-Synteng; Pani-Jamir.
3.	*Citrus jambhiri* Lush	Soh-Myndong; Soh-Khalia; Kata-Jamir; Sinduri-Nemu-Tenga; Nemu-Tenga; Mitha-Tulia
4.	*Citrus karna* Raf.	Soh-Sarkar
5.	*Citrus aurantifolia* Sw.	Abhayapuri-Lime; Karimganj Lime.
6.	*Citrus limetta* Risso	Mitha-Kaghzi.
7.	*Citrus reticulata* Blanco	Soh-Niamna; Soh-Umkdiat; Naga-Santra; Soh-Siem; Kapura-Tenga; Narangi.
8.	*Citrus nobilis* Lour	Jeneru-Tenga
9.	*Citrus indica* Tanaka	Indian Wild orange
10.	*Citrus sinensis* Osbeck	Soh-Niangriang
11.	*Citrus aurantium* Linn	Karun-jam ir; Gondh-Huntra
12.	*Citrus maxima* Merr	Dowadi; Nowgong; Jorhat; Khanapara; Kamrup Khasi; Bumi; Zemabawk; Aijal.
13.	*Citrus megaloxycarpa* Lush	Bor-Tenga; Hukma-Tenga; Holong;Tenga; Jamir-Tenga.
14.	*Citrus assamensis* Dutta and Bhattacharyya	Species novo
15.	*Citrus macroptera* montr.	Sat-kara; Tith-Kara.
16.	*Citrus ichangensis* Sw.	Ketsa-Shupfu
17.	*Citrus latipes* Tanaka	Soh-Kymphorshrieh; Soh-Shyrkhoit.

Source : 5th National Citrus Seminar, AAU, Jorhat 1987

post harvest state, as influenced by the typical climatic conditions prevailing in the region. Some of the post harvest diseases of citrus grown in different parts of India are being reported from time to time. Literature reveals that more than 35 species of fungi are responsible for post-harvest spoilage of citrus in different parts of the world, of which more than 25 species have been found to be associated with citrus decay in various localities within India. Although, this part of the Himalayas is famous for its citrus wealth, systematic survey on post-harvest spoilage has not yet been taken up. Investigations were, therefore, undertaken to have a close scientific look on post-harvest fungal spoilage of citrus wealth in Eastern Himalayan region with particular reference to spoilage, isolation and identification of fungi, their occurrence at different localities and pathogenecity.

MATERIALS AND METHODS

Survey on Spoilage

Places situated in the Eastern Himalayan Region were visited for survey which included Haflong, (Assam Hills) Tinsukia and Guwahati (Assam), Along and Bomdila (Arunachal Pradesh), Shillong (Meghalaya); Imphal (Manipur), Kohima and Mukakchung (Nagaland), Tura (Garo hills), Aizawl (Mizoram), Agartala (Tripura). Three representative sample markets were taken into account for a particular place, for estimation of spoilage in citrus. Mandarin (*Citrus reticulata* Blanco), Assam lemon (*Citrus limon* (L) Burn f) and Rough lemon (*Citrus jambhiri* Lush), were considered for this survey. Estimation of spoilage was done at the same time at all places *i.e.* during second week of January for mandarin and of August for Assam lemon and rough lemon. The rotten fruits were collected in polythene bags and stored under aseptic conditions in B.O.D. incubator at 27+1°C for further Investigations.

Isolations, Morphology and Identification

Isolations were made on potato dextrose agar medium. Various morphological characters such as vegetative and reproductive structures were examined under Olympus Binocular microscope (Model KIC 22781). For this purpose, the mycelium and reproductive structure of fungi were mounted in lactophenol (Lactic acid-100ml; phenol - 100g ; glycerin - 100 ml; distilled water - 100 ml) and stained with cotton blue. Thus, identification of the fungal sps. was done on the basis of microscopic observations and descriptions given by various authors (Subramaniam, 1971; Booth, 1971; Brown, 1975; Srivastava and Tanden, 1971).

Pathogenecity

In pathogenecity tests, healthy ripe fruits were surface sterilized with 0.01 per cent HgC1 and washed in changes of sterile distilled water. A corkborer (5mm dia.) was driven to a depth of 4 mm into the fruits making sure that the bored tissue was not removed after withdrawing the corkborer. Two drops of spore suspension (5x104/ml) of a fungus culture were deposited around the wound outline made on healthy fruits. Uninjured fruits were also inoculated by individual fungus and observed for development of rot. Fruits were placed in a microhumidity chamber at 27±1°C and observations were taken after 7 days of incubation.

Occurrence of Fungal Pathogens in Different Localities

Occurrence of each organism causing rots of citrus in different places of Eastern Himalayan region were calculated by the method described by Adisa (1985) as follows :

$$\text{Percentage of frequency of occurrence} = \frac{\text{No of times of occurrence in each loaction}}{\text{Total number of localities surveyed.}} \times 100$$

$$\text{Average occurrence} = \frac{\text{Total figure obtained in all localities}}{\text{Total number of localities surveyed}}$$

where, % occurrence of each fruit rot organism was expressed as a percentage of total occurrence.

RESULTS AND DISCUSSION

Among the three major varieties of Citrus, Mandarin suffered from maximum spoilage with average percentage of as high as 29.32 as compared to Assam lemon (6.14) and the Rough lemons (6.06). At different places of survey, the spoilage percentage of Mandarin, Assam lemon and Rough lemon varied between 24.6 to 31.9, 4.3 to 6.7 and 4.8 to 6.6, respectively (Table 39.2).

The infected fruits of citrus on repeated isolation resulted in a few fungal organisms which were later identified on the basis of morphological characters. In case of Rough lemon, 7 species of fungi, *viz. Aspergillus niger, A. flavus, Botryodiploidia theobromae, F.oxysporum, Penicilium digitatum, P. italicum, Sclerotina sclerotiorum* were found to

Table 39.2 : Percentage spoilage of Citrus fruits in different locations

State	*Places*	*Mandarin*	*Assam Lemon*	*Rough Lemon*	*Mean*
Assam	Haflong	31.9 (33.86)	6.7 (14.96)	5.6 (13.62)	14.73 (20.81)
	Tinsukia	30.8 (33.50)	6.9 (15.16)	6.1 (14.17)	14.6 (20.95)
	Guwahati	31.3 (33.60)	5.9 (14.02)	6.3 (14.50)	14.5 (20.71)
Tripura	Agartala	29.6 (32.95)	6.8 (15.09)	5.8 (13.89)	14.06 (20.64)
Mizoram	Aizwal	27.4 (31.56)	6.3 (13.27)	6.6 (14.87)	13.43 (19.90)
Meghalaya	Shillong	27.6 (31.68)	6.2 (13.13)	5.9 (14.02)	13.23 (19.61)
Garo Hills	Tura	30.2 (33.33)	5.8 (13.91)	5.9 (14.73)	13.96 (20.66)
Nagaland	Kohima	28.2 (32.07)	5.9 (14.02)	6.3 (13.69)	13.46 (19.93)
	Mokokchung	29.6 (32.95)	6.2 (14.38)	6.2 (14.31)	14.00 (20.55)
Manipur	Imphal	31.2 (34.16)	6.4 (13.40)	6.3 (14.40)	14.63 (20.65)
Arunachal Pradesh	Along	24.6 (29.73)	4.3 (11.90)	4.8 (12.61)	12.46 (18.08)
	Bomdila	28.8 (32.44)	6.6 (14.25)	6.2 (14.23)	13.86 (20.52)
	Mean	29.32 (32.65)	6.4 (14.01)	6.06 (14.09)	13.84 (20.25)
		CD	5 per cent	1 per cent	
		Places	1.08	1.44	
		Varieties	0.54	0.72	
		Places x Varieties	1.88	2.50	

Figures in parenthesis are angular transformations occur of which *Aspergillus, Penicillum* and *F. oxysporum* exhibited 100 per cent frequency of occurrence (Table 39.3).

The principal fungi associated with decay of Rough lemon were *Aspergilus* followed by *Penicilium* with a range from 4.01 to 22.0. Besides the fungi infecting the Rough lemon *Collectotrichum gleosporioides* was identified in Assam lemon. The average occurrence ranged from 5.43 to 20.13 (Table 39.3). In addition to the fungi identified in Rough lemon and Assam lemon, the fungi associated with Mandarin were *Asperigillus flavipes, Alternaria alternata* and *Fusarium moniliforme* exhibiting 100 per cent frequency of occurrence indicating that these pathogens affected the variety in all places of survey. The average occurrence ranged from 2.37 to 17.82 (Table 39.3).

Pathogenecity tests were carried out with the fungi associated with post harvest spoilage in order to estimate their ability to cause rots in different varieties of citrus. Results encountered are presented in table 39.4 with the observations that all the fungal species isloated from Citrus were pathogenic to three varieties of Citru, *viz*. Mandarin, Assam lemon and Rough lemon. In Mandarin, percentage of rot was the highest (59.2) as compared to Assam lemon (49.1) and Rough lemon (40.1). Injured fruits were infected by all the fungal species, while the uninjured fruits did not exhibit any spoilage.

Morphologically, fungal species isolated from rotten fruits of citrus were found to be identical to those described earlier by various authors (Subramaniam, 1971; Boath, 1971; Brown, 1975; Srivastava and Tandon, 1971). It was indicated that Mandarin was more prone to post - harvest spoilage than the others. Hondelmann and Richter (1973) also correlated susceptibility with conversion of soluble pectins from insoluble state as ripening of the fruit

Table 39.3 : Percentage of occurrence of fungal species isolated from rotten fruits of Citrus

Fungal species	*Mandarian*		*Assam Lemon*		*Rough Lemon*	
	Average occurrence	*Frequency of occurrence*	*Average occurrence*	*Frequency of occurrence*	*Average occurrence*	*Frequency of occurrence*
Aspergillus niger	17.82	100	20.13	100	22.0	100
Aspergillus flavus	16.09	100	20.07	100	20.89	100
Aspergillus flavipes	2.45	50.0	–	–	–	–
Alternaria alternata	2.05	35.7	–	–	–	–
Botryodiploidia theobromae	8.39	92.8	11.30	100	9.90	85.71
Colletotrichum gleosorioides	2.65	50.0	3.04	36.4	–	–
Fusarium moniliforme	7.58	100	–	–	–	–
Fusarium oxysporum	6.46	100	11.94	100	12.35	100
Penicillium digitatum	16.94	100	14.29	100	15.64	100
Penicillium italicum	15.06	100	13.70	100	15.18	100
Sclerotinia sclerotiorum	2.37	50.0	5.43	50.0	4.01	0.36

Table 39.4 : Pathogenecity of fungi isolated from citrus fruits

Fungal organisms	*Percentage rot (After 7 days of incubation at 27±1°C)*					
	Mandarin		*Assam lemon*		*Rough lemon*	
	Injured	*Uninjured*	*Injured*	*Uninjured*	*Injured*	*Uninjured*
Aspergillus niger	65.8	0	53.6	0	46.3	0
Aspergillus flavus	62.4	0	51.5	0	44.6	0
Aspergillus flavipes	60.8	0	49.2	0	42.8	0
Alternaria alternata	51.4	0	42.5	0	39.6	0
Botryodiplodia theobromae	66.9	0	58.3	0	48.7	0
Colletotrichum gloesporioides	56.2	-	46.4	0	38.4	0
Fusarium moniliforme	54.6	0	41.2	0	35.3	0
Fusarium oxysporum	58.6	0	38.3	0	32.4	0
Penicillium digitatum	61.5	0	54.6	0	46.7	0
Penicillium italicum	63.2	0	56.2	0	36.3	0
Sclerotinia sclerotiorum	50.3	0	48.6	0	30.6	0
Mean	59.2	0	49.1	0	40.2	0

causing reduction of firmness of the fruit. According to Scott and Lawrence (1975), fruit firmness includes skin toughness and flesh firmness, which are inheritable characters. Cultivars with fruits that maintain firmness over a longer period of time, remain less susceptible than fruits of cultivars that soften early. Thus, in Mandarin higher percentage rot recorded during pathogenecity test, might also be due to its loose skin for which the fruit was very much prone to injury facilitating easy entrance of the fungal pathogens.

Post harvest spoilage cause considerable economic losses to the gorwers, sellers and common consumers. Such losses are proportionately greater than losses caused in the field due to diseases or total cost of harvesting, transport and storage. Therefore, management of post harvest deterorations caused by fungal pathogens in case of citrus wealth of North East Himalayan region is of great concern from economic point of view. Management technology could be developed either chemically or biologically to save this wealth from post harvest losses.

KEY WORDS AND ABSTRACT

KEY WORDS Citrus-wealth. North-Eastern Himalayas. Post-harvest. Fungal Deteriorations.

ABSTRACT Citrus wealth occupies a place of considerable importance in fruit economy of the country. A number of citrus species are indigenous to this region. Citrus fruits suffer from spoilage due to fungal attack during post harvest stage. Post harvest deterioration of Mandarin, Assam lemon and Rough lemon are investigated. *Aspergillus niger, A. flavus, Penecillium digitatum, P. italicum* and *Fusarium oxysporum* are principal fungi associated with post-harvest decay of the above three major citrus varieties.

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Authors' Address : **Paran Baruah, P.C. Sarma, A. K. Bordoloi, R.S. Singh and Anil C. Ghosh,** Division of Plant Sciences & Ecology, Regional Research Laboratory, Jorhat 785 006, Assam, India

Traversing The Karakorams: Routes and Socio-cultural Development in Northern Pakistan*

Charles S. Haines

INTRODUCTION

For millennium traders, monks, armies, wanderers traversed the mountainous rimland of South Asia. The routes crisscrossing these mountains are symbols of transcontinental linkages, interconnections between the civilizations of South Asia, East Asia, Inner and Central Asia. But the mountain passes are not solely linkages; they were, and are, the home of the unique conglomeration of peoples and cultures. For the Nagas, Sherpas, Ladakhis, Hunzakuts, and Pakthuns the mountains are not a place to 'conquer', but a place to eke out a living; the mountains are their 'home'.

Yet, for the people from the plains, the lowlands, down-country, the mountains have been held in awe. The drama of their landscape and the treacherousness of the journey through them inspired lowland dwellers to imagine the mountains as imbued with spiritual and economic wealth. From the abode of the gods to gold-digging, the lowlanders have been inspired to 'discover', 'conquer', and 'traverse' these mountains.

The Silk Route, the colonial Gilgit Road, the modern Karakoram Highway were etched upon the mountain landscape as lowlanders sought their fortunes and defined their political territories. These routes and the transactions occurring along their shoulders structured and restructured socio-cultural processes in the Karakoram mountains. As an aspect of an ongoing research project, the following is a sketch of the transformations engendered by the routes constructed to and through the Karakoram mountains during colonial administration of the Gilgit Agency.

SOCIO-CULTURAL SKETCH

The Hindu Kush, Pamir, Karakoram, and Himalayan mountains converge in northern Pakistan, forming a dramatic landscape of narrow valleys winding amidst some of the tallest mountains in the world. Fertile land is scarce and agriculture is dependent on irrigation, giving one observer to describe the region as a "mountainous desert" (Whiteman, 1985:7).

In the upper valleys, such as Hunza and Gojal, subsistence farming must be supplemented by additional economic activities. Since the establishment of the Gilgit Agency in the 1870s such activities were based on the camp economy that arose around the provisioning of the Kashmiri and British troops stationed in the region. Similar opportunities continued following independence with the replacement of the Kashmiri and British troops with the Pakistani army.

Since the opening of the Karakoram Highway in 1978 new economic opportunities have emerged: migration down-country and to the Middle East, cash crop farming, tourism, and small-scale trade between Pakistan and China.

Today the Karakoram Highway provides a linkage to the variety of peoples and cultures inhabiting the mountain valleys. In travelling down the Karakoram Highway from the Khunjerab Pass at the China border, one first traverses the valley of Gojal populated by Wakhi speaking Isma'ills originally from the Pamir region of Afghanistan and Tadjikistan. Below Gojal is the well known valley of Hunza, populated by Isma'ills, speaking a linguistically unique language known as Burushaski. Nagar is the next valley, populated by Shi'a Muslims. Below it is the town of Gilgit, today populated by people from every valley, religious and ethnic groups in the region, plus from "down-country" -

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particularly Pakthuns. They, as well as the original Shina speaking people of Gilgit (a Dardic language related to Kashmiri), are Sunni Muslims.

MILITARY ROUTES AND TERRITORIAL INTEGRATION

Prior to the colonial encounter the various peoples of the Gilgit region did not live in isolation. While their interactions were perhaps not as fluid as those of Peshawar, they were an important component in social developments. Since the late eighteenth century the kingdom of Hunza had forged tributary relations with Chinese rulers in Yarkand. The Hunza ruler had rights of pasturage and tax collection in the Pamirs and paid a nominal tribute to the Chinese representatives in Yarkand. The northern valleys of the Gilgit region are populated by Wakhi speaking people. It is generally believed they have been settling into the Karakoram mountains since the 1600s and continue to maintain relations with the Pamir Wakhis and Kyrgyz, now in Afghanistan and Tadjikistan. As well, there were intense political relations between Gilgit and Chitral to the west. Many families now living in the villages of the Northern Areas claim to have settled originally from Chitral, Dir, or Swat (now all in the North West Frontier Province).

Following the Treaty of Amritsar, creating modern Kashmir in 1846, there was also an intensification of encounters with Kashmir, to the southeast of Gilgit. In the 1860s and 1870s, when the first British agents travelled into the region, the only route to Gilgit was from Srinagar *via* Astor. Early British agents that travelled to the Karakorams included Dr. Leitner in 1866 who visited the region on a linguistic mission, Frederick Drew of the Indian Geological Survey in the 1860s and early 1870s, and Capt. John Biddulph who became the first Political Agent following the establishment of the Gilgit Agency in 1876.

All three reported on the difficulty of the route and its unmaintained nature. The only travellers they recorded encountering along the way were Kashmiri soldiers. It is also important to note that the route between Gilgit and Hunza, to the north, was barely passable. In Biddulph's report on his mission he recounted that "in winter the road from Gilgit to Hunza can be traversed by horses as the bad parts can be avoided by crossing and recrossing the river, which at the time of (his) journey (spring 1876) was impassable" (Biddulph, 1876). He recounted how the route entailed scrambling over rocky ledges, hundreds of feet above the river. In the mid-nineteenth century, Gilgit and Hunza were not a through route to Chinese Turkistan.

In 1876, Biddulph was stationed alone in Gilgit. His mission weakened by the inaccessibility of the region, the inability of the British Empire to mobilize troops to the remote outpost. The only route to Gilgit was *via* the Princely state of Kashmir. This was to remain the situation until 1891, the year of the Hunza Campaign, led by Colonel Durand.

The people of Hunza, Hunzakuts or Kanjutis, were viewed as "ruffians", vultures who raided trade caravans and supported the disruption of work along the Gilgit Road (the route to Srinagar) [Knight, 1991 (1893)]. In short, they were causing havoc to the administrative efficiency of the Empire.

Col. Durand undertook the Hunza campaign with an army consisting of 1,000 regular troops. Supplying these troops was a major component to the campaign. It was estimated that 25,000 coolie loads of grain would be required [Knight, 1991 (1893) : 340]. To support the campaign, a British engineering contractor was deputed to widen and improve the Gilgit Road to Srinagar and military posts were established along the route southward through Chilas and the Kaghan Valley, enabling supplies to be carried up from the Punjab. In order for the campaign to be carried out the route northward from Gilgit also had to be improved, allowing for the movement of artillery to bomb the impenetrable forts of Nagar and Hunza. When Biddulph travelled to Hunza fifteen years earlier, there was no route to follow. Special troops of Pakthuns and Sikhs were called upon for road building purposes.

TRADE ROUTES AND THE WORLD-ECONOMY

The Hunza campaign led to the routing of the Mir (*Raja*) of Hunza and his replacement with a Mir more cooperative to the wishes of the British. One of the justifications for the campaign was the former Mir's blocking the expansion of trade linkages to Chinese Turkistan. Trade with Chinese Turkistan at the time was taking place solely through Lakakh, administratively under the control of Kashmir and a British Joint-Commissioner. "Ladakh trade had increased from Rs. 200,000 in 1863 to Rs. 1,500,000 by 1873" (Aitchison, 1873). By 1890 it had amounted to over Rs. 3,000,000 (Alder, 1963:318).

Now that there was a route directly southward to British territory, rather than *via* Kashmir, the Gilgit route was looked favorably upon by policy makers. The weakness of the Ladakh route, though historically the "natural" route to Kashgar, was its linkage to Kashmir. In the 1860s and '70s there was a concerted effort on the part of certain British agents to reroute the Ladakh trade away from Srinagar into the eastern Punjab through Kullu and Spiti (now in Himachal Pradesh). These included creating villages along the route to support pasturage for pack animals and the construction of coverings to protect the travellers from the fierce alpine winds. The policy also included the establishment of a trade fair in the eastern Punjab to entice further Central Asian traders away from Kashmir. The effect on rerouting the trade was minimal, but the policies influenced the Maharaja of Kashmir to administer more effectively the trade through his region.

In Gilgit, one practice of capturing the China trade was through encouraging Pakthuns to settle in Gilgit in order to forge trade relations with Chinese Turkistan and Central Asia. Only Pakthuns participated in the long distance trade northward. The new routes to and through the regions "opened" it up, but principally only to outsiders. Many shops in the market of Gilgit were owned by Kashmiri Hindus, Kashgaris, and Pakthuns. The people of the region did increasingly participate in trade, but only local trade, supplying goods from the large market of Gilgit to the outlying valleys.

However, given the strenousness of the Gilgit route, it could not compete with the trade *via* Leh, even as it dwindled. By the time the British established administrative control over the region, disturbances in China began to disrupt the trade with Kashgar. In 1931, imports from Kashgar *via* Ladakh amounted to only Rs. 400,000 and exports to over Rs. 1,000,000; while in Gilgit imports were merely Rs. 25,000 and exports were Rs. 179,000 (External Affairs Department 1938).

Though the people dwelling in the Karakoram mountains did not participate directly in the trade with Chinese Turkistan, their economic relations were nonetheless transformed by the 'opening' of the route. Gilgit emerged as a town, supporting political agents, an army, and many merchants from down-country. In short, the Gilgit Road engendered a cash economy in the region.

ROUTES AND ETCHING THE STATE UPON THE LANDSCAPE

The routes to support long distance trade and provide supplies for the military occupation of the region transformed social transactions in the Gilgit region in a multiplicity of ways. One integrative factor included the emergence of Gilgit as the administrative center of the region. The construction of new routes to the outlying valleys (particularly Ishkoman and Yasin) drew the region into an administrative unit, affecting new social ties between the desperate peoples of the region. A second integrative influence of the new routes was the emergence of a cash economy, compelling changes in labor practices required to construct and maintain the routes as well as in the hiring of porters to carry supplies across the mountain passes. A third impact of route development was the changing nature of state control. Local control was usurped by an expanding colonial empire, distancing the decision-making center away from the region.

In summary, the routes through the Karakoram mountains offer an important window to understanding these processes of political and economic alienation. Most importantly, the routes have structured and restructured how both lowlanders and highlanders experienced the mountain environment. Such transformations in experience are important for our understanding of historically emergent ecological practices of today in the mountains of South Asia.

KEY WORDS AND ABSTRACT

KEY WORDS Mountains. Living. Culture. Trade. Porters.

ABSTRACT This study reports the infrastructural development in the Karakoram mountains under colonial administration. The Gilgit Road and Kaghan Valley Road, linking the Gilgit Agency with Srinagar and Rawalpindi, respectively, were constructed initially to support military advancements into the region. New forms of labour practices were employed to construct the routes and new state apparatuses were developed to control the flow of goods and people along the routes. These new practices and institutions restructured the manner in which

lowlanders and highlanders experienced the mountain environment. As the nature of the routes traversing the Karakorams changed, given transformations in the geo-politics of the region, so have our experiences, understandings, and representations of mountains.

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Author's Address : **Charles S. Haines**, Department of Anthropology, University of Wisconsin-Madison, Wisconin, USA

Effects of Socio-Cultural Factors on Fertility and Mortality Among the Oraons of Assam : A Preliminary Study

Sarthak Sengupta and Arundhati Gogoi

INTRODUCTION

A study of differential fertility is useful in identifying the factors which determine fertility levels among various groups and sub-groups. Though human reproduction is essentially a biological phenomenon, it is greatly influenced by several ecological as well as socio-cultural factors (Michelson, 1944; Lorimer et al., 1954; Bharadwaj and Viramani, 1971; Valsik et al., 1973; Choudhury, 1984). It has been observed that the levels and patterns of fertility as well as mortality vary considerably in various sub-groups/sub-samples of the same population. These sub-groups/sub-samples may be based on family types, residence/habitat, both rural and urban, religion, educational attainment, occupation, social and economic status etc.

In the present study an attempt has been made to analyse the effect of a few socio-cultural determinants causing micro-cultural differences on the rate of fertility and mortality among the Oraon women inhabiting two contrasting settings, *i.e.* in tea garden labour *lines* and ex-tea labour *bastees* of Upper Assam.

The Oraons are a Dravidian speaking population and are believed to be migrants from southern India settling in the Chotonagpur plateau (Dalton, 1872; Hunter, 1877; Risley, 1891; Roy, 1915) many centuries ago. They are commonly known as Kurunkh, Dhangar, Uraon etc. at different places. In Assam, they call themselves Urang. Their principal settlement is in the Ranchi district of Bihar. But they are also found in Assam, West Bengal, Orissa and Madhya Pradesh.

Majority of the Oraons in Assam identify themselves as Hindu (*Sansari*), while Oraons subscribing to Christian faith are also considerable in number. An important fact worth mentioning here is that though the Hindu and Christian Oraons in Assam live side by side, the interaction between these two segments seem to be very limited in their day to day socio-cultural life. The Hindu Oraons are seen to avoid interdining and matrimonial alliances with the Christian counterparts.

The Oraons are settled in the tea gardens of Assam more than a century ago and are far remote from their native land. At present the chief means of livelihood of most of the ex-tea Oraon labourers is agriculture, while some of them earn cash as daily labourers and workers in tea plantations as *'faltu'* labourers or casual workers.

MATERIAL AND METHOD

The entire data on reproductive performance were collected from 220 married Oraon women of whom 122 are from tea gardens (Hindu=72, Christian = 50) and 98 from ex-tea Oraon labour settlements (Hindu = 52, Christian = 46). For this study six tea gardens (Basmotia, Hatiali, Kailaspur, Lengrai, Nandanban, Timakpho Tea Estates) and four ex-tea labour settlements (Basapathar, Dihinghula, Siringhula, Bamunikuriha Gaon) in Madarkhat and Tengakhat Circle under Dibrugarh district were selected.

While interviewing the mothers, the detail reproductive histories *i.e.* the number of offsprings, living and dead, miscarriage and still birth including sex and age of living and dead children have been collected. Apart from these, family type, educational attainment, place of residence, age at marriage etc. of the women concerned were also collected as these are purported to have an effect on reproductive performances.

Only those women aged 45 years and above, whose husbands are alive and who have atleast one child, have been interviewed. It may also be mentioned that abortion cases reported here are all of spontaneous type. No information has been obtained on cases of induced abortion.

RESULTS AND DISCUSSION

Family Type

Replenishing societal membership, sexual regulation, maintenance, cultural transmission and status ascription are five important functions of the family that are universal in all societies. The reproductive function being the prime functional necessity of the societal survival and also being anchored in the roots of the family functions, the decisive influence of the family system on fertility behaviour overrides other societal systems (Davies, 1970).

Studies conducted in India reveal that the women from joint families register lower fertility compared to women in nuclear families (Dutta, 1961; Bebarta, 1961, 1966; Nag, 1965; Pakrasi and Malakar, 1967; Patel, 1993; Sengupta and Chakravarty, 1995). However, Davis (1951), Lorimer (1954), Deka Mahapatra (1970) and Choudhury (1979) observed that fertility is high in women from joint families. Studies in this regard reveal that early marriage, which is a characteristic of joint family, has a positive effect on fertility. In Indian context, agrarian economy which needs more manpower prefers joint family and as a result fertility rate increases in joint families. It is also to be borne in mind that a few studies in India reported a lack of relation between fertility and family type (Mathen, 1962; Mahadevan and Sumangala, 1987).

Analysis of the data (Table 41.1) reveals that in both the tea garden and ex-tea garden Oraon labour settlements, women belonging to nuclear family are overwhelmingly dominant over the women from joint family type. This tendency of adhering to nuclear family among the Oraons of Assam was not seen or rarely seen at home and seems to derive from a number of reasons. In the present context, more particularly among the Oraons still working in tea gardens, allotment of quarters to each family by the garden authority, perhaps encourages it to set up nuclear family life. Economic state of livelihood may also be one of the important factors as observed by Mendelbaum (1970) that poorer people show higher proportion of nuclear family than do the wealthier class. It will be worthwhile to note here that the wages of tea garden workers a few decades earlier was indeed very low - much lower than the rates received by any unskilled labourers in Assam.

Table 41.1 : Fertility and mortality among the Oraon : Some socio-cultural determinants

Demographic Parameters	*Tea-Garden Oraon*							*Ex-Tea Garden Oraon*							*Oraon*	
	Hindu			*Christian*			*Pooled Data*	*Hindu*			*Christian*			*Pooled Data*	*Hindu*	*Christian*
	JF	*NF*	*Total*	*JF*	*NF*	*Total*		*JF*	*NF*	*Total*	*JF*	*NF*	*Total*			
Total no. of mother	20	52	72	6	44	50	122	31	21	52	18	28	46	98	124	96
Age at marriage (yrs)	18.90	19.79	20.04	19.00	20.14	19.82	19.95	19.33	20.02	19.19	18.00	18.95	18.63	18.63	19.68	19.25
Age at Ist conception	20.20	20.97	21.04	20.50	21.19	21.16	21.09	20.54	21.43	20.87	19.08	20.22	19.89	20.41	20.97	20.55
Total conception	136	341	477	38	241	279	756	212	141	353	135	179	314	667	830	583
Mean conception	6.80	6.56	6.62	6.33	5.48	5.58	6.20	6.84	6.71	6.79	7.50	6.39	6.83	6.80	6.69	6.18
Total no. of live birth	123	317	440	34	216	250	690	186	134	320	118	164	282	602	760	532
Mean live birth	6.15	6.10	6.11	5.67	4.91	5.00	5.66	6.00	6.38	6.15	6.56	5.86	6.13	6.14	6.13	5.54
Abortion rate (%)	5.15	2.64	3.35	7.89	5.39	5.73	4.23	5.66	4.26	5.10	7.41	4.47	5.73	5.40	5.73	5.723
Still birth rate (%)	4.41	4.40	4.40	2.63	5.39	5.02	4.62	4.72	3.55	4.25	5.19	3.91	4.46	4.35	4.34	4.72
Pre-reproductive wastage (embroyonic) (%)	9.56	7.04	7.76	10.52	10.78	10.75	8.60	10.38	7.80	9.35	12.60	8.38	10.19	10.04	8.43	10.45
Neo-natal mortality (%)	1.63	4.73	3.86	-	2.31	2.00	3.19	3.76	5.22	4.38	5.93	7.32	6.74	5.48	4.68	4.51
Post neo-natal mortality (%)	4.88	3.15	3.64	-	1.39	1.20	2.75	2.69	-	1.56	0.85	1.83	1.42	1.50	2.76	1.32
Child mortality (%)	7.32	2.21	3.64	-	1.85	1.60	2.90	2.69	1.49	2.19	1.69	-	0.71	1.50	3.03	0.75
Juvenile mortality (%)	-	0.63	0.45	-	0.93	0.80	0.58	0.54	-	0.31	-	-	-	0.17	0.39	0.38
Reproductive wastage (Post-natal)	13.83	10.72	11.59	-	6.48	5.60	9.42	9.68	6.72	8.44	8.47	9.15	8.87	8.64	10.26	7.33

Note : JF - Joint Family; NF - Nuclear Family; A case of twin birth has been found in nuclear family ot tea-garden Christian Oraon group.

It is seen that the mean age at marriage is relatively high among Oraon women belonging to nuclear family, and it is also observed that the mean age at first conception is relatively low in women living in joint family. The mean conception as well as live-birth among them is slightly higher in joint family than those of nuclear family. However, turning to percentage occurrence of live births, barring the Christian Oraon from tea gardens, the rate is higher in nuclear family than that in joint family of both the settings.

The mothers from joint families have higher incidence of abortion rate than mothers from nuclear families. This holds true in Oraons of both tea garden and ex-tea labour settlements. Incidence of still birth in Oraons from tea gardens is higher in mothers living in nuclear family than those in the joint family, while it is just the reverse in case of ex-tea Oraon labourers. The fetal wastages as a whole are thus higher in mothers living in joint families than in their counterparts in nuclear families. It is also apparent that the women from joint families with high fetal wastages have also the high fertility rates. One of the factors which motivates to produce more offsprings might be the effort to compensate for the loss of the high fetal wastages. Likewise, Oraon mothers living in nuclear families, especially in tea gardens, experience higher incidence of infant (both neonatal and post neonatal) and juvenile mortality than the mothers living in joint families whereas child mortality is comparatively high in the latter.

Religion

There is a close relation between fertility and mortality with religion. It has been reported that in different minority communities like Muslims, Christians, Sikhs etc., the birth rate is quite high compared to that of the Hindus. However, the fertility of Zoroastrian (Parsee) women is the lowest of all the minority religious groups in India, so far studied (Choudhury, 1979).

It will not be out of context to mention here that the arrival of Christianity in the tea garden and ex-tea labour population of Assam has brought about a tremendous change in many spheres of life, especially in the domain of people's belief and practices. With regard to educational attainment also, the Christians dominate over their Hindu counterparts. In the present study, therefore, the data have been analysed on the basis of religious affiliation with a view to understanding the probable effect of religion on fertility rates.

Although there is no significant difference in respect of mean age at menarche in the Oraon subsamples with religious affiliation, yet the Hindu Oraons are found to attain their menarche relatively late as compared to Christian Oraons.

In both the settings, Oraon women belonging to Christian faith have lower age at marriage than Hindu Oraon. The mean conception rate is found to be higher in women belonging to Hindu religion in both tea and ex-tea labour settlements than the Christian Oraon women. Mothers from Christian sub-samples also have higher incidence of abortion rate than their Hindu counterparts. Such observations hold good with regard to still birth rates also.

The infant mortality rate is found to be higher in Oraons working in tea gardens, especially those belonging to Hindu religion, but in case of ex-tea Oraon labourers, infant mortality rate is higher in Christian than Hindu Oraons. The juvenile mortality, however, does not reveal any uniform trend.

Place of Residence

It has long been recognized that place of residence/habitat is one of the major social as well as ecological parameters for differential fertility. A large number of studies carried out in Indian metropolitian cities (Chandrasekharan, 1979; National Sample Registration Bulletin, 1985) to study the fertility behaviour of women having different residential backgrounds reveals higher crude birth rate than the urban crude birth rate.

In the tea gardens of Assam, labour quarters are distributed in clusters which are locally known as *line*. These consist of lanes and bylanes. Long rows of quarters with definite compounds for each family are built on either side of the lanes and bylanes usually facing each other. On the other hand, ex-tea garden labour populations are settled mainly in the rural areas of Assam by establishing villages, occupying Government Khas land or unused tea garden land in the vicinity of the tea estates, forming an integral part of the Assam rural folk.

It would be relevant to mention here that the Oraon population from tea gardens of Assam besides free housing also receives supply of rice at concessional rates, free fire-wood, drinking water supply, provision of toilets, free medical facilities, maintenance of creches and primary school etc. On the other hand, the ex-tea Oraon labour populations do not enjoy any benefit through any statutory measure. Considering the availability of these welfare measures, perhaps we may consider that the Oraon sample drawn from tea gardens are relatively more exposed to and benefited from the modern facilities which are usually available in urban centres than their counterparts living in ex-tea labour *bastees* in typical rural situations.

The present study reveals (Table 41.1) that irrespective of religion, consummation of marriage of ex-tea Oraon labour women is held at a much earlier age than that of the Oraon women working in tea gardens. The age of mothers at the time of first conception also shows considerable variation in the two sub-samples. The tea garden Oraon labour women record relatively higher mean value in this regard.

The Oraon women working in tea garden also shows lower average birth rates than do the ex-tea garden Oraon labourers, and the apparent variation is great enough in terms of live-birth rates. The pre-reproductive (embryonic) wastages as a whole is relatively higher among Oraon mothers of ex-tea labour sub-samples, particularly the Hindu Oraons with higher fetal wastages also record higher fertility rates.

The present analysis (Table 41.1) also reveals resonably higher infant mortality rate in ex-tea labour samples than in the tea garden sample, while Oraon mothers from tea garden experience comparatively high incidence of child and juvenile mortality. Incidence of pre-reproductive mortality as a whole is seen to be higher among offsprings of Oraon mothers working in tea garden where 9.68% of all live births failed to reach reproductive age while among the Oraon mothers from ex-tea labour settlements such rate show relatively low (9.02%) frequency.

Educational Level

It is generally believed that education leads to improved knowledge of, and favourable attitude towards, birth control and better communication between husband and wife. There is consistent relationship between fertility and educational level. Steady decline in fertility rate with increasing education has been reported by Driver (1963), Hussain (1970a, 1970b). Dutta and Seal (1974) showed education of both husband and wife had an inverse relationship with number of children, the relationship with wife's education being relatively stronger. Palloni (1981) has shown that literacy has a much greater influence on child mortality than infant mortality.

Caldwell and McDonald (1981) opine that education of mother is a tool which helps a women in breaking some of the traditional norms and makes one relatively more independent in taking decisions within the family situations. Bharati and Ghosh Dastidar (1990) showed that a negative relation exists between maternal education and both fertility and mortality. Gandotra et al. (1982), Ruzicka and Kanitkar (1971) and many others report that education of the mother is the most crucial determinants of infant mortality. This is also supported by Khan et al. (1986) who pointed out that education of the mother has a strong bearing on infant mortality. The National Sample Survey Reports (1960-61 and 1961-62 rounds) showed a increase in women's education. It is well established that decline in fertility in Kerala is due to high literacy level of women there.

In the present study, the majority of the Oraon women is found to be illiterate. Only a few of them are literate but without any formal educational level. Therefore, instead of finding out the relation between maternal education with fertility and mortality if any, in the present study both husbands and wives have been treated unitedly to ascertain the association of these two variables.

In the present sample, it is observed that fertility level declines considerably with an increase in the educational level of the couple. In ex-tea Hindu Oraon sample, fertility rate of illiterate group is 6.59, while it is 4.85 for those who are educated. Similarly among the Christian ex-tea Oraon labour, total fertility rate of illiterate couple is 6.15 and that of the educated couples is 6.08. It is interesting to note that, just reverse to it, the average number of children born to Hindu Oraons working in tea gardens under the aforesaid two grades categories are 5.90 and 7.16 respectively as against the Christian counterparts where the mean live births are 4.86 and 5.19 for illiterate and educated couples respectively (Table 41.2).

The total and average fetal death cases of Oraon illiterate couples show high incidence of foetal deaths in general. Pregnancy wastage (calculated per 1000 pregnancies) is also found to be higher

Table 41.2 : Fertility and mortality among the Oraon according to the educational categories of couples

Demographic	*Tea-Garden Oraon*						*Ex-Tea Garden Oraon*						*Oraon*			
	Hindu		*Christian*		*Pooled*		*Hindu*		*Christian*		*Pooled*		*Hindu*		*Christian*	
	I	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*	*I*	*II*
Total no. of couple	60	12	29	21	89	33	39	13	33	13	72	26	99	25	62	34
Mean conception	6.47	7.42	5.52	5.67	6.16	6.30	7.36	5.08	7.00 ·	6.38	7.19	5.73	6.82	6.20	6.31	5.94
Mean live birth	5.90	7.16	4.86	5.19	5.56	5.91	6.59	4.85	6.15	6.08	6.39	5.46	6.17	5.96	5.55	5.53
Total live birth (%)	91.24	96.63	88.13	91.60	90.31	93.75	89.55	95.45	87.88	95.18	88.80	95.30	90.52	96.13	87.98	93.07
Abortion rate (%)	3.87	1.12	6.25	5.04	4.56	3.37	5.57	3.0	36.49	3.61	5.98	3.36	4.59	1.94	6.39	4.46
Still birth rate (%)	4.90	2.25	6.25	3.36	5.29	2.88	4.88	1.52	5.63	1.20	5.21	1.34	4.89	1.94	5.88	2.48
Infant mortality (%)	5.93	13.95	3.55	2.75	5.25	7.69	7.00	1.59	8.37	7.59	7.61	4.93	6.38	8.72	6.40	4.79
Child mortality (%)	3.95	2.33	1.42	1.83	3.23	2.05	2.33	1.59	0.98	–	1.74	0.70	3.27	2.01	1.16	1.06
Juvenile mortality (%)	0.56	–	–	1.83	0.40	1.03	–	–	–	–	–	–	0.33	–	–	1.06

Note : Category I = Illiterate Couple
Category II = Wife literate but without education level and husband has passed primary standard or above

among the illiterate Oraons (Hindu = 94.81, Christian = 122.76) as compared to the educated Oraons couples (Hindu = 38.71, Christian = 69.31).

Among the Oraon mothers, incidence of death of their offsprings is quite high. Infant mortality rate among the Hindu sub-samples is rather high and this holds good more particularly to the tea garden section of the present population. The child mortality rate appeared to be lower among the offsprings of educated couple, compared to those of illiterate couple. Juvenile mortality which could be recorded only among Oraons working in tea garden, does not show any clear trend, however.

Age at Marriage

It has long been recognised that age at marriage is one of the major parameters for differential fertility. Pearl (1939) is of the opinion that contraception is less effective than age at marriage to reduce total fertility. Coale and Tye (1961) have observed that delayed marriage plays a significant role to reduce the birth rate and consequently the population growth rate. Choudhury (1984) reports that the higher age at marriage itself indicates a strong desire on the part of the women to control fertility. Many studies in different part of world have substantiated this view. Studies conducted by Driver (1963), Agarwala (1965), Rele and Kanitkar (1966), Wyon and Gordon (1971), Poti et al. (1980), Sinha (1987), Chatterjee (1995) and others reveals that there is an inverse relationship between age at marriage and fertility. The works report that the fertility rates decline with the increase in mean age at marriage. Nag (1962), however, does not find any relationship between fertility and the age of marriage in a cross cultural study of 48 non-industrial societies. Two other studies, one by Sinha (1952) and other by Das (1965), also do not find any such relationship between fertility and age at marriage.

In the present Oraon population, it is clear that the mean number of pregnancy and live birth (Table 41.3) decreases as age at marriage increases. Further, there is an inverse relationship between the age at marriage and number of pregnancies. It is observed that the women married at the age between 15-16 years have on an average nearly double the number of pregnancies and live-births in comparison to the women marrying in the age between 21 and 22 yeras. In respect of reproductive performence there are considerable differences between the Hindu and Christian Oraons. The fertility rates of the Hindus is relatively high compared to the Christians'. The number of spontaneous abortion or miscarriage and the incidence of still-births are also relatively more in the case of women marrying at early years of age than those who married late, and such reproductive wastages are comparatively more among the Christian Oraons. The infant and child mortality consistently declines with an increase in the age at marriage, although juvenile mortality does not show any uniform trend among them. The Oraon mothers, irrespective of religion, experience quite relatively low juvenile mortality rates.

CONCLUSION

The present investigation among the Oraons of Assam indicates that most of them live in dire poverty, depending upon earnings either as plantation labourers or daily wage earners. Maternal-child care

Table 41.3 : Age at marriage and fertility among the Oraons of Assam

Groups Religion	*Age at marriage*	*No. of mothers*	*Fertility and Mortality* Pregnancy Mean	Live Birth Mean	Abortion %	Still Birth %	Infant %	Child %	Juvenile %
				Tea Garden Oraon					
Hindu	15-16	2	8.50	8.00	5.88	–	–	6.25	–
Oraon	17-18	14	7.00	6.43	2.04	6.12	10.00	2.22	–
	19-20	44	6.80	6.20	3.68	5.01	6.96	4.39	0.73
	21-22	10	4.80	4.60	4.17	–	10.87	2.17	–
	23+	2	7.5	7.5					
Christian	15-16	3	7.67	6.33	13.04	4.35	10.53	–	–
Oraon	17-18	9	7.22	6.67	3.08	4.62	–	3.33	–
	19-20	20	5.35	4.70	6.54	6.54	3.99	1.06	2.12
	21.22	15	4.47	4.07	4.48	4.48	–	1.64	–
	23+	3	5.67	5.33	5.88	–	18.75	–	–
				Ex Tea Garden Oraon					
Hindu	16	7	8.00	7.29	7.14	1.79	9.80	3.92	–
Oraon	17-18	11	7.27	6.55	2.50	7.50	4.17	–	1.39
	19-20	21	7.04	6.38	6.76	2.70	5.97	1.49	–
	21-22	11	6.09	5.55	2.99	5.97	4.92	4.92	–
	23+	2	1.00	1.00	–	–	–	–	50.00
Christian	16	5	10.00	8.60	8.00	6.00	11.63	–	–
Oraon	17-18	15	7.93	7.07	5.88	5.04	8.49	1.89	–
	19-20	21	5.19	4.71	6.42	2.75	6.60	–	–
	21-22	5	7.20	6.80	–	5.56	8.82	–	–

among them is indeed very poor. The expectant mothers are seldom inoculated. Although hospitals are available in most of the tea gardens, only very few of them go for advice for prenatal care. Delivery occurs mostly at home being attended by untrained *dais*. Vaccination and immunization of infant and children are rare occurrences. Environmental sanitation in tea gardens as well as ex-tea labour settlements is utterly poor. Poor personal hygiene and sanitation each year takes heavy toll. Mass illiteracy particularly among females tends to aggravate the problem. Traditional customs have deeper roots among them that could be modified little even by the influence of so called enlightend norms of Christianity which came to them quite recently.

For controlling fertility and mortality among the Oraons of Assam, therefore, it would be appropriate to improve the nutritional status of the Oraon mothers and the babies along with adoption of healthy child rearing practices. Education on health and environmental situation should be imparted to all Oraon couples. Promotion of maternal education to enable them to accept modern medical facilities would go a long way in reducing fertility as well as mortality among the Oraons of Assam.

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KEY WORDS AND ABSTRACT

KEY WORDS Fertility. Miscarriage. Mortality. Labourers.

ABSTRACT Human reproduction, essentially a biological phenomenon, is also to some extent influenced by several ecological and socio-cultural factors. A good deal of variation is noticed in respect of the levels and patterns of fertility as also mortality in various groups and sub-groups of the same population. Here will be an attempt in this study to analyse the effects of a few socio-cultural determinants causing differential rates of fertility and mortality.

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Authors' Address : **Sarthak Sengupta**, Reader, Anthropology Department, North Eastern Hill University, Shillong 793 014, Meghalaya, India
Arundhati Gogoi, Rajiv Gandhi Junior Fellow, Institute of Social Change and Development, Guwahati 781 001, Assam, India

Changing Lepcha Habitat in Dzongu, North Sikkim

Rip Roshina Gowloog

INTRODUCTION

The objective of this study is to discuss the changing Lepcha habitat in Dzongu, a Lepcha reserve in North Sikkim. The discussion will be based on data from a village called Lingthem, which was studied by Geoffrey Gorer and John Morris in 1937. On the basis of their study two best known works on the Lepchas *viz.*, *Himalayan Lepchas* and *Living with the Lepchas* were published in 1938. Thus these two works serve here as the benchmark for studying change in their habitat. The changes in this village were recorded in a restudy by the present author during 1987-90.

Before embarking upon the theme for discussion here, it may however be worthwhile to briefly dwell upon the people, their distribution, and their locale. This is perhaps called for in view of the fact that there are still many people who do not know much about this tribe, though it is certainly better known than other tribes found in the region.

WHO ARE THE LEPCHAS?

The Lepchas are a scheduled tribe community living in Sikkim, West Bengal and East Nepal. They are variously known as 'Rong', 'Monpa', 'Meri', Memba', etc. in the concerned literature but most popularly they are called 'Lepcha'. The term 'Lepcha' is supposed to be an anglicized form of the word 'Lapche'. But according to one Lepcha scholar, A Foning (1987), it is a corrupted form of the Lepcha word 'Lapchyo', which in the Lepcha language, means an elevated place. The name 'Lapche' is generally a term believed to have been given by the Nepalis referring to 'vile speakers' but Subba does not agree to it (1988:1). He writes that it must have been given either by the Limbus or the Rais who were historic neighbours of the Lepchas. But neither in the Nepali nor in the latters' languages, 'Lapche' means vile speakers. The word 'Monpa' or 'Memba' is obviously given by their northern neighbours or Tibetans, and it refers to 'low landers' in the latter's language. And the term 'Meri' is said to be used by the their eastern neighbours or the Bhutanese to refer to the Lepchas.

As of now, the word 'Lepcha' has received universal acceptance, and it is one of the most popular surnames too. But it is also common to use names like Sada, Karthak, Namchu, Sompu, Rongong, Foning, and Gowloog as their surnames. It may also be pointed out that the Lepchas often refer to themselves as 'Rong', while 'Lepcha' is more commonly used by non-Lepchas in the region. But no one has been found to have used the word 'Rong' as a surname.

The Lepchas are one of the oldest inhabitants of Sikkim, which once included the present district of Darjeeling and the area east of the Arun river. They have no legend of migration from elsewhere and believe that they originated from a mythical land called Mayel Lyang believed to be located somewhere near Mount Kanchanjangha. However, some British scholars like Gorer and Siiger have speculated their origin from the east, after crossing the Khasi hills and other parts of Assam en route Sikkim. Such a speculation is based on linguistic affinities of some tribes of the north-east with the Lepcha but there is no historical evidence in support of this claim.

DISTRIBUTION OF POPULATION

Historically, the Lepchas' major concentrations are found in the present day Sikkim, Darjeeling and east Nepal. A small number of them are also found in other places like Calcutta, Jalpaiguri, Bhutan, and Kathmandu. The Lepchas' stay in Calcutta is quite old as they were taken there by the British and Bengali administrators as cooks. On the three major areas mentioned above, population figures are not available, though in east Nepal, the Lepcha population is expected to be quite large. It is difficult to have the Lepchas' exact population figure even for India, specially after 1951, as caste-wise population figures are no longer published and figures based on religion or language are not reliable in the case of the Lepchas. Their total population in the region as a whole is estimated at present to be about fifty thousand, including a few thousand of them distributed over various parts of the world.

DZONGU : THE LEPCHA RESERVE

Dzongu is a Lepcha reserve and their land right are best protected there. Even a Lepcha from outside this reserve cannot buy land or settle there permanently. Though the Lepchas there have come under a heavy spell of the Nepali language as a consequence of the migrant Nepali labourers working there in cardamom fields in the last couple of decades, this is perhaps the only area where the Lepcha language is still vibrant and so is their culture. There has been some influence of the Bhutias also, which is evident in the dress and dialects of the Lepchas there. Yet this area may be considered as the most virgin land of the Lepchas as far as their language, religion, and their culture are concerned. It is for the posterity to see how long the Lepchas will be able to withstand the exogenous forces trying to impinge on their society.

It is not known exactly when Dzongu was created as a Lepcha reserve though it had attained this status prior to the visit of Gorer and Morris there in early 1937. 'Dzongu' is a word which, in Bhutia language, means 'nine districts'. It falls in the North District of Sikkim, which is the largest of the four districts and which covers an area of 4226 square kilometres or 59.6 per cent of the total geographical area of Sikkim. This district is strategically located with Nepal in the west, Tibet in the north, and other three districts of Sikkim in the south. This district is the least sparsely populated with a density of 7 persons per square kilometre, according to the Census of 1991. Towards the northern border the population is even more sparse due to climatic and other geographical conditions. The average altitude there is more than two thousand metres above sea level. Human habitation is roughly confined to about one fourth of the total area of this district.

Dzongu consists of 13 out of the total 45 revenue blocks under this district. There is no town, police station or a firestation located within Dzongu though Mangan where these features are available is just outside the limits of this reserve. The total area covered by this reserve is 15,845 hectares and the total population, according to the Census of 1981, is 7745 including 3414 seasonal labourers from Nepal. Administratively, it is divided into Upper Dzongu and Lower Dzongu with the Barfok village forming the boundary of the former and Heegyethang of the latter. The village in question here falls in the former.

Lepcha Habitat in Lingthem - 1937

This section deals with the Lepcha habitat of Lingthem as depicted by Gorer and Morris in 1937. According to Gorer, "(t)he river valleys are hot, steamy and somewhat malarious" (p.51). Most of the houses are located between 3500 and 7500 feet above sea level, and above that is "the forest in which wild produce is gathered, a decreasing amount of hunting done, and to which the cattle are sent to pasture in the winter months" (p.51). He further writes: "Above the forest level comes first the rhododendron forest, and then the snows, rarely visited except by hunters searching either for ibex and musk-deer or for the wild aconite which forms the basis of their arrow poison" (p.51).

The climate of the Talung valley which houses Dzongu is described as "excessively wet" with no rain only during September end to November end. It rained continuously during the rainy months and intermittently throughout the year. But due to the slope of land the water ran down quickly. And there were many streams running down the river carrying the rain water along with them.

The temperature varied according to altitude, as it largely does even today. Snowfall was known to be rare in the valley, and only once it occurred in 1906. But in the altitudes above 8000 feet snowing was quite regular and sometimes it snowed even at around 4000 feet. This was however indeed rare going by the fact that there were plenty of orange and peach trees below 7500 feet. According to Gorer's rough estimate, the temperature varied from 40 degree Fahrenheit in winter to about 86 in summer.

The grouping of the households, according to Gorer, did not "necessarily correspond to any emotional or kinship ties" (p. 54), and according to Morris, it was "entirely haphazard and in no way based upon relationships" (p.24). The selection of the sites for making houses was instead guided by the people's belief that such a site must be free from evil influences. But it must be remembered here that there was hardly any flat land worth mentioning in the entire valley. The precipitous terrain obviously limited the choice of the villagers to build their houses wherever they wished to. Another factor to be remembered here is the fact that natural water source was a major consideration for constructing houses in those days.

About the Lepcha houses, it is noted that they generally consisted of two rooms and one attic though the poor had only one room (Gorer, p. 63). Elsewhere it is noted that the Lepcha houses were all thatched and the walls or the floor were made of either bamboo or timber. The houses used to be constructed on raised platforms supported by huge wooden pillars resting on huge flat stone slabs. The vacant space below the platform used to be a multipurpose place: it used to be, among others, a storing place for firewoods and household implements or shelter to the domestic animals at night. A notable characteristic of the construction of the Lepcha houses was that no nails, hinges, screws, etc. were used. There was no furniture, no beds, tables, and chairs (Morris, p. 173). Gorer adds: "With the exception of the altar, and a couple of the biggest houses, which have rough coloured frescoes on the external plaster and slightly carved doorways and windows, Lepcha houses are entirely unornamented within or without" (p.65).

The main crops grown were wet-rice, dry-rice, buckwheat, maize, millet and cardamom. Of these, millet was mainly grown for fermenting and making *chi* or the local beer. Besides, a variety of pulses and vegetables were also grown for self-consumption. Fish was occasionally eaten, mostly boiled. Meat was a luxury, enjoyed specially during some sacrifice or when a big feast was offered by someone. Fowls, wild birds and goat meat were eaten fresh but beef and pork were preferred high (Gorer, p. 98).

As for the original dress of the Lepchas, a thick piece of woven cloth was fastened over the shoulder and tied at the waist with a sash hanging upto the knees. But Gorer has noted that the Lepcha women had "completely given up this indigenous type of dress in favour of the Tibetan costume, which consists of a coloured, long-sleeved under-bodice, and dark sleeveless overdress, reaching half-way down the calves and fastened with buttons" (p.52). About the Lepcha men, he found them wearing their traditional dress but their hat was "almost completely abandoned in favour of the biretta-like Tibetan hat decorated with coral beads" (p.53).

Gorer has also observed that only a few women used to weave as most of the villagers wore clothes bought in the Mangan town. The weaving of clothes were almost abandoned but the weaving of mats and baskets out of bamboo barks and reeds, mainly by men, was common in 1937 (p.67). Such articles were essentially meant for domestic use.

From the above account it appears that the Lepchas were heavily dependent on their habitat. It is clear that they seldom used any article which was not bio-degradable and which could not be available from the local environment. Even the utensils for storing and carrying water were made of resources locally available. Similarly, serving spoons and others articles of kitchen were made of either timber or bamboo. Further, it may be pointed out that Gorer's account of the Lepcha food gathering and their religious practices show a very close dependence on their natural environment.

Habitat in Lingthem - 1987

Considerable changes have come about in the habitat of the Lepchas from what was observed 50 years ago. These changes may now be described briefly.

First of all it may be noted that a lot of forest has vanised from the vicinity of the village. This has come about mainly as a consequence of cardamom cultivation, which has been expanded a hundred times since its introduction a little before 1937. Its cultivation takes place between an altitude of about 3000 feet to about 8000 feet. Though trees are preserved in the cardamom field for providing shade and moisture to the cardamom bushes, such trees are intermittent and often stand in a distance of over 8 metres. Besides not all kinds of trees are preferred: only those which have a large foliage and preferably with deciduous leaves to fertilize the fields are preserved in such fields. As a result the mixed character of the trees is destroyed to a large extent.

The disappearance of forest is also caused by extensive land reclamation for agricultural cultivation. There are virtually no trees allowed to stand in such lands because shade causes harm to the agricultural crops unlike its merit for the cardamom plants. Besides, such lands are periodically disturbed in many ways. For instance, the irrigated field terraces are to be cleaned or upturned before every cultivation, which leads to soil erosion to a large extent though it is perhaps a greater evil in unterraced fields.

The disappearance of the forest noted above is not only within the altitude range where human habitation is found but also in the river side and at higher altitudes. The presence of thick and dense forests is nowhere to be seen today. This has not only led to disappearance of wild birds and animals from the village but even the Talung river becomes more muddy due to eroded soil than it used to be fifty years ago. The fish population in this river is also reported to be diminishing very fast due partly to the blasting activities indulged in by some villagers.

The construction of a busable road along the Talung river at the bottom of the Lingthem village has brought further changes in the settlement pattern. Many villagers have abandoned their ancestral houses in higher altitudes and shifted themselves to the roadside which now has the semblance of a small township with rows of houses along the road. This is particularly true of a hamlet known as Passingdang, where a high school, a primary health centre, a post office, a fair-price shop, and other shops have also come up.

With an improvement in the village infrastructure, the style of life has considerably changed and there are a lot of articles in use today which are not bio-degradable. Of such articles, special mention may be made of the corrugated and galvanized iron sheets which have begun to cover more and more roofs today as it has become a status symbol. The use of cement in lieu of mud pulp, beer bootles in lieu of bamboo containers, and more recently polythene and plastic junks have begun to choke the streams of the village. To all this, add the hinges, nails, glass panes, plastic toys, mugs, buckets, etc. and one can well guess the environmental chaos the new life style has created now. While the problem is not as serious as it is so in urban areas today, the onset of this culture indicates a gloomy future even for the rural areas.

CONCLUSION

It is obvious from the above comparison that the village has become increasingly independent of its habitat and is orienting itself to the urban style of life. This orientation has been successful to a large extent due to the surplus generated from cardamom cultivation, which is found very lucrative today. Even the migrant labourers who come from Nepal are believed to make a lot of money every year through this crop. The villagers often say that the labourers reach the village on foot but they return home on hired taxis.

This is not a simple case of decreased dependence on the local habitat. With this one also notices a depletion of what is called 'eco-piety' among the people. It is this which is responsible for the rampant use of non-degradable articles by them. And there seems no realization of the harm it is causing and going to cause to their ecology. As a matter of fact, there seems a race towards consumerism threatening not only their traditional values but also jeopardising their environment.

If the present trend continues, the future holds bleak prospects for them. However, there is a silver lining in their horizon. This is clear from their recent protests against the 1200 MW Teesta project, which has been cleared by the state government on June 6, 1995. Athup Lepcha, a resident of Lingthem village, former minister, and the Chairman of the Sikkim Tribal Salvation Council, says that this projects will "uproot the tribals from their homeland" (Sikkim Observer Aug 26, 1995). Since the main work of this project is to be carried out in Dzongu, North Sikkim the fear of the Lepchas who constitute about 99 per cent of the population there is perhaps not unfounded. Experience elsewhere has also shown that displacement due to such projects is never attended to carefully and the worst sufferers are the poor residents of the area thus affected.

KEY WORDS AND ABSTRACT

KEY WORDS Bio-degradable. Change. Dependence. Habitat. Lepcha. Reserve.

ABSTRACT This study deals with the changing habitat of the Lepchas living in a village called Lingthem, which is located in Dzongu, North Sikkim. The benchmark for studying change is provided by two studies on the village conducted in early 1937. The changes in their habitat are noted on the basis of a restudy of the village by the author during 1987-90. This study shows that in the last 50 years or so the dependence of the villagers on their habitat has decreased considerably along with the disappearance of the forest from their vicinity. This delinking between the villagers and their habitat has resulted in a life style which is giving rise to accumulation of non bio-degradable articles in the village and loss of eco-piety.

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Author's Address : **Rip Roshina Gowloog,** Assistant Anthropologist, Anthropological Survey of India, North East Regional Centre, Shillong 793 003, Meghalaya, India

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