



Library

IAS, Shimla

630.9541 N 811 S



00059643

Price Rs.15/-

SHIFTING CULTIVATION IN NORTH EAST INDIA

North East India Council For
Social Science Research

B. T. HOSTEL, SHILLONG - 793 003
MEGHALAYA

630.9541
N 811 S

630.9541
N 811 S

100

100

100

100

100

100

100

SHIFTING CULTIVATION IN NORTH EAST INDIA



North East India Council For
Social Science Research
B. T. HOSTEL, SHILLONG - 793 003
MEGHALAYA



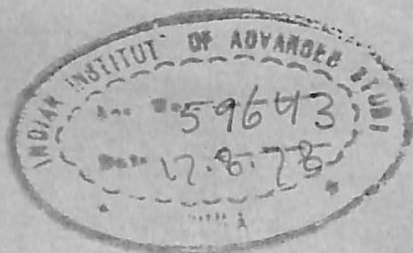
Library

IAS, Shimla

630.9541 N 811 S



00059643



630.9541
N 811 S

Preface

A two-day seminar on the Socio-Economic Problems of the Shifting Cultivation in North-East India with special reference to Meghalaya was held by North-East India Council for Social Science Research on 18-19 June 1976 at Shillong. A macro-level study of the problems of integrated development of North-East India was made by this Research Council in March 1975 which was followed by a micro-level study of the problems and prospects of the Tea plantation industry of the region in November 1975. This seminar is its third attempt to study the problems of the region.

The Shifting Cultivation is an important agricultural practice of the hill region on North-East India. It is not only a source of livelihood for half a million families of Tripura, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Arunachal Pradesh, it is intimately connected with their life-cycle.

The main theme of the seminar was divided into four panel discussions : (a) Historical and Sociological, (b) Economic, (c) Ecological and Technological, (d) Open Panel. Prof. M.C. Goswami, Professor of Anthropology, Gauhati University, Dr. P.C. Goswami, Professor of Agricultural Economics, Assam Agricultural University, Jorhat, Dr. D.N. Barthakur, Director, Indian Council of Agricultural Research Complex, North-Eastern Hill Region, Shillong and Dr. G.S. Arora, Professor of Sociology, North-Eastern Hill University, Shillong, presided over different panel discussions. Mr. B.M. Pugh, an eminent Agronomist of this region presided over the concluding session. Dr. D.D. Narula, Director, Indian Council of Social Science Research, New Delhi inaugurated the Seminar which was presided over by Dr. P. Goswami, Professor of Folk-Lore Research, Gauhati University. Dr. K. Alam, Prof. S. Sen, Dr. B.P. Misra, Prof. B.B. Dutta, Dr. N. Saha and Dr. R. P. Awasthi were Rapporteurs for the various sessions. A large number of field experts, economists, sociologists, anthropologists, soil scientists, animal husbandrymen, foresters, soil conservation engineers, social scientists and social workers from different parts of the country attended the seminar. We are thankful to all of them.

Although a number of studies have been made on the problems of shifting cultivation, hardly any study has been made from multidisciplinary point of view. A close look at the list of participants given in the appendix reveals the multidisciplinary nature of approach.

All papers read in the seminar are included here in the book. The consensus of the seminar may be seen in the appendix. The note of Mr. P.R. Mawthoh is also added to in the appendix as the paper reached us late.

Captain Williamson A. Sangma, Chief Minister of Meghalaya, Dr. M.S. Swaminathan, Director-General, Indian Council of Agricultural Research, New Delhi, Prof. Barun De, Hon. Director, Indian Council of Social Science Research, Eastern Regional Centre, Calcutta, Mr. K.M. Mirani, Secretary, North-Eastern Council, Shillong took keen interest in the seminar. We are grateful to them. We are particularly grateful to Mr. K.K. Sinha, I.A.S., Secretary, Department of Agricultural, Meghalaya, Mr. P.S. Ingty, Director, Soil Conservation Meghalaya, Dr. D.D. Narula, Director, ICSSR, New Delhi, Dr. D.N. Barthakur, Director, ICAR Research Complex, Shillong, Dr. M. Aram, Director, Nagaland Peace Centre, Kohima and

Rev. Brother R. B. Vieyra, Principal, St. Edmund's College, Shillong for their help and assistance for the success of the seminar. We thank Mr. M. Chakravarty, Manager, Ri-Khasi Press, Shillong for bringing out the seminar papers in record time. We take this opportunity to thank all our friends and well wishers for their very constructive support to all our work.

Shillong.
10 December 1976.

B. Pakem
J.B. Bhattacharjee
B.B. Dutta
B. Datta Ray.

C O N T E N T S

1. The Prehistoric Background of Shifting Cultivation : <i>Dr. Tarun C. Sharma.</i>	1
2. Shifting Cultivation : A Plea for New Strategies : <i>Prof. P. K. Bhowmick</i>	5
3. Shifting Cultivation, Is It A way of Life ? An Analysis of Garo Data : <i>Dr. D. N. Majumdar</i>	11
4. Levels of Production and Income under Shifting Cultivation in North-East India : <i>Dr. Niranjan Saha</i>	15
5. Socio-Economic Problem of Transition from Shifting to Sedentary Cultivation in North-East India : <i>Dr. J. B. Ganguly</i>	21
6. Settled Agriculture in areas of Shifting Cultivation : <i>Dr. S. K. Mukherjee</i>	28
7. Practice of Shifting Cultivation in North-East India : <i>Dr. Satya Dev Jha</i>	31
8. An Integrated Approach for Treating the Lands Subject to Shifting Cultivation : <i>D. C. Das</i>	34
9. Plant Pioneers in a Jhum Field and their role in Soil Conservation and Soil Fertility : <i>Dr. R. P. M. Bordoloi</i>	40
10. Shifting Cultivation and Evolution of Flora : <i>Dr. S. K. Jain, P. K. Hajra,</i> <i>Dr. G. H. Bhaumik</i>	43
11. Animal Husbandry as a Subsidiary Source of Economy for Jhumians : <i>Dr. D. J. Roy, Dr. A. Verma</i>	47
12. Soil and Water Conservation Technology for Jhum Land : <i>A. Singh, Dr. R. N. Prasad</i>	52
13. Management of Land and Water Resources of Jhum affected area of North-Eastern Region : <i>Dr. R. N. Rai</i>	58
14. Alternative Systems of Farming for increasing Productivity in Jhum Land, <i>Dr. D. N. Borthakur, R. P. Awasthi, Dr. S. P. Ghosh</i>	63
15. Impact of Shifting Cultivation on Wild Life in Meghalaya : <i>S. Biswas, Dr. A. K. Ghosh</i>	77
16. A Positive Approach to the Problem of Shifting Cultivation in Eastern India & a few suggestions to the Policy makers: <i>Beniprasanna Misra</i>	80
17. Development and change in an area under Shifting Cultivation. <i>Dr. Saradindu Bose</i>	92
18. Shifting Cultivation-Maladies & Remedies : <i>Dr. G. P. Gupta</i>	99
19. The Problems of Rehabilitation of the Jhumia Families in the Hill Areas of Assam : <i>B. N. Bordoloi</i>	101
20. The Burning Problems of Shifting Cultivation (Jhumming) in Meghalaya : <i>P. R. Mawthoh</i>	10

100
100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

100

The Prehistoric background of Shifting Cultivation

Dr. Tarun C. Sharma
Gauhati University.

Abstract :

The origin of shifting cultivation could be traced back to the Neolithic period dated to c. 7000 B.C. on the basis of archaeological data. This marked a revolutionary change in human societies from food-gathering to food-production. It is interesting to note that this method of cultivation still persists among many primitive communities of the world. These primitive agriculturists use very simple agricultural tools such as, digging stick, hoe and iron knives. The prehistoric shifting cultivators used stone axes and hoes. Among the present day shifting cultivators, the agricultural operations remain unchanged, the only appreciable change, we notice among them is in the level of equipments i.e. the stone tools of the prehistoric farmers are replaced by iron tools in the present day. The causes of continuity of this prehistoric system are linked up with the ecological, economic and cultural factors. This speaks well as to why many of the new methods of cultivation recently introduced in the tribal societies are yet to generate the process of cultural acceptability.

Introduction :

We learn from the recent archaeological and Palaeontological discoveries in East Africa that humanity on our planet is 3.5 million years old. The radioactive dating methods, which are the recent innovations in Archaeological Studies, have pushed the age of man from the previous estimated date of one million years to such a long antiquity. For more than 99.9 per cent of the total span of humanity, on earth, man was a parasite. Being ignorant about the techniques of food-production he had to depend for his subsistence entirely on the wild animals and plants. He lived by hunting wild animals and by gathering roots and tubers of wild plants. On technological level, he is regarded as a Stone Age man, because, being ignorant about metal, he utilised stone for fabricating tools and equipments. The nature of the subsistence pattern demands that he must lead a nomadic life. Throughout the vast era of Stone Age, man had made no fundamental change in his attitude to the external world i.e. Nature. He had remained content with what the Nature could offer him.

It is known through archaeological discoveries that by about 7000 B.C. man's attitude to his environment underwent fundamental changes. It may be accident that he took to hoe from bow, i.e. from hunters he became food producer. The effects of the productive economy as against food gathering economy of the Old Stone Age upon human societies were so impressive that they stand out to us as revolutionary innovations (Childe 1956). This had enabled prehistoric Stone Age communities to exercise control over his food supply. Man began to plant, cultivate and improve species of edible plants by selection. These prehistoric communities also experimented in domesticating wild species of goat, sheep, pig, cattle etc.

Among the food-plants cultivated by the Neolithic people rice, wheat, barley, millet, maize, yam, sweet potatoes provided staple food. The domestication of these plants from their wild species was not possible in all the areas of the world occupied at present by cultivation. The domestication of these species of plants could

take place in those areas where the wild species of these plants are available. As for example, the wild species of rice grows in a limited area of the world covering Southern China, Southeast Asia and Northeastern India. On botanical evidence, it is therefore 'logical' to seek for the domestication of this cereal plant in these areas. Similar is the case for the origin of cultivation of wheat and barley in the highlands of western Asia. It therefore follows that the idea of cultivation spread to different parts of the world from the above mentioned regions. These are therefore termed as 'Nuclear areas' of food production. As in case of the Old World there are separate nuclear areas for plant and animal domestication in Americas, mainly in the Mesoamerica.

Neolithic Methods of Cultivation :

We are primarily concerned here to delineate, if possible, by archaeological methods the techniques of food production in the prehistoric times and to examine if some of these techniques stand in the line of ancestry of some of the methods of cultivation of the modern times. Authorities are of opinion that prehistoric man before they acquired the knowledge and experience to grow plant, experimented in improving the growth of wild species by tending the seedlings. They gathered the gains of the wild species thus tended and used them to supplement their animal food collected by hunting. Archaeologists have shown that the Natufians - a mesolithic or Middle Stone Age community of former Palestine were a people of this transitional stage.

In the next stage man experimented in growing plant by sowing seeds. From the distribution of prehistoric sites of the early food producers, it is evident that the neolithic farmers were hill or highland dwellers. They cleared a patch of jungle on the hill slopes by cutting the trees, grasses and creepers with the help of the stone axes and then setting them in fire. They had no implement to till the soil as we do in case of plough cultivation. They used a dibble or a digging stick, which is a pointed tool of wood or bamboo used for making holes in the ground for planting seeds in the cleared hill slopes. When the seeds germinate weeds also grow along with the seedlings. Further, every shower of rain would wash away the loose soil from the hill slopes thus exposing the roots of the seedlings. The removal of weeds and covering the exposed roots of the seedlings comprise the main agricultural occupation of the highland cultivators. For these purposes, they used stone or wooden hoe or bamboo scrapers. In all the prehistoric sites occupied by the early farmers, we get large number of stone implements called 'celts'. These stone implements are classified as axe, adze or hoe blades. The hoe blade is generally hafted to a crooked bamboo haft by mounting the blade perpendicularly to the long axis of the haft. The survivals of wooden hoe and bamboo scraper are very rare in prehistoric sites, but the prevalence of these agricultural tools is known among the primitive farmers of the present day. V. Gordon Childe identified the neolithic farmers of the Danube valley as nomadic cultivators (Childe 1957). K.C. Chang has proved through archaeological methods that the Neolithic farmers of Formosa were shifting cultivators (Chang, 1970).

The History and Archaeology of Shifting Cultivation :

It is therefore clear that we can trace back the history of shifting cultivation to about 9000 years from the present. It is certainly a matter of great interest to us that age old prehistoric methods and techniques of food-production are still valid as the principal mode of subsistence among our tribal brethren. Although they are exposed to the forces and influences of advanced civilization with all its lures and attractions for about two hundred years, their main agricultural pattern has not changed, the only difference we observe is that the stone implements of the prehistoric shift-

ing cultivators have been replaced by iron tools with the exception of the primitive cultivators of some of the pacific islands who still use stone axes and hoes (Blackwood, 1950). Some of the Kuki tribes of Northeastern India are reported to have been using stone hoes till the middle of the last century (Godwin Austen 1875).

Shifting Cultivation in India :

It has been estimated that about 2.6 million tribal people living in the interior hilly areas practise shifting cultivation (Vidyarthi, 1975). The area covered under this type of cultivation is estimated about 1.35 million acres spread over different parts of India. This type of cultivation is wide-spread among the hill dwellers of Assam, Meghalaya, Nagaland, Mizoram, Arunachal, Manipur, Tripura, Bihar, Orissa Madhya Pradesh, Andhra Pradesh and Mysore. It is known in different areas by a variety of local names. In N. E. India it is called **Jhum**. In these wide-spread areas, there is a remarkable uniformity of the methods of cultivation. The cycle of agricultural operation in all these areas is marked by the following stages :—

- (1) Selecting the forested hilly land;
- (2) Cleaning the forest tract by cutting down the jungle;
- (3) Burning the dried forest into ashes;
- (4) Worship and sacrifice;
- (5) Dibbling and sowing of seeds;
- (6) Weeding; (7) Watching and protecting the crops;
- (8) Harvesting; (9) Thrashing and storing;
- (10) Merry making; (11) Fallowing.

The above mentioned processes speak well about the most simple and primordial nature of shifting cultivation. The digging stick used for planting seeds is undoubtedly the crudest agricultural tool used by man. It is nothing but a branch of a tree pointed at the one or both the ends. On the day of sowing which is a ceremonial day for the whole village, it is interesting to observe that the male members of each family on reaching the Jhum field early in the morning engage in preparing the digging sticks. The dibbling and planting seeds is an exclusive job of the female members. The male members sow seeds by broadcasting. There are some varieties of cereal crops, such as millet, the seeds of which is sown by broadcasting. All other varieties of corns, and vegetables are planted by dibbling.

Conclusions :

The most remarkable feature of shifting cultivation is that almost all the varieties of cereals and vegetables, are grown in one Jhum field, which is impossible in case of wet plain land. This is probably one of the reasons as to why the simple communities still cling to this method of food production. The other important factors are — (1) the mode of adaptability in an ecosystem which provides very little alternative; and (2) the tradition which dies hard. The whole gamut of primitive society is interwoven with the means of food production, which in this case, is shifting cultivation. Their way of life, training of youths, the whole social and political system, the ceremonies and festivals, in other words their philosophy of life is a product of this system of economy. Culture and society are susceptible to changes but the ecology offered by the geographical environment could hardly be changed. This speaks well as to why many of the new methods of cultivation recently introduced in the tribal areas are yet to generate the process of cultural acceptability.

REFERENCES :

- | | | |
|----------------------|------|---|
| BLACKWOOD, B. | 1950 | The Technology of a Modern Stone Age People in New Guinea , Oxford University Press. |
| CHANG, K.C. | 1970 | The beginnings of Agriculture in the Far East Antiquity , 44:175-85. |
| CHILDE, V. GORDON | 1956 | Man Makes Himself , (3d ed) Watts & Co., London. |
| ————— | 1957 | The Dawn of European Civilization , (6th ed). London. |
| CONKLIN, H.C. | 1961 | The Study of Shifting Cultivation, Current Anthropology 2 :1. |
| GODWIN -AUSTEN, H.H. | 1875 | A Celt found at the Khasi Hills at Shillong, Proc. Asiatic Soc. Beng. |
| VIDYARTHI, L.P. | 1975 | The Future of Traditional Primitive Societies : a case study of an Indian Shifting Cultivation Society, The Eastern Anthropologist 28 (4). |

Shifting Cultivation : A Plea for New Strategies

Prof. P. K. Bhowmik, M.Sc., Ph. D., D. Sc.,
Calcutta University.

The backward communities, the Scheduled Castes and the Scheduled Tribes, have drawn the special attention of the Government of Free India. If we believe in India's national solidarity we are to subscribe to the view that all the different parts of it should move forward conjointly. In fact, if a part of the nation lags behind, it will be hanging like a deadweight from the rest of the country. Hence making suitable arrangements to enable the backward people to move along with others to integrate themselves with the mainstream of the national life is necessary. The economic development of these groups of people, therefore, is a must.

The present paper seeks to deal with the economic problem of the hill people centering around the shifting cultivation. According to many, shifting cultivation is the natural way of life of some Tribal people—the natural source of earning their livelihood. According to others, shifting cultivation is detrimental to forest economy—therefore, to national economy—as it leads to wanton destruction of forest and the resultant erosion of soil, etc. One should consider the problem as a part of the broader socio-cultural milieu and an eco-technological system. In the first part of the paper a description of the way of life of the shifting cultivators and the ecological system they belong to, are, in brief, described. The second part deals with the arguments for and against the shifting cultivation. In the final part of the paper certain suggestions are offered by the author in relation to the problem. With the emphasis on Social Planning in India there has been a shifting emphasis on the shifting cultivation—a traditional technique of primitive farming adopted by different tribal communities in many parts of the Indian sub-Continent.

I

Shifting cultivation is described as slash-and-burn or swidden in the English language whereas in India, the process of shifting cultivation is differently known in different tribal belts. In north-east India it is known as **Jhum** or **Jum**; in Orissa as **Podu**, **Dabi**, **Koman** or **Bringa**; in Bastar as **Deppa**; **Kumari**, in Western Ghats; **Watra**, in S.E. Rajasthan; the Maria call it **Penda**; **Bewar** or **Dahia** in Madhya Pradesh. The shifting cultivation is prevalent in other parts of the world, specially in Sumatra, Northern Burma, Borneo, New Guinea and in many parts of the African continent. The usual process demands the selection of a plot on or near the hill side or jungle. Then, after winter, it is cleared off by felling of tress and lopping off the under growth which are left for drying. Shortly dry leaves and bushes are set on fire to turn these to ashes which are scattered over the ground. Very simple implements like dibble or digging sticks or bill hooks are used to make holes for the seeds. No animal is employed, there is no artificial irrigational system, initial investment is very little. A little earth is covered over the holes and after rain seeds begin to sprout and when ripe is harvested. After raising the crops twice or thrice, the plot is shifted to another place due to loss of fertility of the soil; the old one is left for years to recuperate. Period of recovery varies from place to place, with a range between four and twenty years. In conformity with the ecological condition and the technological knowledge of the people there are specific implements which are intimately associated with the jhum cultivation in the

eastern and the north-eastern frontier of India. A list of implements mentioning the scope of their utilization in the process of cultivation may be noted as under :—

Table - 1
Implements used :

Name of implement	Primary use	Secondary use
1. Axe	For felling the big trees while jungle is cleared for cultivation	Occasionally it is used as an adze for giving concrete shape to the wooden handles of the implements associated with cultivation
2. Dao	(i) It is used for clearing jungles particularly the branches of the trees and undergrowth (ii) It is used for making holes for planting the seeds in the jhum field	(i) It is occasionally used for removing the unwanted weeds by cutting them off from their stems (ii) Sometimes it is used for preparing the handles of the agricultural implements.
3. Hoc	It is used primarily for turning up the soil to make the field ready for cultivation	(i) It is sometimes used for clod-crushing with the blunt side which receives the handle. (ii) It is also used for levelling the ground, repairing the ridges and for removing unwanted weeds by scraping as well
4. Digging stick	It is specially used for making holes on the ground for planting the seeds	(i) Sometimes it is used for clod-crushing purposes. (ii) Occasionally the digging stick is used for destroying the unwanted weeds in the jhum field by beating them so as to remove the leafy portion from the stem
5. Clod crusher	It is used for crushing the clods in the field	
6. Rake	It is used for collecting together the leaves small branches, unwanted weeds which are distributed scatteredly all over the field	
7. Winnoing fan	It is used for separating the food grains from the unwanted particles of the waste products	
8. Sieve	It is also used for the same purpose	

Bose noted that in different parts the process or technique of cultivation is the same and more or less uniform though rainfall and topography and the nature of crops vary. It has been estimated that about 26 lakhs of people practise shifting cultivation in various States and Union Territories of India like Nagaland, Arunachal, Manipur, Tripura, Orissa, Bihar, Madhya Pradesh, Andhra Pradesh, Tamil-Nadu, Maharashtra, Mysore (Karnataka) and Kerala. According to the Report of the Commission for the Scheduled Castes and Scheduled Tribes (1960-61) total area under such cultivation may be estimated to be 14 lakh acres (Since land changed due to rotation hence total area estimated must be 5 times the actual area under cultivation at any particular time).

Crops vary from area to area. The hill tribes of Assam, Meghalaya, Arunachal, Nagaland, Manipur, Mizoram and Tripura produce various agricultural products in their jhum field. The produce food grains, vegetables and also cash crops. Among the foodgrains coarse varieties of rice is the 'principal crop followed by maize, millet, job's tears etc. Cotton is another important product of the jhum field. Potatoes in certain places has been introduced recently. Among the vegetables, pumpkins, cucumbers, yams, arum are mainly cultivated. Besides these varieties, tobacco, chillies, ginger, indigo, etc. are also occasionally cultivated. By and large, these produces are sold in the market by which the people get cash money or other daily commodities though food crops are consumed by the people.

Other factors are also involved specially, some magico-religious activities in connection with many communities in selecting the sites. Joint endeavour or mutual aid in preparing the field, for harvesting is in vogue in many commodities.

II

There are two divergent views regarding shifting cultivation : the first of which appears to be a narrower one, and the second, according to the author, seems to be a more liberal and humane.

Shifting cultivation, it is not denied, does some damage to the forest. It, therefore, proved to be a perpetual bugbear to Forest Department. According to it, it is ruinous and wasteful. It dries up the springs of the hills, causes soil waste-erosion; destroys valuable forest; adversely affects rainfall and deprives the 'people of the benefits of the forest produce.

Mr. Nicholson, one time Conservator of Forests in Orissa, giving evidence before the partially Excluded Areas Enquiry Committee of Orissa, observed that "The **Damage** done to the forests by shifting cultivation was **serious** and **only under certain conditions** where the area of land available is large and population small **such cultivation does little harm**" (Emphasis added).

Dr. M. L. Bor, Botanist of the Forest Research Institute, Dehradun remarked in his presidential address to the Botany Section of the Indian Science Congress, "of all practices initiated by men, the most anxious is that of shifting cultivation." Anyway, how far such a view is correct is a point for examination and in the subsequent part of this paper the view has been examined.

The other view, which is modern and more liberal, considers the practice as an organic response of the people engaged in it to certain specific ecological condition, rather to a particular eco-techno system. Here Shri M.D. Chaturvedi's opinion may be taken as a representative statement : "The notion widely held that shifting cultivation is responsible in the main for large-scale soil-erosion needs to be effectively dispelled. The correct approach . . . lies in accepting it not as a necessary evil, but re-

organising it as way of life; not condemning as an evil practice, but regarding it as an agricultural practice evolved as a reflex to the physiological character of land."

Those who subscribe to the opinion that shifting cultivation results into soil erosion will find it disquieting that shifting cultivation is a response of the tribal people of the hill areas to the problem of erosion of fertile top soil of steep slopes. As Mr. M.S. Shivaraman, Adviser to the Programme Administration of the Planning Commission, observed in 1957 : "It is a mistake to assume that shifting cultivation in itself is unscientific land use. Actually, it is a practical approach to certain inherent difficulties in preparing a proper seedbed in steep slopes where any disturbance of the surface by hoeing or ploughing will result in washing away of the fertile top soil. The tribal people, therefore, take care not to plough or disturb the soil before sowing. The destruction of weeds and improvement of tilth necessary for a proper seedbed are achieved with the help of fire In most of the interior areas, where communication is not developed and not sufficient land suitable for terracing is available jhuming alone can be done for the present and as such every effort should be made to improve the fertility of the jhumed land."

Mr. S.H. Howard, another former Inspector-general of Forests, recommended regulation, and not abolition, of shifting cultivation, "Which means that if a longer period of rest is given between the fellings, there is little danger of soil erosion." Almost a similar view was shared by Mr. J.P. Mills.

The author likes to close this section with an emphasis on the practical aspect of the problem. The hard fact is that nearly 10 per cent of the tribal population (according to the Dhebar Commission) depends on jhuming, and they cannot be deprived of their land, their livelihood and their way of use on the basis of some theoretical opinion which is not shared by all the scholars alike. May be, shifting cultivation is not an ideal method. It is crude but it is interlaced with the way of life of people who possess a crude technology and a very little capital. At the same time the problem of soil erosion is there, the problem of improving the techniques of exploiting nature remains. Shifting cultivation cannot be wiped out with a stroke of pen by the legislators. It will take a lot of time to replace the system totally. In the meantime, the proper course is to regulate it, experiment with it, improve it, and, what is most important, try other alternatives.

III

One of the chief objections raised against shifting cultivation is that it leads to deforestation, as the hill people who engage in shifting cultivation indiscriminately destroy the trees, the forest. As trees are destroyed, erosion of soil takes place and it is only one of the hazards of deforestation. The author's humble question is : while shifting cultivation had been pure used by the hill people through the centuries, did it create any ecological imbalance? Or, do we face the crisis of ecological imbalance caused by deforestation by contractors sanctioned by the Government ? A lot of plain-speaking is needed. And what do we find in reality ? While the hill people have to depend on shifting cultivation for sheer sustenance, for survival, and, therefore, cause some amount of deforestation, we, the gentlemen, raise a hue and cry : 'they' are destroying the forest. But when contractors destroy the forest for collecting timber for furnishing the quarters of gentlemen, for their multi-storied building, for providing the slippers for the railways used by them, we miss the fact that deforestation is caused by these contractors as well. Here the author insists on the Government's and the Social Scientists' making a survey or enquiry in order to examine how much of deforestation is caused by shifting

cultivation and how much of it is done through the activities of the contractors enjoying licence from the Government.

A charge allied to the first one is that the tribal people who are engaged in shifting cultivation fell trees indiscriminately. This charge has not a very solid foundation. The author wonders how one misses the fact that the tribal people have a very close link with nature, with the forest, and, they too, are lovers of trees. In fact these people draw their sustenance not only from shifting cultivation but from different kinds of forest produce. Naturally, they, for their own interest, would not destroy trees indiscriminately : they would save those trees wherefrom they get fruits or other things which they can use for their own purpose. One may take the instance of the Samanths of Andhra Pradesh, for whom 'podu' (shifting) cultivation is the major source of livelihood (Tribal Cultural Research and Training Institute, 1972 : Ch. IV). It is found that the Samanths also collect roots, tubers and herbs for their livelihood. They preserve and not destroy them. Secondly, the food also includes Caryota Palm products. These caryota palms "are found on the mountain slopes. The Samanths do not fell the trees on the hill slopes when the clear for 'Podu' cultivation" (Ibid., 48). The same applies to Mango, and jack trees, the fruits of which are important constituents of the Samanths, and to Tamarind trees produce of which has both a dietary and commercial value for the Samanths. Then, as the author has been informed, in Manipur, groups of people engaged in shifting cultivation do not destroy but presume and grow with care those trees which have a commercial value. In fact, When they fell such trees, they do it for meeting the costs of running schools for their children and other welfare schemes.

Now, the author likes to draw the attention to one basic problem. These tribal people engage in shifting cultivation for earning their livelihood. With a lot of labour they make an area cultivable. In fact, thanks to their peculiar efforts the slopy ridges turn into terraces. Now once this terracing is done, it is found that non-tribal people occupy the terraced plots of land, and thus force the tribals to have recourse to activities that may prove to be detrimental to the forest. Now, should those people, who are critical of the tribals, take some measures for stopping the ouster of the tribals from the ground which was prepared through their untiring toil ?

Another problem of these people is that because of the absence of adequate marketing facilities, these tribals do not get adequate price for the commodities they sell. In fact, they are forced by circumstances to sell whatever they have to sell to the 'middlemen' at throw away prices. Where would these people then go? What steps have been thought of for putting a stop to this exploitation by the middlemen ? We have passed zemindary Abolition Acts. Why don't we pass laws for abolition of middlemen system in the sphere of tribal economy ?

Most of the times these tribals suffer because of lack of proper marketing facilities and communication facilities. They have to travel a long way for collecting some bare necessities of their life. And a portion of whatever little they earn is wasted on the way. The Government can make arrangement for making the necessities of life available to them, say, through micro-growth centres or corporations for tribal development like the Girijan Corporation of Andhra.

Then, as it is evident from what has been said a little earlier the tribals like to preserve many trees. And arrangements may be made so that trees loved or liked by these tribals grow or are grown in the areas where these people are allegedly found causing deforestation. These tribals may be introduced to the cash crops and attempts should be made to enable them to appreciate the value of these.

If one forcibly stops shifting cultivation it is commonsense that one should

also think in terms of providing people dependent on it with alternative means of livelihood. Naturally, measures should be taken to see that these tribal groups are trained in other types of occupation. They should be given training in raising trees protecting plantations and trees etc. Cottage and Small Industries and indigenous handicrafts should be developed in tribal areas. One should see to the fact that the tribal people get jobs there and they are not exploited.

They should be given an education which is in tune with the eco-techno system they belong to. Their love for nature and forest should be reinforced through the education. It should be ensured that they can utilise the education and training they receive for enriching their life.

The thrust of the paper is laid on the fact that shifting cultivation should not be viewed simply as a menace but as a part of the way of life of the people in it. Then and then only the rational behind it and the nature of it can be understood. And once this understanding is there, the 'modern people', the rational people can come out of the grooves of their own prejudice. The shifting cultivators are not wanton annihilators of trees and forests. They have something with them which many of the plain people, particularly intelligent and modern people of our country lack in. The story of co-operative movement is not one of success despite tremendous effort and huge expenditure incurred by the Government. But these tribals have an element of mutual effort and dependence among them. This cooperative feeling which is ingrained in them can be fostered, if effort is made by the Government. It is no use blaming the shifting cultivators for deforestation. Provide them with some alternatives which must be in tune with their broader way of life, their social system, which is interlaced with the ecological system they belong to, they will not destroy the forest; wipe out their hunger, poverty and exploitation and yet preserve and foster their basic principle of mutual aid and corporate spirit.

References :

- | | | |
|-----------------|--------|---|
| Bhowmick, P.K. | (1969) | Economy and society of the Primitive people of India Cultural Forum : Ministry of Ed. Govt. of India, New Delhi. |
| Bose, N.K. | (1971) | Tribal life in India, New Delhi. |
| Bose, Saradindu | (1968) | Carrying capacity of land under shifting cultivation, Cal. |
| Dhebar, U.N. | (1961) | Report of the scheduled Areas and scheduled Tribes commission, New Delhi. |
| Gohain B.C. | (1953) | Shifting cultivation among the Abors. |
| Mahapatra, L.K. | (1953) | Shifting cultivation in Orissa. |
| Pratap, D.R. | (1972) | The Samanthalas of Andhra Pradesh, Hyderabad. |

Report of the second conference for Tribes and tribal (scheduled) Areas. 1953, New Delhi.

Shifting Cultivation, it it A Way Of Life ? An Analysis Of Garo Data

Dr. D.N. Majumdar,
University of Gauhati.

Every human being belongs to a group which has its culture. The material artifacts which he employs to make a living or to protect himself from the elements form the material part of his culture. His beliefs concerning his relationship with nature, rules and regulations governing his relationship with other individuals; his attitudes, his values all form the nonmaterial aspect of his culture. In short, the way of life he shares with other members of his group is his culture. Gittler's (1952) remark that "a particular consists of a mode of life characteristic of a particular society" is relevant in this respect. We want to emphasize here that the totality of culture, and not a part of it, is the way of life of a particular group.

When we say that culture is nothing but the sumtotal of the lifeway, we do not imply that whether it is culture or the lifeway, is temporally fixed. Any culture is liable to change from one point of time to another. No culture can remain static. The conditions which make a culture to exist change, and alongwith these the culture is also bound to change. According to Nisbet (1969) change is one of the natures of culture. He also considers change as immanent; there are forces within the culture itself which provide dynamism. In this connection he quotes Leibniz: "I mean that each created being is pregnant with its future state, and that it naturally follows a certain course if nothing hinders it". Nisbet also thinks that change is a necessity in all societies. As change is inherent in culture, so also its capability to accept and absorb change. Culture satisfies the basic needs of most of the individuals who are bearers of that culture. But these basic needs do not remain static. In this connection Linton (1940: p 467) says:

"Under normal conditions every culture insures the survival of the society which bears it and also the contentment of most of the society's members. However, the adaptation which it provides are so perfect that they cannot be improved upon nor are they ever completely satisfactory to all the society's members. Imperfection of cultural adaptations result in individual discomforts and these, in turn, provide the motives for culture change."

The cause of culture change may lie within the culture (some inconsistencies due to changed circumstances) or may be external to it. When the geographical environment changes the culture is bound to change to adjust itself to the changed environment; or also, the culture may change by imitation to an external culture. Sometimes these two factors may combine; when the geographical environment changes, the culture strives to adjust itself, and if it finds an existing model of adjustment it imitates the model, because, it saves the effort to invent a means for adjustment. The Garos' adoption of plough cultivation is a change of this nature. Due to denudation of forests as a result of repeated use for shifting cultivation, caused by increase of population caused the Garos to seek some better method of cultivation to suit the new needs and they found that the neighbouring communities were already practising plough cultivation and so it was easy for them to adopt this method of cultivation.

At a particular moment each culture is suited to its geographical environment. When the geographical environment changes two alternatives face the culture: either to modify the culture to suit the new needs it to face the consequences of maladjustment between culture and nature. Naturally a culture accepts the first alternative. There is no denial of the fact that culture is a way of life — but the whole of it. As culture is changeable so also the way of life. Those who propounded the theory of shifting cultivation as a way of life made the fallacy of considering a part as the whole. However, if we think that shifting cultivation was so important that all other activities centred round it (this is true not only about the shifting cultivators, but is equally true about all the peasant cultures), still we have no reason to think that when shifting cultivation becomes obsolete they should stick to other social activities connected with it.

The ideology that any change in shifting cultivation is undesirable involves some sort of ethnocentrism. Such ideologists make a tacit distinction between two categories of cultures: cultures where change should be considered as natural (e.g. occidental culture) and cultures where change is undesirable (i.e. isolated cultures away from the major cultural streams of the world). Another principle is implicit in these ideologies: smaller cultures have no right to determine their own course. This is nothing but a big-brotherly attitude. Course of cultures cannot and need not be dictated. Course of cultures is determined by a juxtaposition of circumstances and also change in a culture is affected by the values, conveniences and inhibitions of the bearers. The right of the bearers of a culture to decide what they would accept and what they would reject has been clearly upheld by the great action anthropologist Sol Tax (1958:1-19):

“Freedom in our context means usually freedom for individuals to choose the group with which to identify, and freedom for a community to choose its way of life But to impose our choices on the assumption that “we know better than they do what is good for them” not only restricts their freedom but is likely to turn out to be empirically wrong.”

shifting Cultivation and Traditional Garo Culture :

According to traditional Garo belief the first man to settle in the Garo habitat was Bone Nirepa Jane Nitepa (Rongmuthu 1960), who was also the first man to start shifting cultivation in which he was aided by the deity Misipa. There are archaeological evidences to show that in very early times shifting cultivation was practised in the Garo habitat. Neolithic celts of various sizes and shapes have been found all over the Garo habitat and this stone implement is very much like the iron hoe used by the Garos of the present day. There is no doubt about the fact that only slash and burn cultivation is possible with such a tiny implement. Due to lack of adequate archaeological evidence it has not yet been possible to establish conclusively that the neolithic tool makers were the forefathers of the present day Garos. But there is no doubt about the fact that the forefathers of the present day Garos were shifting cultivators. All cultures necessarily have intimate links with the mode of subsistence. Rather cultural forms revolve round the mode of subsistence. As in other preliterate cultures (King 1954:52-53; Noss 1969:4) traditional Garo religion was nothing but a way to obtain bumper crops and to keep away diseases and disasters. Hence, all operations of shifting cultivation were performed with religious awe and the series of annual rites and festivals were linked with different stages of shifting cultivation. After allocation of plots each household performed a religious rite in the plot. The **agalmaka** rites marked burning and planting. The **mi-amua** rites are performed by the **nokma** (representative of the land owning clan) at the time of fruiting of the rice plants. The **rongchugala** and **ahia** rites mark the lifting of taboo on certain plants and vegetables of the shifting cultivation. The agricultural activities of the year culminated in the **gand wangala** rites and festivities to mark the end of harvest and also to mark the close of the agricultural season. **Wangala** rites

are performed in honour of **Saljong**, the Sun-god, who is the ultimate bestower of crops. All these rites involve festivities, in which rich man can demonstrate their wealth which adds to their prestige. The concept of ownership of land is associated with shifting cultivation. Land is owned by a particular lineage, the elderly male members of which act as a corporate group as regards utilization of land. Though land is considered to be the property of a particular lineage, every member of the village community (whether he or his wife belongs to the land-owning lineage or not) has the usufructuary right to cultivate in the land. The usufructuaries of land acts as a corporate group (having political functions) with the **nokma** as its head. Now, interestingly enough, though the **nokma** does not belong to the land owning lineage, he has to be an affine of that particular lineage. Thus power was distributed among the **nokma**, the land owning lineage and the village community in general and there was a perfect balance of power.

Utilization of plots of shifting cultivation as common property of the village community does not negate private ownership of other forms of property. Here I must contradict a notion held by some administrators and social workers that as the Garos are 'shifting' cultivators, their villages are 'temporary'. Garo villages are very much permanent. A village is abandoned only when some calamity strikes it. Garos have very clear notion about individual property (Goswami and Majumdar 1972).

Are the Links between Shifting Cultivation and Traditional Garo Culture Absolute ?

From the preceeding section it becomes clear that traditional Garo culture was in complete harmony with shifting cultivation. But when they found that shifting cultivation was inadequate to serve their purpose and when they realized that there are other methods of cultivation more efficient than their traditional method, they readily accepted the new method without thinking about the links — only social scientists and over jealous social workers think about the links. Nobody had to persuade them to accept plough cultivation. They first willingly accepted the innovation and then gradually made necessary adjustments in their traditional culture. Now a large proportion of Garos are plough cultivators (in the plains areas cent percent of them are plough cultivators). Even in the hills the shifting cultivators have opened up large tracts for permanent plough cultivation. People in these areas who have retained the traditional faith have not found permanent cultivation incompatible with their traditional faith. However, most of such people still retain shifting cultivation, the reason for which is not a desire to keep the link unbroken, but to keep the womenfolk employed in some gainful occupation (Majumdar 1976). Fortunately as they have retained shifting cultivation, no major adjustment in their traditional religion has become necessary. They perform the traditional rites and festivals in consonance with shifting cultivation or whatever has remained of it. It may be asked here what will happen when the last vestiges of shifting cultivation fades away. Neither the well wishers of the Garos, nor the Garos themselves should bother about this. When a level of adjustment becomes disbalanced a new level of adjustment comes into being (Radcliffe Brown 1958). Even if they ultimately give up all their traditional rites, we need not mourn it as the death of a 'grand way of life'. Importance of religious rites and performances is directly variable to their importance in the day to day life of the people. It is an empirical fact that even among the Garos having no weakness towards Christianity, the importance of traditional rites and festivals is decreasing alongwith the decline of shifting cultivation.

Bibliography :

- Gittler, Joseph B. 1952. *Social Dynamics. Principles and Cases in Introductory Sociology.* McGraw Hill.
 Goswami, M.C. & Majumdar, D.N. 1972. *Social Institutions of the Garo of Meghalaya. An Analytical Study.* Calcutta.

- King, Winston L. 1954. **Introduction to Religion**. Harper and Row.
- Linton, Ralph. 1940. **Acculturation in Seven American Indian Tribes**. D. Appleton-Century Co.
- Majumdar, D.N. (in press). 1976. 'Economic Changes among the Garos of Meghalaya' **North Eastern Research Bulletin**.
- Nisbet, Robert A. 1969. **Social Change and History, Aspects of the Western Theory of Development**.
- Noss, John B. 1969. **Man's Religion**. London.
- Radcliffe Brown, A.R. (ed Srinivas, M.N.). 1958. **Method in Social Anthropology**. Bombay.
- Rongmuthu, Dewan Sing. 1960. **Folk-Tales of the Garos**. Univ. Gauhati.
- Sol Tax. 1958. 'Values in Action : The Fox Project', **Human Organization** 17 : 17-20.
-

Levels of Production and Income under Shifting Cultivation in North-East India

Dr. Niranjan Saha

Agro-Economic Research Centre
for North-East India, Jorhat.

Introduction :

1. Shifting cultivation known locally as **jhuming** is the predominant form of agriculture in the hill areas of N.E. India. In this region, about 15 lakhs of tribal people are of tribal people are dependent on **jhuming** for their livelihood. It is widespread in Arunachal Pradesh, Mizoram and certain parts of Nagaland, Manipur, Meghalaya and Assam. In Tripura it is in its last leg. All the hill tribes of northeast India except the Apatanis and Monpas of Arunachal Pradesh, the Angamis of Nagaland and the Hajongs of Garo Hills (Meghalaya) are shifting cultivators. But there have emerged sections of settled cultivators among most of the tribes, their proportion varying on geographical location.

2. The system of shifting cultivation is regarded as the first stage in the evolution of agriculture - the transitional stage from hunting and gathering to settled cultivation. It is a labour-intensive form with extensive use of land. The technology being primitive, the level of producing and income is low. This is why the carrying capacity of shifting cultivation is quite low even at the most simple subsistence level of living. 2

The Practices under Jhuming :

3. **Jhum** cultivation is undertaken in the hilly and undulating land mostly covered with bamboos and other secondary growth. There is no permanent field for cultivation, a plot of land is cleared and cropped once or twice (hardly thrice) and then abandoned under forest fallow. In November or early December, land is selected by the entire village on the basis of rotation of fields. During the dry winter months, from December to February, the forests on the selected patch are cut jointly or severally and left to dry. Before the onset of the monsoon in early part of April, the dry debris are burnt. After a shower or two ash settles down and the field becomes ready for sowing. The entire area is divided among the households. Soil is never ploughed. A mixture of seeds of several crops are 'put into holes made by dibble sticks or sharp knives. Seeds of some other crops are broadcast. A large variety of crops are grown in the same field. Weeding is a continuous process. Harvesting starts from the third month and continues upto December next. Thus, a complete cycle of activities is completed for the first year field. A new plot is selected for cultivation for the next year. The field used for a year may be left to forests fallow or cultivated with one or two specially selected crops. Occasionally some residual crops are collected from the abandoned fields.

1. 75% of the cultivable land 42% of the tribal population (appro. 3.50 lakhs) are under shifting cultivation in Meghalaya. (Draft Fifth Plan, Meghalaya, pp. 4 and 9).

2. For a critical estimate of carrying capacity of shifting cultivation, please refer to an article by the present author published in North Eastern Affairs, Vol. 2 No. 410 1974.

Subsidiary Occupations with Jhuming :

4. The **jhum** cultivation was once a complete economic system with several subsidiary occupations as its adjuncts. Each village was, more or less, self-sufficient in respect of food, clothes implements and housing materials. But such isolation was possible only during the period when such villages were ruled by independent chiefs. Even now the economic life in the **jhum** villages revolves round the system of **jhum** cultivation. Traditionally, hunting, fishing and gathering from Nature's stock are important subsidiary sources of food. Moreover, collection of timber, canes and bamboos for house-building and making household tools and implements remains an important source of income, though income cannot be accurately calculated. Besides these, each **jhumia** household possesses a few domesticated animals, cows or mithuns, pigs and poultry birds. Almost all hill tribes practising **jhum** do not drink milk and as such cattle breeding and dairy do not have much place in the economy. Weaving is an important female occupation supplying almost all the consumption requirements of dress, but it has now lost much of its grounds to mill-made clothes.

5. **Jhuming** and its associated activities though remain the chief sources of income of certain hill tribes of N.E. India. These are no longer able to provide even the bare subsistence. This is why some non-traditional occupations are finding favour with the **jhumias**. The most important non-traditional occupation is the employment as wage labour. Under the pure **jhum** economy, nobody offers labour for hire but there are indications from village survey reports that the **jhumias** have been adopting some non-traditional occupations. The emerging pattern of income from different sources in the hill villages in northeast India can be had from data given in Table I which presents data on the percentage contributions of different occupations in the village income of some hill villages.

6. It will be found from the Table that there is wide range of variations in respect of contribution of **jhuming** to the total village income of different hill villages. It contributes more than 50% of the total village income in all the surveyed villages except Mawtnum (Khasi Hills) and Banshidua (Garo Hills). Kanther Terang, a Mikir village near Dipu, the headquarters of the Mikir Hills district of Assam has all the characteristics of a **jhum** economy. Mawtnum, a Khasi village located in the Bhoi area of Khasi Hills beside the Shillong-Gauhati Road and Banshidua, a Garo village near Phulbari, a growing urban centre in Garo Hills are no longer dependent on **jhuming** and its associate occupations. Settled farming and horticulture contribute bulk of the income in these villages. In Mawtnum, animal husbandry and dairying contribute substantial income. Comparatively, the economy of Hmunpui in Mizoram, Agalgri in Garo Hills (Meghalaya), Pakam and Khonsa in Arunachal Pradesh is dominated by **jhuming** aided by some non-traditional occupations. Pakam, a Gallong village in Arunachal Pradesh has, of course, a good source of income from settled farming.

7. **Jhuming** has been passing through a critical phase and situation varies from area to area depending on the **jhum** cycle³ which indicates the extent of 'pressure of population on land. This is why the level of productivity (both physical and value products) from **jhuming** varies from area to area, as it will be evident from the following discussion.

3. **Jhum** cycle is the number of years between two consecutive **Jhum** operations, It is the number of years under cultivation plus the years under forest fallow.

TABLE I.

Percentage Distribution of the Contribution made by Different occupations in the village Income of several Hill villages of North East India.

Source of Income	Kanthar Terang (Mikir)		Mawtnum (Khasi)	Hmunpui (Mizo)	Banshidua (Garo)	Agalgri* (Garo)	Pakam (Gallong)	Khonsa (Nocte Naga)
	1960	1965	1963-64	1964-65	1963-64	1968-69	1969-70	1966
1. Jhuming	66.1	71.2	5.4	58.6	22.4	57.5	50.8	56.3
2. Settled Farming	—	—	21.5	—	28.9	0.9	21.4	3.5
3. Horticulture	—	—	28.2	4.6	14.9	0.7	5.2	N.A.
4. Agricultural Wages	—	—	0.2	0.7	—	—	—	—
5. Animal Husbandary & Poultry Farming	6.3	5.2	14.2	11.3	2.5	1.3	2.1	0.6
Sub- Total : Agriculture	72.4	76.4	69.5	75.2	68.7	60.4	79.5	60.4
6. Extraction from Forests	6.6	8.4	5.8	N.A.	5.1	N.A.	N.A.	13.6
7. Arts & Crafts	1.9	2.5	1.5	6.1	1.3	0.3	2.0	N.A.
8. Trade & Transport	—	—	—	0.1	6.9	—	—	—
9. Non-Agricultural Wages	3.9	3.6	4.5	10.6	5.6	30.4	13.7	5.4
10. Salary and Remittance	15.2	9.1	17.6	8.0	8.4	8.9	4.8	11.8
11. Miscellaneous	—	—	1.1	—	4.0	—	—	8.8
Sub- Total : Non-Agriculture	27.6	23.6	30.5	24.8	31.3	39.6	20.5	39.6
Total :	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

N.A.- Not available

* Agalgri is cluster of three villages.

Source : Village Surveys, A.E.R. Centre, Jorhat.

Level of Production Under Jhuming :

8. For the study of level of production, data available from the villages referred above (Table I) will be used except those on Mowtnum, where there was little **jhuming**. The survey of Agalgri, a cluster of Garo villages shows that there are two types of field for cultivation in a year. The first-year-field (adal) is cultivated with mixture of crops and the second-year field (abreng) is sown only with a exclusive crop of paddy (in rare cases with maize or millets). But in other villages, a field is cultivated only one with a mixture of crops. The production of crops, farm price and gross value of crops in Agalgri for the year 1968-69 are presented in Table II. In the first-year-field, paddy contributes about half the total gross value products of Rs. 505.00 per hectare. In the second-year-field the productivity of paddy/hectare remained almost at the same level as in the first-year-field.

Table II.

Physical Products, Farm Price per Quintal and Gross Value of Crops in Mixture in Agalgri (Garo Hills) for 1968-69.

Q-Quantity in quintal.
V-Value in rupees.

Crops	Farm price(Rs.)	First-year Q.	field V.	second-yr. Q.	field V.
Paddy	67.00	3.69	247.23	3.72	249.24
Millets	54.00	1.55	83.70	0.22	11.88
Maize	67.00	0.42	28.14	—	—
Cotton (Raw)	125.00	0.20	25.00	—	—
Cassava	50.00	0.42	21.00	—	—
Chillies (dry)	200.00	0.06	12.00	—	—
Sesama	100.00	0.07	7.00	—	—
Fruits & vegetables	50.00	1.62	81.00	—	—
Total	—	—	505.07	—	261.12

Source : Saha, N. (1970) : Economics of shifting cultivation in Assam (Ph.d Thesis, G.U.)

as paddy is exclusively grown. This is not the pattern in other villages. The data on the estimated crop production (in mixture) per hectare of jhum land for Kanther Terang (Mikir Hills), Banshidua (Garo Hills), Hmunpui (Mizoram), Khonsa (Arunachal Pradesh), Pakam (Arunachal Pradesh) are given in Table III. Compared to Agalgri the level of productivity (both in physical and value terms) is higher in all the villages. It is to be noted that average productivity of paddy per hectare (along-with other crops) at Kanther Terang, Banshidua, Hmunpui, and Pakam varies between 8 to 11 quintals. In Khonsa paddy and millets together come to about 9 quintals. This shows that productivity in **jhuming** per unit area under cultivation compares favourably with productivity of paddy produced under settled farming in the traditional manner in this region. The average productivity of paddy per hectare in Assam plains is not more than 12 quintals (about 8 quintals in terms of rice).

9. But the defects of **jhuming** lies in the fact that while a hectare of land can produce crops only once in several years (say 5 to 19 years) depending on the **Jhum** cycle, under settled farming the same field can be brought under multiple cropping with scientific management under irrigation, producing two or more crops. The productivity pr hectare can be raised considerably, to 70 quintals of paddy per annum, if not more. Thus in respect of level of production, **Jhuming** suffers from many defects.

Level of Income from Jhuming :

10. From Table III, we can find the gross value of products under **jhum** in different villages. Data on the total inputs of man-days per hectare are available for Kanther Terang, Hmunpui, and Agalgri. In **jhuming**, land is free and capital investment is insignificant. Seeds, the main capital inputs are all home produced. Keeping

Table - III

Estimated Production of Crops (in mixture) per hectare of Jhum cultivation in certain Hill villages of N.E. India.
(In quintal).

Crops	Kanther Mikir Hills)	Terang (Hills)	Banshidua (Gar Hills)	Hmunpui (Mizoram)	Khonsa (Tirap Arunachal)	Pakam (Siang Arunachal)
	1960	1965	1963-6-4	1964-65	1966	1969-70
Paddy	10.97	8.85	8.94	8.06	4.08	8.32
Maize	0.46	1.70	0.64	1.12	—	0.30
Millets	—	—	0.55	—	4.82	0.87
Cotton (Raw)	1.05	1.47	1.10	0.05	—	—
Castor Seed	1.42	0.47	—	—	—	—
Sesamum	—	—	—	—	—	0.49
Mustard Seed	0.20	Ng.	0.08	—	—	—
Turmeric (dry)	—	—	0.31	Ng.	—	—
Ginger	0.01	0.01	Ng.	0.02	0.12	0.05
Taro	0.02	0.28	0.14	—	1.88	—
Yam	0.32	0.50	0.18	—	0.12	—
Black Gram	0.09	Ng.	—	—	—	—
Chillies (dry)	0.28	0.04	0.18	0.40	0.17	0.06
Tobacco	—	—	—	0.07	—	—
Cassava	—	—	0.57	—	0.60	—
Gross Value of products (Rupees)	544.00	693.35	607.87	654.87	N.A.	746.25

Source : Village surveys, A.E.R. Centre, Ng-Negligible.
Jorhat.

these facts in mind, the return per man-day (8 hours a day) of labour can be calculated. In Table IV are given data on the inputs of man-days and gross value products per hectare and return per man-day in Kanther Terang, Hmunpui and Agalgri from **jhuming**.

Table IV :
Inputs of Labour and Value Products per Hectare and Return per Manday in Hill Villages.

Villages (year)	Mandays per hectare (annual)	Gross value products per hectare	Return per man-day (Rs.)
Kanther Terang (1960)	219	544.00	2.48
Hmunpui (1964-65)	276	655.00	2.45
Agalgri (1968-69)	257	505.00	2.00

Source : (i) A.E.R. Centre, Jorhat - Village surveys.
(ii) Saha, N. (1970).

Conclusion :

Thus the level of income from jhuming appears to be very low compared to prevailing wage rates. Of course, the low level of income under jhuming is supplemented by hunting, fishing and gathering and other subsidiary occupations.

10. Both in respect of productivity of land and return to labour, Jhuming suffers from the disadvantages of a primitive technology. Under jhuming, land is free as there is no private ownership of land. This does not encourage the farmers to take adequate soil conservation and improvement measures. Due to low productivity, there is no surplus which can be ploughed back. The growing population has brought about a vicious circle of more area being jhumed leading to shortening of fallow period and consequent deterioration of soil fertility which requires bringing more under jhuming.

11. Jhuming, is also a predatory system of agriculture involving destruction of forests, deterioration of soil fertility and erosion. Though it provides a subsistence to the jhumings, the system is outmoded and should be replaced by suitable alternative occupations like settled farming, horticulture, dairy and poultry farming and small-scale industries. The sooner it can be done, the better for all concerned.

Select Bibliography :

1. Barkataky, M and Dutta, P.C. (1972) : Pakam, Socio-Economic Survey of a Gallong village in Arunachal Pradesh, A.E.R. Centre, Jorhat.
2. Bose, Saradindu (1967) : Carrying Capacity of Land under Shifting Cultivation, Asiatic Society, Calcutta.
3. Ganguly, J.B. (1969) : Economic Problems of Jhumias of Tripura, Calcutta.
4. Gohain, D (1969) : Mawtnum, Rural Life in Assam Hills, A.E.R. Centre, Jorhat.
5. Gohain, D and Saikia, D (1970) : Khonsa : A Socio-Economic survey of Nocte-Naga village in NEFA, A.E.R. Centre, Jorhat.
6. Goswami, P.C. (1968) : Shifting Cultivation and its Control in Garo Hills, Department of Soil Conservation, Assam.
7. NCAER (1961) : Techno-economic Survey of Manipur, New Delhi.
8. -- (1961 B) : Techno-economic survey of Tripura.
9. -- (1962) : Techno-economic survey of Assam.
10. Ray, D (1969) : Kanther Terang Rural Life in Assam Hills.
11. Saha, N (1970) : Economics of Shifting Cultivation in Assam, Gauhati University (Ph. D. Thesis).
12. Saha, N. and Barkataky, M.D. (1969) : Banshidura and Hmunpui, Rural Life in Assam Hills, A.E.R. Centre, Jorhat.
13. Saha, N. and Buragohain, D.K. (1969) : Assessment of Colonisation Scheme of Shifting Cultivators in Tripura, A.E.R. Centre, Jorhat.
14. Saikia, P.D. (1969) : Socio-Economic Structure of A Dafala village (Ph.D Thesis). Gauhati University.
15. Saikia, P.D. (1968) : Changes in Mikir Society, A.E.R. Centre, Jorhat.

Socio-Economic Problems of Transition from Shifting to Sedentary Cultivation in North-East India

Dr. J. B. GANGULY.
Agartala, Tripura.

The North Eastern Region (besides Orissa) represents the primary areas under shifting cultivation in the country. According to "a rough and ready estimate" of the North Eastern Council about 25 lacs hectares of land is subject to shifting cultivation in the region.¹

Under the Five Year Plans, the different State Govts., Union Territory Administrations and Local Authorities, like the District Councils, have adopted various measures to regulate and improve shifting cultivation practice and to wean the shifting cultivators away from the axe. It is now commonly admitted that shifting cultivation causes erosion of hill slopes and denudation of forests. But what is more important : following this practice, the hill men cannot maintain a reasonably good standard of living. Being based on the principle of self-sufficiency the system does not lead to any capital formation and growth. But this being a way of life with the hill people, it is not easy for them to give it up. Their society, polity and culture are all based on the form of agricultural practice. Whatever that may be, the growing pressure of population in the region has made it urgent for the Govts to try to control jhuming practice and reclaim jhum lands for permanent cultivation. It is also to be noted here that the improvement in economic condition of the people in the hills cannot be brought about without improving their agricultural practices.

Their villages being perched on hill tops the hill men have no other alternative but to follow jhuming practice to grow their food grains. So long as they were isolated from contact of the outside people they were practicing jhuming without any restriction or modification. But as they came into contact with the plains people the hill people also turned to some modernisation of their agricultural practices and therefore in many hill areas of the region the Tribal people have been practising settled wet rice cultivation. Nonetheless the incidence of jhuming is still very widespread in the region and therefore needs to be controlled and improved upon.

The **modus operandi** of shifting cultivation varies from State to State within the region. The steps taken so far to improve the practice of shifting cultivation and to induce the hill men to turn to permanent cultivation also vary from unit to unit. In Tripura the core of the jhum Control Scheme has been the setting up of jhumia rehabilitation colonies where the jhumias are given individual plots for settled wet rice cultivation and are provided with various extension services.

Assam's Jhum Control Scheme has been a part of the soil conservation programme undertaken by the forest department. As in other areas, various restrictions have been imposed on the practice of jhuming in the forests. Under the Tanyangya system the services of the jhumias are utilised for the carrying out of afforestation programme. This system has become a common feature of Silviculture in

5904
17.6.78

the region including Tripura - Assam also has taken measures to introduce horticulture in the hills on an extensive scale.

In the Angami and Chakasang areas of Nagaland hill slopes have been terraced where the people practise continuous cultivation. The State has taken up the plan for extending the area of terrace cultivation by providing subsidies to the farmers. Jhumias are urged to grow the commercially valuable and quick-growing various species on the suitable jhum plots.

Terrace cultivation obtains in Meghalaya also. In fact potatoe is extensively grown as a cash crop on hill terraces in the parts of Khasi hill. Horticulture is popular there. Cash crops like cashew nut, black pepper, cardomom etc have also been introduced. At Madam Rangman an Khasi and Jaintia hills a pump system had been installed to irrigate terraced fields.

Terrace cultivation is also being tried in Manipur, particular's in the Tang-hul area in Ukhrul Sub-Division. The programme for the extension of wet rice cultivation through reclamation and provision of irrigational facility has been taken up there. There is a plan to reclaim 5852 sq. mtr. of forest under the Jhum Control Scheme. Horticulture and planting of Oak for sericulture are also being encouraged.

In Arunachal Pradesh the main plank on which the jhum control scheme rests is the introduction of terrace cultivation. According to a recent report, of about 70000 hectare of jhum area, 23000 hectares have been reclaimed for wet rice cultivation.²

Despite the various jhum control and improvement measures adopted in different parts of the region it cannot be said that the problems of shifting cultivation have been substantially solved in any of the State or Union Territories. On the contrary, the problem is still very much there. In the mean time a new development is taking place adding a new dimension to the problem. All the units of the region have decide to start a number of forest-based industries, such as paper pulp ply wood, vineer, matches, saw mills, wooden railway slippers, etc. Such an industrialisation programme, according to some people, would greatly help achieve economic rehabilitation of the jhumias. For when they will realise the potential value of bamboos timber species, which they can sell at a price, they will automatically try to conserve these resources which will be a source of income for them.

But this will entail a great change in the occupational pattern of the jhumias. They are emotionally much attached to producing rice (which is their staple food) on their own farms. They will feel extremely helpless if they do not produce their staple food themselves. Such a vital change in their economic organization cannot be smooth or even readily acceptable to them.

The industrialization programme is a necessary and unavoidable part of overall planning for development of the region. Without an industrialization programme agricultural improvement programme cannot succeed. Apart from providing inputs to agriculture and demand for agricultural and forest products industrialization programme would provide employment to surplus farm hands. This will cause a fall in the pressure on land. Thus industrialization programme would indirectly help soil conservation programme.

Despite industrialization programme, the need for raising food production by the hill-men cannot be overlooked. We must take note of what P. D. Schlippe said about the Africans in the wet tropics³ :

"The great tragedy which I see unfolding is the threat to the survival of the greater part of a continent which is everywhere in the grip of a foreign culture penetrating it from above. We are blind to the necessity of adapting this culture to innumerable local environments; and this blindness is made the more dangerous because it has become possible through modern techniques to maintain large groups of people artificially for long periods by substituting a dependence on other groups for a natural dependence on environment. Towns and industries grow. The number of Africans who are ignorant of food production and therefore dependent on these remaining on the soil increase rapidly, thus giving an appearance of progress and prosperity. Ultimately, what will decide whether Africans in the wet tropics will survive will be the ability of their agriculture to stand the strain which is imposed on it by the necessity of feeding that part of the population which has been removed from their natural environment to serve the demands of the penetrating foreign culture."

Food production by the hillmen, therefore, must continue but not by slash and burn method. Their agricultural practices have to be improved upon so that productivity per hectare rises without causing soil erosion. To save the hill slopes from erosion and to reafforest them some amount of restrictions on the practice of shifting cultivation would not be disastrous, on the contrary, would pave the way for survival.

History provides examples of disappearance of civilizations based on such primitive practices of cultivation. According to P. Gourou,⁴ the Maya Civilization which flourished in Central America in the sixth century A.D. was based on the 'cut and burn' method of maize cultivation. But it caused such utter exhaustion of soil fertility that the population which supported the cities and temples must have been compelled to scatter again.

Cases are not unknown of primitive peoples resorting to permanent settled cultivation in valleys surrounded by primitive peoples who practise shifting cultivation. In Arunachal Pradesh the Apa Tanis "developed an extensive system of irrigated fields; and, though ignorant of the plough, succeeded with their hoes in raising two annual crops for themselves and their neighbours"⁵. To many this appears as a mystery though there is nothing mysterious about it. Being surrounded by enemies a tribe is forced to practise intensive and continuous cultivation. The Apa Tanis were prevented by the Dalls to secure more lands for freely shifting their farms. Similar instances are also found in Africa such as the island of Ukara in Late Victoria and in the mountains of Madagascar. "It appears that there are historical reasons for these settlements where the people have been hemmed in by enemies, and compelled to subsist on much smaller areas than they would like".⁶

Therefore, it should not be believed that the hillmen cannot be induced to take to settled cultivation. By offering suitable incentives and creating necessary conditions for practising sedentary cultivation they can definitely be made better and more prosperous farmers. Of course the transition from the shifting to the sedentary cultivation is beset with various problems which need careful considerations while drawing up plans for helping the shifting farmers to take to continuous intensive cultivation. There is a basic organizational difference between the two systems of cultivation.

If there is no input restraint so far as land is concerned, the technique of shifting cultivation implies a low labour-output ratio i.e., greater amount of out-

put per unit of labour than that under sedentary cultivation. Various studies in shifting cultivation by the hill men in several countries indicate that "it yields him better returns, in kg. grain / man-hour of labour input, than does settled agriculture."⁷

In the process of transition from upland to wet rice cultivation land thus becomes the important specific factor in place of labour. To compensate the loss of productivity per man year, sufficient measure of arable lands must be available to individual households.

Any plan for improved farm practices, therefore, cannot be drawn up without settling the question of land reforms and land distribution. In the North-Eastern Region the following three broad categories of land ownership system are found :—

- i) Lands owned by the villagers collectively.
- ii) Lands owned by the chiefs who distribute lands among the individual households for jhuming purposes.
- iii) Lands owned by individual families.

Of course, even in places where communal ownership of lands obtains (as by the village Kegang in A.P.) individual families do have individual plots of their own. The sizes of family plots do also vary and, as in Nagaland, ownership of land 'is not employed either as a means of widening wealth inequality or as a lever for social mobility. One of the reasons for this is the accepted method of joint cultivation of jhums.'⁸ But where the jhumias have taken to continuous wet rice cultivation whether in the river basins or on the terraced hill slopes, land has emerged as a precious form of wealth to be owned as much as one can. Thus land has become a basis for social stratification. Opinions vary on the desirability of having individual ownership of lands under the system of settled wet rice cultivation. The social workers' conference held in Dimapur in 1973, specifically urged the continuance of the tradition of land being a community trust rather than individual property in the hill societies of North-East India. Even under the programme of 'Changing agriculture from shifting cultivation to stable one' incentives should not be offered in the form of an 'assurance that the land will be made individual property'.⁹

It is also pointed out that the introduction of private ownership of land would lead to usuary and debt.¹⁰ The social security enjoyed by individual families under the communal ownership of land will be lost under individual ownership of lands.

Such adverse effects can, of course, be avoided if some well-conceived limitations on the transfer of lands by sale is imposed and if the state either directly provides credit and inputs to individual farmers or encourages setting up of co-operative service societies for the same purpose. In the present century, transition from nomadism to a settled society has been very successfully achieved in Central Asia and Kazakhstan in Soviet Russia. The nomad and semi-nomad Kazakhs, Kighiz, Turkman and the Altaian nationalities switched over to a settled way of life being provided with all facilities by the Government. In the beginning, the

It must, however, be admitted that the transition from shifting to settled-agriculture cannot be successfully achieved without abolishing the system of ownership of lands by the chiefs which has much in common with the usual feudal ownership of land.

"It has been clearly shown by practical experience that it is impossible

to radically solve the problem of transition from nomadism to a settled life without fundamentally changing the pattern of social relationships in the countryside, which meant replacing them with relations of an entirely new type." 12 This is the most vital issue. The present writer has discussed this aspect in detail elsewhere. 13. Suffice it to say that the main changes would relate to the village polity, chiefship, marriage custom, division of labour between man and woman, ownership, use, maintenance and accumulation of new farm tools and assets including land, greater use of money (borrowing and repaying of debts, selling and buying of goods, meeting of various obligations, etc. in money), food habits, dress, etc. These are associated with the adoption of a higher technology of production and will be possible through the spread of literacy and education and easy availability of various extension services. Apart from suitable legal and administrative measure to protect the interests of the hill men necessary government agencies and cooperative organizations have also to be developed to save them from being victim to the exploitation by vested interests.

Different State Govts./Union Territory Administrations have taken up several schemes, such as, terracing the hill slopes, encouraging them in silviculture (taungya system) corridor system of forest plantation and even the colonization scheme. The N.E.C. in its regional plan has taken up the project of making land capability survey of 10 lakh ha. and soil survey of 2 lak ha. of lands. Each member unit of the council has also been given funds to take up "integrated comprehensive schemes for resettlement of jhumias and or reclamation (including soil conservation plantation, afforestation) in one river basin in each state during the Fifth Plan" 14. The N.E.C. has also underlined the need for scientific research about the best way of utilizing the hill slopes, crops to be raised and seeds to be used, etc. The Indian Council of Agril. Research has already opened a research centre in the region to attend to these needs.

The National Commission on Agriculture has expressed the opinion that livestock growth has a big potential in N.E. India. It has suggested in detail what the different State Govts./U.T. Adms. should do to achieve planned development of animal husbandry in their respective areas.

Technologically, one of the ways of improving the hill economy seems to be the introduction of, what is called, the 3-Dimensional Forestry, i.e. combining silviculture & horticulture, with animal husbandry. Various quick-growing tree species have been suggested for introduction in the region. There are all technological questions which can be settled by the experts. But the biggest problem about any plan or scheme would be how to secure "the acceptability with the people". Erik P. Echolm has pointed out 15.

"It is generally easy to recommend technological answers to ecological problems. Political and cultural factors are invariably the real bottlenecks holding up progress. Changing the relationship of man to land in the mountains, as anywhere else, invariably involves sensitive changes in the relationship of man to man."

The hill men are very sensitive about two things :— Ownership of forests and lands and growing of rice which is their staple food. Any scheme which affects either or both of these aspects is resisted by them. In parts of Meghalaya and Manipur there are still the vestiges of feudalistic land ownership. Any attempt to end it may encounter stiff opposition. In Manipur, the Act passed to abolish the chiefship some years back was strongly opposed out of fear that this would affect the ownership of land by the tribal people. It is also for the same reason that every attempt at extending the reserved forest areas, or strictly improvements the forest regulations in the existing reserved forest areas is opposed by the people who

are affected by it. Another land problem relates to the slow emergence of a class of landed nobility in the tribal areas. There are some who cultivate their lands by mechanized process and/or by employing hired wage-labour. Others who live in urban areas pursuing non-agricultural occupations own lands in rural areas and get them cultivated by share-croppers and/or wage-labour. So long as the land areas apparently remain abundant, this problem will escape general attention, more so, as this section, by adopting modernized methods of cultivation, contribute significantly to higher productivity and increased aggregate output. Even admitting the fact that such successful and prosperous farming would have some demonstration effect for the shifting farmers to take to settled farming, it might be justified in enacting land laws fixing ceilings on land holdings in these States/Union Territories where there is none as yet.

The problem relating to land system may not be an insurmountable one. In each of the units of the region popular ministries have been functioning, and therefore, politically the land question in the hills may be settled within the constitutional provisions.

The other problem, that is, of growing rice, is a more ticklish one. All these who have come in contact with the Jhumias know how emotionally and culturally they are attached to the practice of growing rice. As the raising of upland rice 'is a powerful factor in soil erosion' we have to think more about the feasibility of growing wet rice in valleys and flat lands and terraced hill slopes which can be irrigated and drained. But the difficulty would arise (as in Tripura) to find out enough valley/flat lands for the purpose. Even where this may not be a problem (as in Arunachal Pradesh), it would be a very slow process to set up villages in foot hills and places where the hill villages may be shifted. Terracing of hill slopes seem to be an answer. In all the units of the region this has been included in the plan schemes. In the Angami and Chakasang areas (of Nagaland) terraced cultivation has been in practice for a long time now. The State Govt. has been trying to extend the terraced areas. But terracing of hill slopes is not an easy task and it has other difficulties too. Construction of terraces often leads to removal of the fertile top soil, rats and other rodents often damage the terraces and in many places irrigation and drainage of water pose a great problem. Last but not the least importance is the high costs of building terraces.

Despite such difficulties, in places where enough flat valley lands would not be available, terracing of hills with gentle slopes to enable the hillmen to grow rice besides practising horticulture, silvi-culture, animal husbandry, etc cannot perhaps be avoided even investing huge amounts. And this would mean diversion of resources from being invested in towns and plains. Would it be possible? "In the end", says Eckholm, "this may be the greatest challenge of all: how to convince the people of the plains that the future of the mountains cannot be isolated from their own." 16

In the Fifth Five Year Plan special emphasis has been given on preparation of separate sub-plans within the State Plans "for areas predominately inhabited by tribals so that it will be possible to ensure that tribal areas get an adequate share of plan resources" 17 In the sub-plans of the different units of the north-eastern region, therefore, due emphasis must be given to the programme of reclamation of jhum lands by various means including terracing of hill slopes.

1. North Eastern Council Shillong Draft Regional Plan -p-25
2. The Statesman, Calcutta, 10 June, 1976.

3. P.D. Schlipp, *Shifting Cultivation in Africa*, Routledge & Kegan Paul, London, 1956. P. XIII-XIV.
 4. P. Gourou, *The Tropical World*, 1961, as cited by Colin Clark and Margaret Haswell, in their book, *The Economics of Subsistence Agriculture*, Macmillan, 1964, P. 47.
 5. Verrier Elwin, *A Philosophy for NEFA*, Shillong, 1959, P. 14.
 6. Colin Clark and Margaret Haswell, *op. cit.* P. 46-47.
 7. *Ibid*, p. 47.
 8. National Council of Applied Economic Research, *Technoeconomic survey of Nagaland*, New Delhi, 1968, p. 15.
 9. Problems of North East, Report of the Eastern Zone serial Workers' conference, held in Dimapur, Nagaland from March 10 to 12, 1973, Po. 40.
 10. Rene Dumont, *Types of Rural Economy*, Methuen, London, 1957, p. 46.
 11. Abdch Tursunboyv, *From Nomadism to a settled society*, published in "Ways of overcoming Economic Backwardness" Novosti Press Agency Publishing House Moscow, 1972, p. 84.
 12. *Ibid* P. 82.
 13. J.B. Ganguly, *Jhumia Rehabilitation and Social change in Tripura*, published in *The North Eastern Research Bulletin*, Dibrugarh University, Vol-I, Summer 1970.
 14. NEC, *op. cit.*
 15. Erik P. Eckholm, *Lost Shangri-la*, *The Statesman*, Calcutta, 12 December 1976.
 16. *Ibid*.
 17. Draft Fifth Five Year Plan, P. 90.
-

Settled Agriculture in areas of Shifting Cultivation

Dr. S. K. Mukherjee
Bose Institute, Calcutta.

Statistics :

No reliable information is available on the extent of shifting cultivation of **ghum**, either in terms of area or in the number of persons practising it. An old ICAR review (Kaith D.C. 1950) gives the following estimate :

Total area utilised for shifting cultivation	 5,42,000 ha
No. of tribal people dependent on shifting cultivation	 26,44,000

Dhebar Commission observed that 25.89 lakhs tribals depend on shifting cultivation, the area extending at the rate of 5.41 lakh ha per year. The intensity of shifting cultivation is appreciable in Andhra Pradesh, Orissa, Tripura, Assam and North East Indian States. The situation in the North Eastern Region has been recently quantified (vide Report of National Commission on Agriculture (NCA) Part IX on Forestry, 1976) as shown in the table below:

State	Area affected Jhum by	Area under Jhum at one time	No. of tribal families involved
	.000 ha	.000 ha	.000
Arunachal	248	92	148
Mikir Hills	415	54	45
N. Cachar Hills	83	15	13
Manipur	100	60	50
Meghalaya	416	76	68
Mizoram	604	61	45
Nagaland	608	73	80
Tripura	220	22	43
Total :	2694	453	492

Evil effects of jhuming :

Because of rapid growth of population the rate of jhuming has increased considerably. As a result, the cycle of jhuming has narrowed down from 30-40 years to 5-10 years. Consequently, attempts have been made to stall the rapid rate of jhuming. Jhuming is itself harmful, but if the cycle is long, there is a chance of recuperation; as the cycle is shortened all the harmful effects show up and jhuming turns out to be a menace.

Apart from soil erosion and consequent loss of soil fertility, jhuming acts againsts the development of forest wealth.

The problem of replacing jhuming :

It must be realised that jhuming is practiced for livelihood, but not without knowledge of its bad effects. Unless alternative ways are available for food production the abolition of jhuming will remain a mere wish. Two broad methods of weaning away the tribal people who practise jhuming suggest themselves : (1) provide alternative occupations, e.g., animal husbandry, forestry and forest produce etc., and (2) settle the tribals and others practising jhuming to normal farming as far as practicable. What the possibilities and problems and prospects of (2) above are, is the subject matter of this article. Because of the peculiar topography of the land used for jhuming, the introduction of normal agriculture is not an easy task. The Dhebar Commission, which went at great depth on the question of shifting cultivation vis a vis tribal peoples development, observed that the only way was to gradually regulate shifting cultivation and allow the lost soil fertility to build itself up. This would greatly help adoption of normal agriculture.

Other accessory operations :

Assuming that jhuming cannot be altogether stopped, it is advisable to make the process more productive by taking recourse to terracing, and other soil and moisture conservation practices. At the same time if forest-based industries are set up locally on a small scale thereby boosting up the economy of the region, the people would appreciate the importance of forests and indirectly act as a brake on jhuming. The NCA has adequately dealt with the measures required to develop forestry in areas affected by shifting cultivation. It has also emphasised the rigorous implementation of the forest policies in different states in regard to shifting cultivation. The other indirect action that is likely to detract the people from jhuming and eventually draw them towards permanent cultivation is to find a marketing channel for their agricultural produce. In this context roads connecting urban or semiurban marketing centres are essential. Besides, the cost of conversion of a jhumed site into one suitable for permanent cultivation is high, may be, rupees three to four thousands per hectare. Because of the high financial input states have not been able to make much headway in eliminating shifting cultivation. The underlying idea of the Tribal Development Agency and the Hill Area Development Programme is to raise the economic level of those who are engaged in shifting cultivation through agricultural and allied occupations, such as cattle development, dairying, piggery, sheep and goat rearing, poultry and duck keeping, fisheries, bee keeping, sericulture etc. In order to successfully implement these programmes the strengthening of cooperative and marketing infrastructure is essential.

Permanent cultivation to replace Jhum :

The main approach to solve the problem of shifting cultivation is to bring in elements of permanent cultivation by a gradual process. Lands suitable for permanent cultivation are available in the valleys and terraces gentle slopes. In terracing land, which is a costly operation, small scale irrigation from hill streams should be arranged. Terracing should start from a place where other infrastructures are easy to provide, e.g., seeds, fertilisers, credit, marketing etc. In order to protect the forest against misuse and destruction stricter vigilance will be necessary. It is to be clearly understood that shifting cultivation cannot be fully replaced by settled cultivation. There will not be enough suitable lands for this purpose. Moreover, settled cultivation which normally does not take care of erosion hazards may turn out to be a greater menace. Hence, a favourable mix of afforestation and settled cultivation appears to be the logical step.

Agri-silvicultural methods, pasture and grassland development, introduction of horticultural crops, development of livestock etc. should become constituents of settled agriculture in areas of shifting cultivation. The areas suitable for each of these programmes have to be delineated and co-ordinated projects drawn up in consultation with the concerned government departments. Where shifting cultivation has not spread much, commercial production forestry programmes should immediately be taken up, so that attention of the people is drawn towards more economical ventures, and thereby they are weaned away from a harmful operation. Whatever the nature of the development programmes, the welfare and employment of the tribal and local people should be given the highest priority. There must be the minimum import of labour from outside.

Socio-economic surveys of jhuming areas :

Socioeconomic surveys of jhuming areas show a tendency towards settled agriculture in some regions. For instance, the percentages of land under jhum cultivation horticulture and homestead of wet paddy cultivation are about 30, 31 and 39 respectively in Banshidua, a Garo village*, where a decade back shifting cultivation was the main occupation of the people. The survey further shows that villagers having small farm sizes, namely, 0.5-2 hectares tend to stick to the traditional jhum cultivation, but those having larger farm sizes (3-6 hectares) divert a greater proportion of their land to wet paddy cultivation. A similar study (No. 9. Village Survey 1968) of a Mizo village (Hmunpui) shows that there jhuming is a part and parcel of the agricultural it being integrated with settled cultivation, animal husbandry horticulture etc. The percentages of lands under jhuming, horticulture, livestock and poultry are about 60, 5 and 11 respectively. Several cropping patterns exist depending on the land formation and availability of resources; out of these the pattern involving paddy and maize cultivation is the most general because of its high economic return. Some families started sugarcane farming which showed promise.

Alternative to Jhuming :

The problems of evolving a suitable alternative to jhuming are many. Resettlement of jhum cultivators in the face of paucity of land, high cost of terracing, and lack of marketing facilities for commercial produce, becomes an impracticable proposition. A realistic approach seems to be to accept jhuming as a way of cultivation for some tribal people at least. In that case the best one can do is to evolve ways and means to minimise the evils of jhuming. For instance, the jhum cultivators may be induced to sow seeds of a legumious crop before abandoning a jhumed area. This would not only act as some kind of a cover crop but also add nitrogen and organic matter to the soil. Sociologists have another viewing angle, according to which jhuming must not be hastily abolished as this step might react sharply with the way of their life. An uncritical belief in such possibilities may in fact bring about a sense of inaction or half-hearted action which might be harmful in the long run. It is apparent from the survey that even the backward people of Kanher Terang are not unreceptive to innovations, but the adaptability is no doubt a slow process. This should not deter the administrators from abandoning attempts to ameliorate the lot of jhum cultivators.

* Indian Village Studies : Village Survey No. 8 by N. Shaha and M. Barakataky. Agro-Economic Research Centre for N.E. India, Jorhat (1968).

Practice of Shifting Cultivation in North-East India

Dr. Satya Dev Jha.
Directorate of Arunachal Pradesh
Census, Shillong

Shifting cultivation is a way of life of the people in hill areas. It is a practical approach to certain inherent difficulties like preparing proper seed bed on the slopes where any disturbance to the soil surface by tilling or hoeing may result in the washing away of the fertile layers of the arable land. In fact, the shifting cultivation is an agricultural practice evolved as a reflex to the surrounding ecology. Shifting cultivation may be regarded as an alternative farming to permanent or settled cultivation on mountain slopes where the latter is almost impossible with primitive technology. Shifting cultivation, according to the modes, is variously called as primitive, fire farming, nomadic agriculture, slash and burn agriculture, bush-fallow cultivation and so on.

Shifting cultivation is widely practised by the tribals of North-East India as shown in the following table 1 :—

States/Union Territories.	Area under shifting cultivation (in hectares)	Total Population dependent on shifting cultivation (in 000's)	Percentage of total population dependent on shifting cultivation (1971) to total population of respective States/UT
Arunachal Pradesh	70,300	270	57.69
Mizoram	60,000	260	80.74
Meghalaya	76,000	350	34.58
Manipur (Hills)	50,000	300	27.95
Nagaland	83,600	?	?
Tripura	17,000	100	6.42
Only North Cachar & Mikir Hills Districts of Assam.	70,000	403	0.48

It is noted from the table that about 426,900 hectares of land are under shifting cultivation in the north-eastern region of the country. The above table also depicts that a very large segment of population of the states/union territories under reference, except Assam, depend on jhum cultivation for livelihood. Besides, the socio-cultural life of the jhumias is also woven in such a way that it corresponds to this practice of cultivation.

1. The table has been obtained from --“Some Social Constraints to Agricultural Development in North-East India” by R.K. Mukurjee published in North Eastern Affairs, Annual Issue 1975, Page -45.

The socio-cultural life of the tribals of north-eastern India is almost regulated according to the jhum calendar. For example most of the tribal festivals of this region are celebrated in accordance with the timings of jhumming operations. Their social as well as religious pursuits and calculation of times centre round the operations of shifting cultivation. In this connection the example of Padam tribes of Siang District in Arunachal Pradesh may be cited. The newly married wife is brought home for the first time only at the time of new harvesting at jhum fields. There are many tribes and sub-tribes in this region among whom first time hair cutting of children takes place when weeding operation starts. Even house constructing coincides with the timing of shifting cultivation. Among many tribes it is taken as good luck if a mother delivers when a particular stage of jhumming operation is reached. Almost all stages of the jhumming operations are celebrated in the midst of songs and dances along with social / religious rites only to ensure good harvest. It is well known that there are many dances, songs and folk tales which deal with the practice of shifting cultivation. Shifting cultivation finds place in their mythology also. There are many legends in Arunachal Pradesh which narrate how the creation of particular grain by a particular god for jhumming took place.

These facts may inspire one to fall in line with the champions of shifting cultivation who advance traditional arguments that settled cultivation which can be carried on hills by terracing the slopes is not an answer to the shifting cultivation because of high cost, huge requirement of labour, lack of irrigational facilities etc. Besides, chemical fertilizers cannot be applied on the hills as the same requires working on soil to a depth of five centimetres, which would result into serious soil erosion. Some of the supporters of the practice of jhum cultivation say that even spraying of nitrogenous fertilizer is not possible manually owing to the lack of sufficient quantity of water required for its preparation on the hills everywhere. Thus one may get the impression that intensive cultivation is not possible on the hillslopes where jhum has been operation from the time immemorial. But to-day science has established its mastery over nature. The difficulties in respect of scientific cultivation on the hill slopes have almost been got over. The knowledge of science has shown that intensive cultivation is quite possible on the hill slopes too.

The population sustaining capacity of land under shifting cultivation is incredibly low. The studies conducted in the Philippines, Gambia, Malawi and Zambia including a few in India (Bose 1967, Ganguli 1969 & Saha 1970) reveal the same. For example, the estimate of Bose study noted slightly over four persons per square kilometre (Kondakata in Abujmar Hills, M.P.) to 16 person per square kilometre (Mamphi village in Mizoram). According to Ganguli, the population sustaining capacity of land under shifting is noted as six persons per sq. Km. supposing 50% of the areas amenable to the shifting cultivation. The Saha studies (in Mikir Hills and Mizo Hills) estimate the capacity to be between three to nine persons per sq. Km. provided 50% of the area is available for shifting cultivations. Simultaneously, the density of population is reported as 6, 31, 45 and 48 persons per square kilometre area of Arunachal Pradesh Nagaland, Meghalaya and Manipur (whole) respectively. We also note very high growth rate of population in the states and union territories of this region. The decennial growth rate is recorded as 34.71 in Assam including Mizoram, 39.88 in Nagaland, 31.50 in Meghalaya, 37.53 in Manipur, 36.2 in Tripura and 38.91 in Arunachal Pradesh. It is clear enough that wide gap remains between the food-grains production under shifting cultivation and the population dependent on it. The future gap will be wider still.

Now it is widely talked by the forest authorities as well as the soil experts in India and abroad that the practice of shifting cultivation is one of the major causes of devastating floods in the plain areas of the countries. Because of the practice of shifting cultivation, the rivers rushing down the hills and flowing a long the plains are silted. As a result, rivers become shallow and fail to accommodate extra water during monsoon causing floods in the plains. It also impoverishes the soils on hill slopes simultaneously.

To-day, we have reached a stage in the social organisation of production when shifting cultivation has to go, even though it may mean a temporary disturbance to the socio-cultural life of the jhumias. We cannot ignore the fact that the economic factor is always more powerful than social and religious factors in the long run. In this connection the example of the Monpas of Kameng may be cited. They do not have sufficient cultivable land. This scarcity of land led them to switch over to the terrace cultivation on the slopes. They are to-day better off people in relation to their counterparts elsewhere in Arunachal Pradesh. The Khamptis of Lohit in Arunachal Pradesh and the Khasis of Meghalaya operate cultivation by terracing the hill slopes. It may be mentioned that these people are not less happy than those who continue practising the age-old system of shifting cultivation. Rather the reality is that the Monpas, the Apatanis, Khamptis and those Khasis operating settled cultivation are happier than their jhumia counterparts. Social factors in favour of shifting cultivation will have to readjust with the changing economic order, of the choice is left to the jhumias and if they are educated on the economics of alternative methods of cultivation and if they are assisted and guided properly there is no doubt that they themselves will adopt the modern methods of permanent cultivation generating necessary dynamism for restructuring their own society.

References :

- | | |
|--|--|
| Burman Roy, B.K. | Demographic And Socio-Economic Profiles of the Hill Areas of North-East India (1970). |
| Furer-Haimendrof, C.Von: | 1. Agriculture and Land Renure Among the Apatanis A Main in India, Vol. XXVI (1946).
2. Religious Beliefs and Ritual Practices of the Minyong Abors, Author ops. Vol. X (1954). |
| Ganguli, J.B. | The Economic Profiles of the Jhumias of Tripura. |
| Mukherji, Ranjit: | Some Social Constraints To Agricultural Development North-East India (North-Eastern Affairs- Annual Issue, 1975). |
| N.C.A.E.R. | Techno-Economic Survey of NEFA (1967). |
| News Paper: | The Assam Tribune, March 21, 1976. |
| Registrar General & Census Commissioner, India, New Delhi. | 1. Socio-Economic Survey of 'Jara' a Dafl Village in NEFA (1966).
2. Pocket Book of Population Statistics Census Centenary (1972). |
| Report of the Committee : | Report of the Committee on Special Multion Special Multi-purpose purpose Tribal Blocks (1960).
Tribal Blocks (1960). |
-

An Integrated Approach For Treating The Lands Subject To Shifting Cultivation

D. C. Das,
Ministry of Agri. & Irrigation
Government of India, New Delhi.

INTRODUCTION :

The problem of shifting cultivation has been engaging the attention of many the agencies for a few decades. The Report (1976) of the National Commission on Agriculture cites seventeen references besides the study made by D.C. Kaith in 1958 and F. K. Wadia in recent times. Though the reports had differences on many points, there had been agreement in the conviction that the improvement in land use management in the areas subject to shifting cultivation is urgently needed.

The shifting cultivation which is commonly known as Jhooming has evolved over centuries as a mixed land use pattern under the conditions of physiographic remoteness due to lack of communication. This remoteness has forced the people to a system which is self-contained and involves minimum number of items. The practice combines the raising of various crops together which can be compared with cafeteria system of cultivation, one of the latest inovated terms. The system is supplemented by harvest of flora and fauna from the surrounding forest areas.

To meet the exigency of collective security and to adjust the individual needs and responsibilities vis-a-vis the community ones, the system seems to have remarkably served the people of the area. My personal acquaintance with those people over four years did not reveal any significant dissatisfaction with the system. The question, therefore, arises as to why it has become urgent to review the effectiveness of this system which has not only evolved in India under certain conditions, but in many parts of the world the system has come in vogue under similar conditions. The answer to this question will, therefore, call for analysing a number of factors which have changed in the recent time and which are likely to change in the near future. Before deliberating on the integrated approach, it is therefore necessary to look into some of these aspects and to attempt to gauge the severity of the same.

SOIL DEGRADATION AND SEDIMENTATION PROBLEM :

Opinions on the associated hazard of soil degradation and consequent sediment and flood havoc caused by the practice of jhooming on the hill slopes have differed considerably. An opinion exists that the shifting cultivation does not involve any serious disturbance to the soil as the soil is not ploughed and seeds are only dibbled. Consequently, the hazards of erosion from the area subject to shifting cultivation may not be as alarming as often posed. It is true that no systematic studies have been made in providing data on erosion and sedimentation from the watersheds where shifting cultivation is practised. However, considering the rainfall pattern and the geology of the hill slopes, where this practice is prevalent, this view is hardly to be supported. Besides, it is common fact that resultant vegetation on the areas where this practice is prevalent is degenerated with the degrading condition of the area in the successive jhooming cycles. The common experiences of the heavy silt loads in the river system, which causes almost annual floods in

the plains, also donot support the claim that shifting cultivation does not cause any serious erosion and consequent sediment hazards. Some data from the Machkund Catchment possibly will reveal a trend which may set aside the doubt in this respect. The catchment of Machkund Reservoir is entirely populated by tribal people which have been practising the shifting cultivation over the centuries. During the construction of multi-purpose reservoir, the observed sediment production rate was 3.80 Ha-M per 100 Sq. Km. per year. This was higher than the safe limit of 3.57 Ha-M per 100 Sq. Km. per year. It was, therefore, necessary to undertake intensive soil conservation programmes with a view to minimise the sediment production into the reservoir and thereby to preserve the created water storage to be used for generation of electricity and irrigation. The sediment data which became available from the repeated capacity surveys of the reservoirs indicate that during 1951-58, the sediment production into the reservoir was 1.25 million cu. m. whereas during 1969-72, the sediment production dropped to 0.49 million cu. m. During this span of time, about 40% of the critically eroded areas have been treated with afforestation, bench terracing and other permanent supporting conservation practices associated with land management. The sedimentation data collected from the tributary observation posts also reveal similar trends. In some parts of the catchment of Damodar Valley Corporation's reservoirs shifting cultivation used to be practised earlier. The sediment production data over the decades has shown a progressive decrease in the sediment yield into the reservoirs of Maithon and Panchet with the treatment of catchments by various soil conservation practices including the replacement of shifting cultivation. The comparative sediment production rates of the three catchments are given below :—

Sediment Production Rate ha-m/100 sq. km. /year

Name of Reservoir	Original	Reduced
1. Machkund	3.80	2.36
2. Maithon (D.V.C.)	15.45	13.10
3. Panchet (D.V.C.)	13.32	10.30

It is very well known that flood in the plains of the North East India is serious and almost annual. The problem of flood is not so grave due to excessive runoff, but more so due to the associated heavy silt load. The visitation of the flood havoecs in the river system of North East India have always been associated with the heavy sediment loads. These sediments come from the hills where shifting cultivation is practised. Due to the disturbance in the river system and the communication lines developed at great investment the entire economy of the region suffers. The prospect of improving upon the economy of the North East region with the improvement of communication and other facilities is also subject to this disruption of the communication system.

It is not the erosion and sediment hazard alone. The problem is far more serious. The jhoom cycle which used to be 30-40 years a few decades back now ranges from 1-17 years only. The shortened cycle degrades the land at a faster rate and return falls further making the subsistence agriculture even more precarious.

NEED FOR HIGHER PRODUCTION :

Besides the hazards of soil erodin with the associated havoc of floods and sedimentation, the necessity for a more paying land use management in these areas is ines-

capable with the introduction of better communication and rising aspiration of the people for higher standard of living. This has already been viewed by the agriculture Minister of Nagaland. With the introduction of cash crops, as observed by the Chief Minister of Manipur, the desire of the people to enlarge the area under jhooming has also increased. The indication, is, therefore, that the people will surely take up to more intensive land use practices where the returns had to be enhanced introducing better inputs. This transformation will call for certain changes in the entire pattern of agriculture and other land use management.

MULTIPLICITY OF AVOCATION :

With the opening of these areas and introduction of a number of development programmes and facilities, the people will be taking up more and more new vocations other than the one practised by the past generations. This diversion will call for adjustment in the distribution of the available working forces and making maximum utilisation of them for getting higher returns from the lands.

INTEGRATED APPROACH :

The problem of controlling shifting cultivation is, therefore, to be viewed not only as a soil and water conservation problem, but also a necessity of altered way of living suitable to the changing circumstances. Therefore, the elements of the plan should be such that it progressively provides better return from the limited areas with lesser working force involved in the management. The plan should also endeavour to maintain the mixed way of living comprising agro-horticultural activities, livestock keeping and utilisation of resources from forest in selective manner. The plan should also ensure adequate work for each member of the family who opts for the land use management suggested in the integrated plan towards the replacement of shifting cultivation. The speed of implementation of any such plan has to be appropriate so as not to create any disruption in the socio-economic living of the people and further development in that respect.

WATERSHED APPROACH :

Accepting this unavoidable necessity, we have to think as to what are the major precautions that we must take before we can suggest for some alternate system of land use management. The land that we are going to deal with consists of young mountains with possibly more erodable soils, and subject to higher rainfall coming often with high intensities. Planning, therefore, has to be on the basis of a natural unit where natural resources of soil and water can be developed and managed towards obtaining maximum return with minimum hazards in the form of degradation of the area and consequent sediment production into the river system. Such a unit has been acknowledged throughout the world as a watershed, that means the area which drains into common drainage system. Again, considering the accessibility of the areas, units of the local habitations, the size of the watersheds cannot be very large. They should be small enough to be treated with all possible manner for protection and improvement in accordance with a time bound plan. It is difficult to spell out a definite size of such watersheds for adopting in introducing plan of control of shifting cultivation. This will depend upon the local necessities and available resources, both in terms of finance and technical personnel.

MIXED LAND USE :

It is very necessary that intensive agriculture is introduced on smaller area say for one hectare where more than one crops can be grown. The local vegetations helped

by favourable rainfall offer a number of produce which meet many requirements of feed, fodder, housing, etc. of the local people. The utilisation of these items have provided avenues for various handicrafts too. They have become part of their way of living. Therefore, a patch of properly managed woodlots will have to be incorporated in the plan. A quick world-wide survey will indicate that the hill economy has mostly been centering around mixed farming, i.e., agricultural and plantation, crops and some livestock keeping. The people practising shifting cultivation also maintain some pigs and poultry birds besides their prized mithoons. The mixed land use management should also take care of the need of this part of the concerned families. However, the present pattern of livestock keeping may undergo changes in terms of their types, feeds and housing. The changed pattern of agriculture, horticulture and livestock keeping may also call for certain adjustment in the homesteads of the region.

PROTECTIVE SOIL CONSERVATION MEASURES :

The areas where permanent agriculture will be introduced are on relatively keeper slopes and through the continuous exploitation, the soil depth may not be great. The rainfall pattern in the bulk of these areas also suggest that any intensive agricultural horticultural programme must have inbuilt soil conservation protection measures; otherwise the soil, which is the very base of production, will be washed out. In fact, the experimental results have shown clearly that even in the Nilgiris, where soils are far from erodible and rainfall less erosive with even distribution, there is no substitute to bench terracing on hill slopes if cultivation has to be done (Das Etal 1967) In the areas where we are concerned the risks are far more.

WATER MANAGEMENT :

From the terraced lands, if two crops are to be taken with appreciable returns, very careful water management programme is necessary. Irrigation will be a necessity to improve the outturn from the areas. In the hilly areas, generally, diversion of small streamlets through a system, similar to "Khul" of Himachal Pradesh, may be ideally suited. In certain cases, lifting devices may be necessary. All these systems will have to be supplemented by water disposal system to prevent over-saturation, water logging and also to remove excess rainfall safely. Even the horticultural and cash crops, if are to be grown on the steep lands, it will be desirable to raise them on strip of step benches.

TOOLS, IMPLEMENTS and MACHINERY :

Since the intensive land use management is necessary to increase the total return from the land, the area must be prepared and provided with appropriate tools, implements and machinery. This will be necessary to achieve proper soil preparation and carrying out agricultural operations during cultivation and after harvest. But we should remember that while these families were practising shifting cultivation, area which was cultivated by each family was ranging from 0.51-1.37 Ha. with an average of 0.92 (Wadia, 1975). We should, therefore, think that available labour forces which are likely to be lesser with the diversion of many to different vocations, whether it will be possible to take up larger areas under permanent cultivation without assistance of certain minimum tools and implements. At the same time, with the level of technology existing in the area we can certainly not think of introducing tractors, combines, etc. for bringing about a rumbling revolution in the agriculutre within a short time. A via-media is very necessary. But a modest beginning will have to be made in order to determine the suitability of a number of tools, implements, machineries for large scale introduction in the area.

TOOLS AND IMPLEMENTS :

The multi-purpose "Dao" is the main tool which is used by the people. However, it will not be true that no other tools and implements are in use in the region. In the years 1959-60, the Directorate of Agriculture and Community Development of North East Frontier Agency conducted a survey of the Agricultural Tools and Implements which were in vogue. Specimens were also collected and kept at the headquarter. The collection includes mostly the dibbling bars, hoes and rakes. It will be worthwhile to look into these items, which have evolved in the region depending upon the liking of the people, and improve upon those which are likely to fit in the proposed agro-horticultural practices. The improvement will be mostly in terms of materials used for making them and standardisation of sizes.

FARM POWER :

So far, the manual power is the only one which is being used in the region. With the intensification of land use management and likely diversion of available manual labours, it will be necessary to supplement the source of power. The question of introducing animal power for management of agricultural fields is viewed with certain alarm. The first objection possibly is that the introduction of animals may ultimately bring in the competition between man and animal in respect of available resources from the land besides the increase in erosion hazards. However, as stated before, the economy of hill region will follow the proven pattern as evidenced in similar hills throughout the world. This will be a mixed land use management comprising agro-horticultural programmes and livestock keeping. Therefore, the policy of keeping off livestock, particularly, cattle may ultimately starve the regional economy. Besides, permanent agriculture on terraced land will have to be nourished by the supply of organic manures which need to be prepared near at site to keep its cost low. Also, in the near future milch cattle will find its way as the food list of the region is likely to add to it milk and many more milk products. We may, therefore, consider if animal power cannot be introduced as a part of the package. However, since this will call for a much greater social adjustment which will take a longer time, we may think of some mechanical alternatives. Power tillers seem to be an answer to the present need. A representative power tiller with a standard accompaniment can handle 5-8 Ha in a year under double cropping. It will be in a position to do transportation of appreciable load over reasonable distance. Besides, it will provide power for operating small equipment, e.g., thresher and huller; and pumps and other agro-animal based-cottage industry items. Only a few of these possibilities have been realised in other locations in India and many more potentialities are yet to be translated in reality. The power tillers to begin with could be introduced to the area from the Government agencies including the operational maintenance and repair facilities. The people could be slowly trained in handling the tillers.

MACHINERIES :

At present, post-harvest practices, particularly, hulling of paddy, etc. is a daily routine with the housewives, and this takes considerable time. Keeping the paddy in store also occupies more space. It will be desirable to hull the paddy and keep the rice in store. The small hullers can easily be introduced to relieve the burden of the housewives. These hullers can be operated mechanically or by the power available from the power tiller. Thresher, winnower and small water lifting devices may be other welcome items.

STORAGE FACILITIES :

Storage of products, e.g., agricultural produce can be improved considerably and

the loss during the storage can be minimised. Storage bins as have been found suitable in Punjab could also be a suitable introduction in the region. The horticultural items and paddy etc. can be stored in a better way to minimise the rotting and shrinking and damage by the rats.

PROCESSING

The home scale processing of horticultural goods will be a boon in utilisation of harvest. This will avert the losses of the produces due to certain time gap in the transportation to the nearest market.

PRESENT PROGRAMMES :

Keeping these integrated development projects in mind, the Soil Conservation Division of the Government of India had prepared a model scheme for evolving permanent land use management to wean away the people from the shifting cultivation. This approach has further been modified through consultation with the constituent agencies of the region and North East Council. This scheme is in operation in the States and Union Territories who are members of the North East Council. The technical aspect of the scheme has been scrutinised and cleared by the Soil Conservation Division of the Ministry of Agriculture and Irrigation, Government of India. It is hoped that this Pilot Project which incorporates some permanent areas under irrigated agriculture and some areas under horticulture or forest plantations, will further be improved with the experiences gained over years and provide an economically viable package of practices for large scale implementation in the areas where shifting cultivation is in vogue.

SUMMARY AND CONCLUSIONS :

The shifting cultivation has evolved as a necessary system of land use management and way of living for the areas characterised with physiographic romotensess. The practice has evidently served the people well in a given conditions. With the introduction of better communication system, justified aspiration of having higher standard of living and multiplicity of avocations, the need for permanent and stabilized land use management is inescapable. Considering the evolution in other hill areas of the world, the development of these areas will also centre around a mixed farming pattern which will include agro-horticultural programmes, selective forest resources and livestock keeping. The development of permanent agriculture will call for necessary soil conservation and water management practices as well as introduction of suitable agricultural tools, implements, machineries and storage facilities. The expanded livestock programme will also bring changes in their feeds and housing and also modification in the homesteads of the families in the region. The Pilot Project now in operation through the North Eastern Council and under the technical guidance of the Soil Conservation Division of the Ministry of Agriculture and Irrigation, Government of India, aims at finding a technically feasible package of practices which would be economically viable for large scale implementation in the areas.

REFERENCES :

- DAS, D. C., RAGHUNATH, B. And SREENATHAN, A. (1967):
Bench Terracing and Soil and Water Conservation in the Nilgiris. Journal. I.S.A.E. Vol. IV(2): 149 - 59.
- KAITH. D. C. (1958): Shifting Cultivation Practised in India. Review Series No. 24. I.C.A.R., New Delhi.
- NATIONAL COMMISSION ON AGRICULTURE (1972):
Report Part IX - Forestry, Ministry of Agriculture and Irrigation, New Delhi.
- WADIA, F. K. (1975): Control of Shifting Cultivation in the North Eastern Region, Directorate (E.& M). North Eastern Council Secretariat.

Plant Pioneers in a Jhum Field and their role in Soil Conservation and Soil Fertility

Dr. R.P.M. Bordoloi,
Cotton College, Gauhati.

The dry and the barren soil scorched to the ground as it is in a Jhum field, the pioneering plants that make their first appearance are some small macro- but mostly microscopic algae that belong to the group thallophytes. The term thallophytes means a young shoot of a plant (thallus=a young shoot, Phyton=a plant) and was introduced for the first time by the German Naturalist Endlicher referring by the term to the simple small filamentous plants that abound in nature, of which algae form one of the two components the other being the Fungi. Algae has more than 20,000 species and as exploration goes on more and more new forms, varieties and even new species are being added to the group.

Jhum cultivation or shifting cultivation is practised throughout the tropical and sub-tropical belt or the world. In this North Eastern part of our country this method of cultivation has been in practice, in the hilly area, in particular, from time immemorial. During the process of Jhum cultivation before the advent of Spring large tracts of land are burnt down previous to which trees and shrubs of the area are felled and allowed to dry up for sometime. The land is then allowed to remain fallow for a very brief period of time and with the coming of Spring, crops are sown in the area. Jhum cultivation is discouraged as it involves other vital problems like deforestation, soil erosion and so on which, on the whole, brings about a disturbed ecology of the area.

It is interesting to observe how different species of algae make their first appearance in a dry and burnt down soil from where all traces of plant life, apparently, are denuded off by fire. Experimentally, it has been observed in a Jhum field that for the first 2/3 weeks after the fire, nothing seemed to happen on the ash-laden scorched ground. After that period gradually species of Blue-green algae make their appearance. Thus species of Nostoc, Anabana, Aulosira, Tolypothrix of the Blue-green algae and species of *Stichococcus*, *Ulothrixchopsis*, etc. of Green Algae are some of these pioneering plants on such soil. From where or how these plants appear in a soil from where life appeared to be completely wiped out by fire is a thought provoking matter and requires research. Some of these algae, inspite of the fire, remain viable in the sub-soil, at some depth. Given favourable conditions such as humidity and temperature, they make their appearance. Again, some of them are air borne and spores are blown about by wind and on falling on soil, germinate and start life. Be that as it may, the important fact is that, that these plants make their appearance and once they do so, they rapidly multiply by vegetative division or sporulation and within a very short space of time cover up considerable area by their growth.

Soil Conservation :

Most of these algae are coated with a thin or thick mucilagenous sheath around them and collectively, they form a crust of inusilage that form a direct coating over the surface of one dry and barren soil. This sheath or crust of algae play an important role in soil conservation, by way of giving a complete protection against rain and wind action, when rain falls on a coverless soil, the raindrop bombards the soil and break into numerous

small particles. The wind next completes the task of denudation, it blows the soil particles away - resulting in soil erosion. In case of the algal growth, the algal crust, on the other hand, receives this bombardment of the rain drops and thereby protects the soil from direct hit. Besides, the filamentous algae grows in between the soil particles and with their mucilage sheath, which is hygroscopic and absorbs moisture quickly, soil particles are adhered to them. This cohesive force binds the soil particles together and this decidedly lessens soil erosion - an important factor in soil conservation.

Soil Fertility :

The fertility of a soil depends on its soil structure, moisture retaining capacity of the soil, nutrient composition and so on. Algal crust that forms a continuous sheet on the surface of the soil helps greatly in contributing towards moisture retention in the soil. This sheath has a great water absorbing and water retaining capacity. To start with, this sheath catches rain water and as the mucilage is hygroscopic, it slowly absorbs the moisture. The water then gradually trickles down to the soil, beneath the crust which prevents evaporation of the same back into the atmosphere. Singh (1947) experimentally demonstrated that the moisture content of the soil underneath the algal crust was always higher by 10 to 15% than the moisture content of the soil without the algal crust. Species of *Aphanethece*, *Nostoc*, *Aulosira*, *Anabaen*, *Tolypothrix*, etc. of the blue-green algae form extensive sheaths that form a good algal mat on the surface of soil which acts like a water-catching device for the dry soil.

Soil fertility is also greatly enhanced by the algal growth in the soil and soil composition is thus changed to a considerable extent, bringing it to the fertile side. One of the most significant changes brought about by algae is the increase in total phosphorous in the soil (Singh 1960). This increase in total phosphorous is mainly on account of the organic decomposition brought about by the death and decay of these plants. The sheath which is rich in cellulose, pectic acid, pentosen group of carbohydrates etc., also contribute towards this. Other organic substances like carbon, calcium, etc., were also found to increase considerably due to the algal growth. One great quality of algae is their ability to appear and thrive in such a medium as pure sand where organic matter stands at zero. With their soil binding, water absorbing and water retaining ability together with contribution of organic matter, the whole medium is completely altered and made suitable for other plants to follow.

But the most outstanding contribution of these plants towards fertility of the soil is their ability to fix free atmospheric nitrogen in the soil and thereby make it rich in nitrogen which is so vitally important for any plant growth. The heterocysts, i.e. the special enlarged cells are normally the sites for nitrogen fixation in blue-green algae, but recent investigations have proved that ordinary vegetative cells can also fix nitrogen to a greater or a lesser extent, depending upon the types of species. It is the enzyme nitrogenase which is responsible for nitrogen fixation and formation of this enzyme inside these plants is genetically controlled. This ability to fix the atmospheric nitrogen by these plants has been fully exploited by the scientists and now this has been experimentally proved, accepted and adopted into practice of the application of these algae as manure in rice fields, and astounding results to the tune of 30% increase in yield of rice have been recorded. Thus a great potentiality lies in the mass use of these algae in not only in rice cultivation but also in the cultivation of other crops.

To conclude Jhum cultivation should be discouraged. But till such time as other alternatives cannot be offered to the people who solely live on such a type of agriculture means should be adopted so that the dry burnt soil such as in a Jhum field can be quickly reclaimed. The answer lies in encouraging algal growth in such fields. Algal species, therefore, are to be cultured enmass in the nearby scientific laboratories of soil conservation

or forest laboratories and Jhum fields should be inoculated with these cultures for a quick growth of algae which will then take care of the problem of soil conservation by reclaiming such soil. While selecting algae species for culturing, algae with the nitrogen fixing ability should be chosen carefully. Some of the strong nitrogen fixers are *Aulosira fertilissima*, *A. implexa*, *Anabaena circularis*, *A. variabilis*, *Tolypothrix tenuis*, *Oalothrix brevisiina*, species of *Nostoc*, all belonging to the Blue-green algae.

- References :**
- (i) Fogg, G.E., Stewart, W.D.P. etc. —The Blue-green algae.
 - (ii) Singh, R.N. — Role of blue-green algae in Nitrogen economy of Indian Agriculture.
 - (iii) Venkataraman, G.S. —Algae and Rice Cultivation.
 - (iv) „ —The cultivation of Algae.
 - (v) „ —Algae Biofertilizers and Rice Cultivation.

Shifting Cultivation and Evolution of Flora

Dr. S.K. Jain, P.K. Hajra and
Dr. G. H. Bhaumik,
Botanical Survey of India, Shillong.

The vegetation and flora of an area depend on the total environmental conditions of that area. It is common knowledge that disturbance of any one factor has its influence on vegetation as well as flora.

The vegetation of a region is the overall composition of dominant species and an account of the general physiognomy of the plant growth; the flora is an enumeration of all the plants occurring in an area, usually without a commentary on dominance of individual species. Shifting cultivation influences both vegetation and flora.

The process of shifting cultivation comprises of the following main stages.

- a) Selection of the spot for cutting trees and shrubs.
- b) The process of cutting trees and shrubs in the spot.
- c) Burning of plant material *in situ*.
- d) Cultivation on this spot for varying number of years depending on fertility of soil.
- e) Abandonment of this spot in favour of a fresh spot.

All the above stages have direct or indirect influence on evolution of flora of the region. The soil of an area sustains plant growth and hence, changes in soil, in turn, effect flora. The shifting cultivation effects the soil mainly in following manner :—

- i) Due to removal of tree canopy there is no obstruction to mechanical force rain and falling water dislocates soil.
- ii) Rainfall causes leaching and acidity of soil increases.
- iii) Increased acidity renders soil unsuitable for plant growth and makes it further unstable and vulnerable to washing away. The humus which would have been created by falling leaves and other vegetable material is not available any more, further adding to acidity. Such disturbances effect micro-flora and micro-fauna of the soil which in turn effects the flora.

The authors have made some observations in changes in flora of Jhum lands in Meghalaya and Arunachal Pradesh.

It may, however, be mentioned that several other factors, some related with shifting cultivation, and others independent of it, also influence the flora. Some such factors are narrated in a later paragraph.

The following changes in flora are attributable primarily to shifting cultivation and other processes involving destruction of forests :—

1. In some spots certain trees and shrubs are scarce, and may become further rare or even eliminated from the flora of the region, e.g. *Tetracentron sinense*, *Micheal excelsa*, *Betula alnoides*, *Taxus baccata*, *Cephalotaxus griffithii*, *Cinnamoumum tamala*, *Illicium griffithii*, *Magnolia campbellii*, *Acer campbellii*, *Acer hookrg*

are becoming scarce in most of the areas of Arunachal Pradesh where shifting cultivation is being practiced.

The economic uses of some of these plants are already known, such as for timber, spices medicine, etc. As for the remaining, one can rarely know in full the mysteries of nature. Even a most insignificant looking plant may one day be found to possess either useful properties directly, or genes for improving other species. And for this reason, the importance of preserving all, repeat ALL, kinds of living things, at least in limited numbers has been universally appreciated.

2. In process of cutting trees and burning the site many parasites and opiphytes get depleted or eliminated from the flora e.g. *Caleola falconeri*, a saprophytic orchid, (which happens to be one of the largest ground orchids) was collected from the Kameng district of Arunachal Pradesh in the year 1970, but in subsequent visits it could not be located from the same area, as the area had been under shifting cultivation.
3. After the tree cover is removed many components of ground flora find the habitat no more suitable for their survival or reproduction, and perish, for example, *Paphiopedilum fairieanum* in Rupa in Kameng and some parasitic plants like *Balanophora dioica*, *Aeginetia indica* etc. and ferns like *Osmunda*, *Cyathea* at other spots.

Epiphytic plants like orchids and ferns are particularly becoming rare in the areas where forests are being destroyed, e.g. species of *Dendrobium*, *Cymbidium*, and *Vanda*.

In some cases the type locality is disturbed so much that except the original herbarium sheet, nothing may be left of that plant. For example, in the year 1966 a new epiphytic orchid *Oberonia sulcata* was described from a spot in Kameng but in the year 1970 the area was found under shifting cultivation. It means if the plant had not been located in other localities it would have become extinct from nature. A time may come when several new species described more recently from our forests may become extinct, and the herbarium sheets may be left as the only record for their once having existed.

According to Hoodker 1 who visited Khasi Hills in 1850, the flora of these hills in extent and number of fine plants is the richest in India and probably in all Asia. One can imagine the extent of destruction of vegetation mainly due to shifting cultivation. At present, excepting some sacred groves, the vegetation is disturbed in most of the areas. In a recent study of 'Law Lyngdoh' sacred grove, which is only about 1600 m in length and 300 m in breadth, Hajra (1975) 2 has collected about 400 plants which include number of interesting trees, herbs and epiphytic and terrestrial orchids.

A widely travelled forest officer and botanist Dr. N. L. Bor 3 observed about shifting cultivation in 1942 as below :

"While it did little harm in the dim distant ages when number of individuals was small and areas of forest large; it is very different tale when the cultivators live in stationary settlements and their numbers continue to increase.

"What one may call 'saturation point' has now been reached by most of the hill tribes and one of their most urgent problems is that of exhausted soil which must produce more at more frequent intervals. Some tribes solve this question by having permanent fields which they can irrigate and others manure their fields

The tree-less, grass covered hills near Barapani, Shillong Peak and Cherrapunjee are due in part to fire and grazing but the shallowness of the soil cap also has some influence.

Wherever forests are replaced by fields, it leads to introduction of numerous weeds and sometimes exotics into regions where they never existed before.

The common crops on land under shifting cultivation in Meghalaya region are potato; ginger, chillies, maize, cotton and Tapioca. During the cropping periods several plant species, mostly weeds occur in the fields; the common ones are the following :---

Spergula arvensis, *Gnaphalium luteo-album*, *Galinsoga parviflora*, *Cardamine hirsuta*, *Polygonum runcinatum*, *Rumex nepalensis*, *Chenopodium album*, *Oxalis corniculata*, *Plantago major*, *Tridax procumbens*, *Euphorbia hirta*, *E. thymifolia*, *E. prostrata* *Spermacoce hispida* and some annual grasses.

After the land is abandoned the species that gradually establish are mainly *Eupatorium adenospermum*, *Gynura angulosa*, *Ageratum conyzoides*, *Lantana camara*, *Solanum nigrum* and *S. xanthocarpum*. The perennial grasses gradually establish at this stage and then within a few years the land is covered by thick growth of grasses, the land being left for grazing by cattle.

Until recent, most areas of Arunachal Pradesh were undisturbed, but consequent upon development programmes like road - building and creating of new townships the hitherto virgin vegetation has become a victim of sudden large-scale changes upsetting the balance of nature. As a result of this and increase in the extent of 'Jhum' cultivation large areas of forests are destroyed.

In addition to paddy and wheat the commonly cultivated plants in the 'Jhum' areas of Kameng district are the following :—

- (i) *Fagopyrum esculentum* ('brasma'). The local people make flour from seeds
- (ii) *Chenopodium album* (mochalu). The seeds are mixed with rice, or taken as substitute of rice.
- (iii) *Pennisetum typhoides* (Yangrah) - used for preparation of alcoholic beverage.
- (iv) *Eleusine coracana* (Kongpu) - It is used for making a kind of alcoholic beverage.
- (v) *Zea mays* (Phismtang) - Widely cultivated for corn.
- (vi) *Glycine soja* (Lilu) - Pulse, vegetable.
- (vii) *Phaseolus torosus* (Gidilipi) - for pulses.
- (viii) *Amaranthus paniculatus* (Yacherang) - seed eaten.
- (ix) *Capsicum annum* for vegetable, spice.

Gnaphalium luteo-album, *Galinsoga parviflora*, *Rumex nepalensis*, *Capsella bursa-pastoris*, *Erechtites vzalerianaefolia*, *Conyza stricta*, *Plantago major*, *Bidens tripartita*, *Richardsonia secabra*, *Oxalis corniculata*, *Vernonia cinerea*, *Chenopodium ambrosioides*, etc. are the common weeds of these crops and find way into these lands.

The various agricultural operations like sowing, weeding and harvesting, etc. involve frequent traffic of human beings on these lands resulting in further introduction of alien plants like *Mikania micrantha*, *Xanthium strumarium*, *Sigesbeckia orientalis*, *Bidens pilosa*, *Acanthospermum hispidum*, *Eupatorium odoratum*, *Ageratum conyzoides*, *Artemisia vulgaris*, etc.

During the above processes the farmer does some selective weeding, thereby influen-

cing the qualitative as well as quantitative presence of weeds. After the land is abandoned, all kinds of seeds of weeds and adventives introduced during cultivation come up and many fresh ones are brought through grazing cattle. Due to absence of crops there is little shade and many species which would otherwise keep out of the forest area or even agricultural lands invade these spots, such as **Lantana camara**, **Eupatorium chinense**, **Eupatorium nodiflorum**, etc.

At higher altitudes in Arunachal, abandoned lands are colonised by species of **Artemisia**, **Fagopyrum**, **Rubus**, etc. At lower altitude species of **Cannabis**, **Gleichenia** and **Mikania** occur. An entirely new scheme of succession and evolution of flora takes place on these spots. It is usually the hardy and unfortunately spiny and unwanted species that colonise such lands. Vegetationally this kind of plant growth is certainly retrograde, as in place of tree vegetation a low scrub or poor grassland might result. As regards floristic composition there may be depletion of some species and addition of several others. Thus, shifting cultivation significantly influences the evolution of flora of any region.

Many papers deal with social and economic implications of jhuming. Present authors do not intend to propose any methods of stopping this age old practice abruptly. Attention is drawn to a recent article in the journal 'Science' 190 (4217) 1975 -⁴ with the title "Bringing the Green revolution to the shifting cultivator". The following methods of improvement have been suggested :

- (i) Zero tillage, and plant residue mulches.
- (ii) Mixed crops of high-yielding varieties that are disease and pest resistant;
- (iii) Fertilizers to replace the phosphorus and possible other nutrients.
- (iv) Legumes, with highly active nitrogen-fixing rhizobia to supply nitrogen to the soil and other crops.
- (v) and control of acidity by means of ash or mulches of deep-rooted species or by lime and trace elements where lime is readily available.

Though the above suggestion are for lowland humid tropics but in India some of these systems are followed even in the interior places of hilly regions.

In Kemong district of Arunachal Pradesh the tribal people use mixed cropping techniques to keep a plant cover over the soil for most part of the year.

- (i) They cultivate legumes like **Glycine soja**, **Phaseolus torosus** with **Zea mays**.
- (ii) Plant residue is also used after burning to increase the alkalinity of soil.
- (iii) Occasionally fertilizers supplied by government organisations are also used by the tribal people.

Due to increasing difficulty in availability of fresh forests for cutting and burning and also effects of extension and education, trends towards stable cultivation are being noticed in many areas of northeastern India.

The authors do realise that in a developing country like ours, and particularly in the situation now existing in northeastern India where industrialisation is only now showing signs of prosperity, a total taboo on tree cutting will simply be a thing of wishful thinking.

Planned development, with simultaneous steps for afforestation, conservation of germplasm through establishment of national parks, of arboreta or biosphere reserves should be a satisfactory solution.

References :

1. Hooker, J. D. 1854. **Himalayan Journals**, 2 vols. London.
2. Hajra, P. K. 1975. **Law-Lyngdoh (Sacred Grove) Mawphlang Visitor's Guide** For Dept., Meghalaya, Shillong.
3. Bor, N.L. 1942. The relict vegetation of the Shillong Plateau-Assam. **Indian For Rec.** (New series) 3 (6) : 152-195.
4. Greenland, D. J. 1975. Bringing the green revolution to the shifting cultivator **Science** 190 (24217) : 841-844.

Animal Husbandry as a Subsidiary Source of Economy for Jhumians

Dr. D.J. Roy and Dr. A. Verma.
I.C.A.R. Research Complex for N.E.Hills
Region, Shillong.

Shifting cultivation is a traditional form of agriculture restricted in certain tribes and is prevalent in many parts of the world. This system of cultivation of land is often described as a peculiar way of life and cannot be isolated easily from the Socio-economic aspects because of system of land holding, Cooperative efforts of clans, fitness in the pressure of population and the traditional culture. Detail observations of Pelzer (1948, 1957), Dobby (1950), Conklin (1954) and Spencer (1966) are important for understanding all aspects of problems and socio-economic conditions of peasants who follows the typical system of cultivation particularly in South East Asia. An area of about one million hectares of North East (N.E.) Region of India fall under jhum or shifting cultivation. A brief account of Jhumming practice followed in N.E. Region has been given by Goswami (1971). In practice, the particular area of a hill for jhumming is selected by a group of experienced clan leaders usually away from the village and all subsequent agricultural activities are in fact very much of a cooperative enterprise. The various agricultural operations such as clearing the forest, burning the jhum, sowing or dibbling the seed, weeding, fencing and reaping are performed in a religious spirit by the group. The shifting cultivation does not necessarily mean shifting homesteads.

Problems : The basic problem of jhumming started with the pressure of population and frequent cycling of jhum land and thus created a stupendous effect on soil in terms of erosion, fertility and ultimate low yield per acreage. When pressure of population was not significant in hills, the jhum cycling was as long as 40-50 years. In these period, the nature could rebuilt the fertility of top soil. Consequently the delitarous effect of long cycling jhum was negligible.

With the sharp growth of population, the extent and intensity of shifting cultivation increased considerably. In some areas the jhumming cycle is now 3-4 years and thus causing considerable damage to soil and forest wealth. It has been estimated that the area cleared every year for jhumming in Assam and Meghalaya hills comes to about one lakh hectares. (Goswami, 1971).

Short jhum cycle and consistent low agriculture yield on limited command area of the clans have also created a severe socio-economic problem. When the available land in the vicinity is getting exhausted, the tribe migrate to another location for jhumming. The migration of farmers and shifting cultivation are thus two problems interlinked.

Approach to the problem :

Goswami (1971) in his paper underlined the following two basic approaches to the Socio-economic problem of jhumming.

1. The jhumias must be induced to settled farming.
2. Land classification should be done based on the fact that all lands are not suitable for each and every purpose and is required to be used profitably.

Looking back at the fairly stabilised tradition of long jhumming cycle when yield crops was reasonable, even at that time tribe used to depend on animal protein of high biological values beside other food like fruits, roots, tuber etc. The wild game which was such an important supplement to the diet in former days is now in danger of extinction. Keeping the tradition and food habit of jhumias in view, introduction of Animal Husbandry in the two basic approaches, as given by Goswami (1971), will not only satisfy the dietary deficiency of food but also help in number of ways in the whole system of jhum control and economic upliftment of jhumias. In any system or culture, introduction of new taboos - may be a campaign of stopping the destructive jhumming or implementation of sophisticated technology of soil and water managements or even infusion of better breeds of livestock and poultry, there is always a danger of unacceptability, particularly in areas of sensitivity and isolation. The final approach should, therefore, be gradual and through demonstration only after some tangible results are obtained experimentally.

Animal Husbandry as a source of economy and function of jhum control :

Among the people of N.E. Region who practice shifting cultivation, do not generally keep animals to improve their economy. Moreover, the agricultural technique of jhumias is not high enough to produce surplus food. To get extra income and to patch up the shattering economy of jhumias, particularly in N.E. Region, livestock and poultry rearing are perhaps most promising and untouched field. Rotenhan (1966) referred the importance of Animal Husbandry in Sukhumland tribes in Tanzania as a best insurance against economic and social risk. The livestock protect them against uncertainty of rainfall and destruction of their harvest by pests and plagues. These tribes prefer to store their earning in the form of cattle and not in grains. Similarly, in N.E. Hill Region, certain tribes of Nagaland and Arunachal Pradesh consider possession of Mithuns as symbol of prestige and status. Most of the families of Mizoram and Nagaland rear pigs. Number of cattle, pig and poultry per hundred human population is larger in N.E. Region than the average of country. Sixteen per cent of country's pig population and 3.6 per cent of poultry population is present only in N.E. Region (National Commission on Agriculture 1975).

Cooperative approach : Jhumming is a matter of controversy. It is generally destructive to the forest, effecting the bigger trees to yield to a low vegetal cover of bamboos, grasses and shrubs, to the soil causing rapid erosion and loss of fertility; but the system is conducive to many best approaches of cooperative enterprise (Elwin, 1959). Animal Husbandry is one of the well suited practices which could be inducted to jhumias to supplement their economy. Depending on the land classification for various uses and also on the availability of land, a unit of cattle or goat or pig or poultry or even mixed units may be reared by a family of jhumias. Within the tune of cooperative efforts, a slight modification or orientation may be needed for collection and sale of animal products like milk, butter, ghee, eggs and also for marketing mutton, pork, beef, birds etc. This is not a new feature as many jhumias are already participating in the milk collection centre of Meghalaya. To be viable animal units, a strong cooperative amongst jhumias is needed to supply necessary inputs of housing animals with indigenous materials, supply of feed, land and fodder developments, storage of extra fodder in the form of silage, hay or straw for lean periods. The State Govt. Veterinary and Animal Husbandry Department may also assist in providing health guards for animals and other technical guidance. Once the animal unit is economically viable, it will be a standing source of income for the jhumias besides meeting the domestic requirements of milk, meat, egg etc.

Housing : Bamboo, wood and straw can form a very economic raw materials for construction of animal sheds. The location of the sheds may be selected to suit easy approach and availability of water.

Food / Fodder development :

(A) Grasses & Legumes :

Grasses play very important role in controlling soil erosion, runoff and promote rapid absorption of water, increase infiltration rate, stabilize gullies and reduce leaching. On the waste surfaces of terraced area grasses can be planted and several cuttings can be obtained. To make the vertical faces or ridges stable, following grasses were suggested - Wheat grass (*Agropyron semicostatum*) Brown top or colonial bent (*Agrostes tenuis*), Doob grass or Bermuda grass (*Cynodon dactylon*), Cocks foot or orchard grass (*Dactylis glomerata*), Pangola grass (*Digilariaspecies*), Weeping love grass (*Eragrostes curvuta*), Meadow fescue (*Festuca elatior*) Dallis grass (*Paspalum dilatatum*), Large canary grass (*Phalaris tuberosa*).

Interspaces of horticultural crops of jhum-land can be utilized for the production of leguminous fodders as they will provide nitrogen to these trees and will complete very little with the nutrient need of horticultural plants.

(B) Jhum Crop By-Products of animal importance in North Eastern Region :

- (a) Tapioca and its by - products.
- (b) Pineapple and its by products.
- (c) Paddy straw and wheat straw.
- (d) Potato stem and leaves.

(C) Forest by-products of animal importance in North Eastern Region :

- (a) Wild grasses and creepers.
 - (b) Tree leaves.
 - (c) Wild tubers.
 - (d) Wild fruits.
- (Bor, 1940, 1942. Rowntree, 1954).

Scientific and economic animal nutrition can be based on following cardinal principles for North Eastern Region.

(a) **Semi Range System :** In the first instance, it will be uneconomical to rear livestock on complete stall feeding system. Agro-climatic conditions of N.E. Region are more favourable for the semi range system of animal rearing. Secondly, grazing alone is not sufficient for productive livestock. Thirdly, special facilities are required to provide shelter during late hours of night to protect them from extreme weather. So, farm produce of jhum plots may be offered during this period.

(b) Need based animal nutrition programme for following class of livestock.

- (i) **Feeding of youngs :** Special nutrition should be provided for the growth of youngs, in separate managemental conditions.
- (ii) **Feeding of productive livestock :** Extra allowance of nutrients should be provided to the milking, pregnant, wool producing, egg producing and working livestock.
- (iii) **Feeding of adult livestock :** Adult livestock may be maintained with minimum of extra nutrients in North Eastern Region due to the excessive vegetations available round the year.

(c) Conservation of Extra produce for Lean period :

- (a) Hay making.
- (b) Silage making.

The methods of conserving grasses and legume are some what difficult in this region, due to excessive rainfall and humidity. Many forest products are available at Jhum land for making silo towers particularly bamboo and plaintain leaves. Moreover, jhumias are expert in bamboo art they can make it with least guiance and help.

Feeding of poultry and pig.

Very careful nutritional management is required to maintain these monogastrics animals under the odds of N.E. Region. General deficiency of protein, major and trace elements may be suspected due to the acidic soil and high rainfall of the region.

Feeding of cattle.

Ruminants can be reared without much economical investment by jhumias. Excessive vegetations during May to November can be conserved in the form of silage and hay for the lean season. Forest by-products can be given during rainy season.

Value of Manure :

Loss of soil fertility is perhaps one of the most important factors involved in jhum problem. Two major directions to the problems are :

1. Maintenance of soil fertility status.
2. Enriching soil by judicious application of fertilizer.

For conservation of soil fertility, disciplined use of land through irrigation and water management including drainage is needed through cooperative enterprise. The damage caused by irregular flow of water in jhum area is enormous causing distortion in soil balance.

Enriching soil fertility by addition of chemical fertilizer after soil analysis is a common practice now a days in boosting agriculture production. In jhum areas procuring chemical fertilizer and its effective utilization in the slopy soil are problem by itself and beyond the means of poor jhumias. Moreover, recent studies support the fact that application chemical fertilizer without massive organic manure is a ruinous process to the soil. The qualitative and quantitative aspects of "Chemically grown food" are also inferior to "Organically grown food" The peril of ignoring C-N balance through consistent use of fertilizer has been reviewed by Ghose, 1974. The process of recycling that operates in nature between atmosphere, soils, animals and the plant should leave scope for minimal use of chemical fertilizer only as a minor complement. It is apparent, that continued use of organic manure steadily improve the crop yields. The organic matter retention capacity of soil, which is so vital for jhum areas, increases steadily. Organic manure, as steadily growing soil binder-cum-fertilizer brings permanent improvement. The annual requirement of 15 tonnes per acres of farm manure can easily be met through modest unit of livestock. The value of different animal manure can easily be met through ascertained from the table below.

Pounds of plant nutrients in one ton of different animal manures (including both solid and liquid plus bedding).

Kind of animal	Nitrogen (N) lb.	Phosphoric P_2O_5 lb.	Potash K_2O lb.	Tonnes manure produced per year per 1,000 lbs. live weight.
Horse	13.2	5.1	12.1	12
Cow	11.4	3.1	9.9	15
Pig	9.9	6.7	9.3	18½
Sheep	15.8	6.7	18.0	9½
Steer	15.0	6.0	8.0	9
Hen	21.0	16.4	10.2	4½
Duck	11.4	28.8	9.8	—

Source : Cornell University. Press.

There is a bright scope of expansion of jhum areas for cultivation through maintenance of livestock. The extent of Cultivable jhum area is also directly correlated the number and unit of livestock kept by jhumias for direct and indirect source of income.

REFERENCES :

1. Bor, N.L., (1940) Flora of Assam : Gramineae V, Govt. of Assam (Assam).
2. ————— (1942) "The relict vegetation of Shillong Plateau Assam, Indian" For. Rec. (N.S.) 3, 152-95.
3. Conklin, H.C. (1961-62). "The Study of Shifting Cultivation", "Current Anthropology" 27-58.
4. Dobby, E.H.G. (1950), 2nd edn. (1954) South East Asia, London, University of London Press.
5. Elwin, V. (1959), in "A philosophy for NEFA" Publ-Sachin Roy 2nd Ed., Printers Navana Printing Works.
6. Ghose, S.N. (1974), Chemical fertilizer without massive organic manure the name is ruination "Oil. Commentry".
7. Goswami, P.C. (1971), "Status paper on shifting cultivation & soil conservation in North Eastern, India."
8. National Commission on Agriculture (1975) "Interim report on some important aspect of livestock. production in the North Eastern States".
9. Pelzer, K J. (1948). "Pioneer settlement in Asiatic tropics", Amer. Greg. Soc. Special Publ. No. 29, New York.
10. ————— (1957), "Agriculture in humid tropics" Proceedings of 9th pacific science congress. Bangkok, 20, 124-43.
11. Rotenhan, D. Freiherr Von. (1966) Bodennutzung und viehhaltung im sukumaland and (Tansania) Afrika - Studien, Berlin, Heidelberg 11, 131. C.f. Manshard W. "Tropical Agriculture" Eng. Edn. 1974, Publ. Longman (London).

Soil and Water Conservation technology for Jhum land

By. - A. Singh and Dr. R.N. Prasad
I.C.A.R. Research Complex, Shillong.

INTRODUCTION :

Jhuming system of farming on hill slopes without any soil and water conservation measures fails even to meet the minimum food requirement of the people who practice it. Reduced cycle or jhuming from about forty years to five years, itself indicates the fast progressive decline in the potentiality of hill slopes cultivated in the process of jhuming. Exposed bare rocks seen in the abandoned jhumed land are clear evidence of excessive soil erosion during the past. The land at places which produced food crops now finds hard to support even hardy crops like forest species. Therefore, without any doubt one can say that the management of land and water resource remains the key point of interest for workers engaged in study and improvement of farming systems of jhum land. In this paper an attempt has been made to discuss the technical aspect of resource management, conservation and building up of soil fertility with reference to the problem of jhumed land.

Problems of Jhum Land :

Jhuming involves cutting of forest, burning of cut stocks and cultivation of variety of crops on hill slopes up to even 100% or more. The land is abandoned after 2 to 3 years of cultivation and fresh site is selected to repeat the process. Absence of soil and water conservation measures augmented with high rainfall results in increased runoff, erosion of top soil, decline of fertility and low crop yield. Besides the damage at source (up-reservoirs and all the more loss of water to sea. The problem becomes really of peculiar nature particularly with the prevalence of drought condition with the cessation of monsoon inspite of heavy rains during near past. Therefore, control of erosion and conservation of rain water for optimum use are the aspects to be considered towards scientific management of land and water resources in Jhum land.

CONSERVATION MEASURES FOR JHUM LAND :

Considerable work has been done in the field of soil and water conservation during past but the studies were mainly confined to landscapes having milder slopes. Particularly very meagre or no information is available for agricultural land on higher slopes (upto 100% or more) commonly cultivated in jhuming process. Therefore, technology available in the field will have to be carefully used till information becomes available for jhumed land. Soil and water conservation measures namely bunds, terracing, waterways composite check dams will have to be extensively used in the general improvement of the farming system.

Approach to the Problem.

Since the major constraints to agricultural production in jhum land are related to soil and water, the development and management land and water resource should

become the primary objective towards the improvement of farming system. Watershed based farming may help in achieving the objective of development and management of land and water resources. This will result in optimum use of catchment rainfall, maintenance of soil fertility, improved and sustained production. The conservation measures to the land uses planned would also help in achieving the following objectives in general.

1. To have labour intensive technology for the development of land water resource.
2. To have land use systems which could easily be adopted and maintained permanently so as to provide additional employment to the people.
3. To have farming systems for increased and sustained production and thus raising the economic status of the people.

As far as possible a unit watershed having 2 to 10 ha of cultivated area should be planned in such a way so as to provide food, fodder and fuel to the family whom the land belongs or would be allotted. The proportion of land under different land uses will vary from watershed to watershed, but the forest invariably should get minimum 1/3 area or more as per accepted standard in land use systems.

Land capability classification suggested by Goswami (1968) for hills and land use systems used by Tejwani and Dhrubnarayana (1961) for ravines may be guide lines particularly when sufficient informations on hill land development technology are not available. Broadly, the land use in hills as it appears would have to be valleys and foot hills for agricultural and pisi-culture, middle portion of the hill slope for horticulture and upper top portion for forestry use. This concept is illustrated in fig. i(a) and i(b)

Land	Table Land	Slopy land (shallow gully)	Slopy land (Medium gully)	Slopy land (Deep gully)
	Land use Agriculture	Agriculture	Agriculture or Horticulture	River Forest
Fig.1 (a)	land use system used in slopy land (ravines) with intensive soil conservation measures (slopy land)			
Land	Table land (Valley)	Slopy land (Lower hill slope)	Slopy land (middle hill slope)	(Top hill)

River Land use	Slope Agriculture + Pisci-culture	Agriculture	Agriculture & Horticulture	Forestry
-------------------	--	-------------	-------------------------------	----------

Fig. 1(b) Land use system proposed for hills under jhum.

As seen from fig. 1(a) and 1(b) the land use pattern may be similar in hills as of ravines with only changing of place i.e. upland in ravines having agriculture, whereas upland in hills will have forestry. Therefore, technology used in ravine land will have similar nature of application with proper deviations because of climate variance. Considering above the land use and conservation measures for jhum land in hills may be as given in table - 1.

Table -1 Land use and conservation measure for jhum land.

Land description	percentage of total area (Approx).	Land use	Conservation measures.
Valleys			
(a) wide	5	Agriculture	Contour bunds, level terraces, diversion & safe water disposal outlets.
(b) Narrow		Pisciculture/irrigation ponds.	Composite check dams (earth dam with safe disposal outlets).
Hill Slope			
(a) Lower Portion	30	Agriculture	Bench terrace with inwards & longitudinal slope, puertorican type terraces and grassed water ways.
(b) Middle Portion	30	Agriculture or Horticulture	Puertorican type terraces, narrow width terraces, half moon terraces, graded channels (Depending on land use).
(c) Upper top Portion.	35	Forestry	Half moon terraces or plantation pits.

General land use system suggested in table 1 will have wide fluctuation range depending on the soil depth, slope or the capability class (Goswami 1968). Under the land use system proposed 10 to 15% of the agricultural land can be provided with irrigation facilities from the water storage provision in valley lands.

Installation and maintenance of land treatment measures :

The installation of land treatment measures as far as possible should be done by the beneficiary himself under the technical guidance of Government agencies. During installation of the measures, the forest on the top of the hill may not be cut and the whole operation may be phased out in such a way so that the work can be done with the whole able labour force in the beneficiary family. This would enable to maintain the installations which requires intensive watch during the first few years. Land treatment measures will continue to operate & produce designed benefits only so long they are properly maintained. Therefore it would be primarily desired that the maximum involvement of local people (i.e. for whom the work is to be done) will be the key for the success of the efforts for scientific management of land and water resources.

Management of soil after the installation of land treatment Measures :

Nutrients are removed from the soil by plant uptake; leaching; volatilization and erosion. The first three agencies are selective in removal of nutrients, whereas erosion is both selective and non-selective and as such it causes considerable damage in terms of soil fertility. Tamhane et al (1959) reported that soil lost in runoff is richer in plant

nutrients at 3% slopes. The loss of plant nutrient under jhuming will be much higher, since it is being practiced at a slope of even 100% or more. As such the fertility status of such soil is very poor. The management of soil will be discussed here under (i) Disturbed soil (terraces) and (ii) Undisturbed soil (puertorican).

Management under disturbed soil (terraces).

Clearing of the forest by burning causes some change in the physical and chemical properties of soils. There is an increase in the content of available phosphorus (3.8 to 5.8 Kg./ha). PH is also raised from 5.2 to 6.9. However, there is a substantial reduction in content of organic matter (from 2.8 to 1.96%) and cation exchange capacity (21.0 to 17.5) as reported by Awasthi (1976). This change in soil properties however depends on the quality and quantity of the burning material. At the time of preparation of terraces, the top soil is inverted and the subsoil (poor in practically all the plant nutrients) is exposed (Chakraborty 1972).

Liming of acid soil to raise PH to desired level, depending on the crops, has beneficial effect both for yield and for maintaining the soil fertility. In continuous experiment conducted at Ranchi since 1956, Prasad et al (1971) observed that L+NPK treatment is superior to L+FYM+PK. Continuous application of acid producing nitrogenous fertilizer i.e. ammonium sulphate has lowered down PH by a unit and it is not possible to grow a crop either maize or wheat in such situation. Even continuous application of NPK after 15 years has deleterious effect on the yield of maize. Since the soil of the N.E. Region is also acidic, the result of Ranchi can very safely be applied here to maintain fertility status of the soil to obtain desired crop production.

Slow releasing nitrogenous fertilizers may prove better in this situation. Other nitrogenous fertilizers should be applied in many split doses in order to avoid leaching and runoff losses. Organic manure can be prepared out of the forest litter of jhum land which is supposed to be rich in plant nutrients.

There are vast potentiality of the use of rock phosphate in acid soils of this region. At present its estimated reserve comes to about 120 million tonnes (approx). In India rock phosphate has been applied to acid soils in different region during the last three to four decades. Recent work reported by Patnaik et al (1974) on lateritic soils of Karnataka, M.P. and West Bengal suggest that citric acid soluble phosphate and rock phosphates can efficiently replace watersoluble phosphates in rice soils, provided they are primed to the moist soils two or three weeks before flooding and transplanting.

Mussorie rock phosphate has released higher amount of P on Tripura soils at all stages of incubation from 15 to 90 days (Mukhopadhyaya and Chakravarty 1975). The rate of its application should be double, the rate of super-phosphate on P_2O_5 basis. Mandal (1975) also reported much better residual effect of rock phosphate than that of super phosphate. He further, reported to apply certain amount of P_2O_5 as super phosphate in conjunction with rock phosphate in initial year (33%) and the second year (25%). No supplementary superphosphate needs to be applied in the third or fourth year. Panda and Panda (1969) evaluated mixture of ground rock phosphate and super phosphate in lateritic soils of Orissa growing rice. Three crops of rice were grown and 90:10=R.P: TSP gave promising results and this ratio has been recommended for acid soils of Orissa. In the light of above review, it is clear that rock phosphate in conjunction with super phosphate can be applied to build up the phosphorus level of terraced soil under jhum land to sustain crop production. If the farmer is not in a position to apply phosphatic fertilizers in both the crop of rabi and kharif, it would be better to apply in rabi for better utilization of added phosphatic fertilizers. Apart from the major nutrients micronutrients should be supplemented to the soil on the basis of soil and plant analysis.

Suitable legumes particularly cow pea (*Vigna sigensis*), calep (*Calopogonium mucunoides*) and green gram (*Phaseolus aureous*) may be put under rotation. Besides fixing nitrogen, it will provide good canopy and reduce soil erosion as well as plant nutrients. Legumes can also be cropped in between the horticultural plants.

Undisturbed soil (Puertorican type of terraces) or jhum land.

In this system of terracing there is possibility of soil and nutrient loss due to runoff. Bhatt et al (1974) reported that maize-wheat rotation resulted in heavy losses of soil (76 tonnes/ha at 8% slope) and plant nutrients (538, 79, 18, 28, 104 and 42 Kg/ha of organic matter, nitrogen available P_2O_5 , available K_2O , exchangeable Ca and Mg respectively). Under this circumstances besides the application of amendments as discussed for terraced land, the system of cropping should be;

- (i) Strip cropping across the slope with maize, cucumber, paddy etc.
- (ii) and or mixed cropping with few lines of maize and legumes. Legumes will fix some atmospheric nitrogen besides checking the runoff losses of soil and nutrients.

ASSESSMENT OF COST INVOLVED AND GAINS :

Land treatment measures involves enormous cost and some time appears too big amount. When the cost involved and projected benefits are put to test, they generally fail to withstand the test of economic measures particularly in land development and management field. As, we have to develop labour intensive technology for the improvement of jhum land it would not be wrong to measure the inputs in terms of labour units required. For example 'X' labour unit will be required to develop one hectare of land under terracing or construction of check dam for reservoir. This would avoid first hard shock of enormous monetary involvement. In the development of hills for permanent agriculture land use system, considerable amount of money will have to be invested or poured. With our personal experience, we expect that economic feasibility measurement of heavy monetary inputs in the beginning and comparatively low out put during initial years. Therefore, there is need to evolve a simple technique which would be used while planning for land use. An approach proposed by Singh (1976) for waste land development project may be a simple workable technique for jhum land as well. The method proposes the use of a simple formula for resource gain assessment which is as follows :—

$$RG = V.TL - (V.UTL + CT)$$

where RG = Resource gain (Rs./ha).
 V.TL = value of treated land (Rs. /ha).
 V. UTL = value of untreated land (Rs. / ha).
 CT = cost of treatment (Rs. / ha). (i)

Resource gain for any land use can be assessed with the help of above formula. Positive gains may be taken as justification for investment in the proposed land use. This is because the indirect gain (resource gain) for the proposed land use. Positive and direct gains would be flowing in the future. For negative gains, the land use may be changed and replanned for positive gain. This method may provide a check to the proposed land use at the planning stage itself.

References :

1. Awasthi, R.P. (1976) : personal communication
2. Bhatt, P.N.; O.P. Guptana K.G. Tejawani (1971) : Influence of cropping pattern

- and land use on nutrient loss in Doon valley. Proc. Inter. Symp. Soil Fertility, New-Delhi. Page 541-547.
3. Chakraborty, S.K. (1972) : Micronutrient studies in soils and plants Ph.D. Thesis, Ranchi Univ.
 4. Goswami, P.C. (1968) : Shifting cultivation and its control in Garo Hills, Soil Conservation Department Assam Publication.
 5. Mandal, S.C. (1975) : Phosphorus management of our soils J. Indian Soc. Soil Sci. 23(2), 141-157.
 6. Mukhopadhyays, A.K. and R.P. Chakraborty (1975) : J. Soc. Exptl. Agril. Kalyani in press.
 7. Patnaik, S; P.A. Saranganath and B.A. Sinde (1974); Fertilizer News. 19(12), 46
 8. Prasad, C. R.; M.; Shamiuddin; B.N. Singh; K.K. Jha and S. C. Mandal (1971) Effect of continous application of manures, fertilizers and lime on some physical properties of acid red loam soil of Bihar, Proc Inter. Symp. Soil Fertility New Delhi. page 865-872.
 9. Singh, A (1976) ; A method for resource gain assessment in waste land development projects. Paper presented at XIV convention of Indian Society of Agricultural Engineering. 15-18 January.
 10. Tejwani, K.G. and V.V. Dhruvanarayana (1960) : Soil Conservation survey and land use capability planning in the ravine land of Gujrat J. Indian Soil. Sci. (4), 223-244.
-

Management of Land and Water Resources of Jhum affected area of North Eastern Region

Dr. R. N. Rai,
I.C.A.R. Research Complex for N.E. Hills
Region, Shillong,

Land and Water being limited, their efficient use is basic to the survival of an ever increasing population. The success of agriculture depends on the extent to which the soil moisture reservoir is managed for optimum crop production. Our concern with the soil moisture reservoir involves in the preservation of its capacity, in the replenishment of its depletion and its management for optimum beneficial use.

LAND AND WATER RESOURCES :

Negi (1973) reported that this region accounts for 7.7% of India's total area, 2.2% of total cropped area and 3.5% of the country's population. The following statistics about the constituent units of this region would be helpful in assessing the resources.

Table - Density of Population of N.E. Region :

State/Union Territories.	Population in lakhs	Total area Sq. Km.	Density of population per Sq. Km.	%cultivated area.
Meghalaya	9.80	22,272	44	8.1
Assam	146.30	78,550	186	34.2
Manipur	10.70	22,346	48	7.6
Tripura	15.57	10,451	149	21.7
Nagaland	5.16	16,488	31	3.6
Arunachal Pradesh	4.45	81,426	5	N.A.
Mizoram	3.22	21,466	15	2.0
India	548 m.	328 m. ha.	178	45.5

The data show that all the States (except Assam) and Union Territory of the region has lower density of population and less percentage cultivated area in comparison to average figure for India. This area has got the record of having highest rainfall in the world (i.e. about 11000 m.m. per annum) along the Cherrapunji, Mawphlang, Pynursla belt. The rainfall ranges from 2125 m.m. in Kamrup to about 4141 m. m. in Tirap Division of Arunachal. Major part of Barak basin receives rainfall of about 2000 m.m. The South-Western and North Western parts of the Barak basin receive a higher rainfall ranging from 2000 to 3000 m.m. (irrigation Commission 1972).

When irrigation potential studies were made by the Central Water & Lower Commission, the total run off of the Brahmaputra and Barak basin together was assessed as

590714 million cubic meter. The utilisable quantum depends upon the variations in flow, the nature of utilization, the suitability of sites for the construction of water storage reservoirs and diversion works. The actual utilisable quantum from surface water sources will be much lower, while considering the topography of the regions. The Irrigation Commission (1972) have assessed the utilisable water resource from the Brahmaputra System as of 12,300 million cubic meters.

PROBLEMS OF LAND AND WATER MANAGEMENT

Low agricultural productivity of the North Eastern Hill region may be attributed to prevalent primitive method of cultivation in the form of jhuming of steep slopes where land and water resources are not properly utilized. Although very little studies has been made on land & water management in this region, following problems may be considered in light of studies made in almost similar conditions in other parts of the country.

Decline in soil fertility : Nutrients are remove from the soil by uptake of plants leaching, volatilisation, erosion. The first three agencies are selective in removal of nutrients whereas erosion is both selective and non selective as such it causes considerable losses in terms of soil fertility.

(a) Effect of cultivation and cropping pattern on nutrient losses in run off; Bhatt et al (1971) observed that on 8% slope maize resulted into heavy losses of soil (76 tonnes/ha) and plant nutrients (538.4, 79.2, 17.7, 28.1, 108.6 and 41.9 Kg/ha of organic carbon, nitrogen, available P_2O_5 , available K_2O , exchangeable Ca and exchangeable Mg, respectively under high rainfall area (2000mm.) of Dehradun. No. loss was noticed in soil under gross cover (cynodon plectostachyum). It was further observed that major quantities of plant nutrients in respect of Sannhemp-Wheat and jowar fodder wheat rotations were lost in the first fortnight of July, whereas maize-wheat rotation continued to suffer loss till the middle of August.

Geol and Khanna (1969) observed beneficial effect of keeping the soil under some crop and not leaving it follow during the monsoon. The losses of all the nutrients under study were highest when the plot was kept cultivated follow during the rains. The losses of nutrients under sannhemp when grown for green manuring sowed that even this was not good in respect of checking the loss on sloping lands. It was so because it covered the land only upto middle of August and after it was ploughed under the plot became bare and suffered from accelerated erosion. Mixed crop of Jowar and Arhar sown broadcast and found quite effective in checking the nutrient losses. It proved superior to all crops other than til.

The studies at Dehradun and Kanpur have revealed that a simple practice of contour cultivation has been very effective in reducing runoff, soil loss and plant nutrients and has increased the yield of Jowar grain and straw by 22.5 and 12.5 Kg/ha respectively for each m.m. of rainfall conserved.

(b) Effect of degree and length of slope on nutrient losses in runoff; Geol et al (1967) reported that the loss of nutrients increased with the increase in the degree of slope. This loss was gradual upto slope of 1.5 percent but became abruptly high above this slope. The losses almost doubled with the increases of slope from 1.5 to 3.0 percent in respect of organic matter, nitrogen phosphorus and potash, while the loss in respect of calcium and magnesium was more than three times.

Gupta and Singh (1967) studied the loss of different forms of soil phosphorus and stated that losses were heaviest for calcium bound phosphorus and least for aluminium bound and iron-aluminium occluded phosphorus. They further noted that humus lost

in the runoff on steeper slopes was poorer in phosphorus, while on longer mild slopes, it was richer in phosphorus. The relationship of the loss of different forms of phosphorus with increase in the degree and length of slope was almost linear except for aluminium bound and iron alluminium occluded phosphorus.

Goel et al (1968) indicted that loss of calcium, magnesium, phosphorus and potash increased with and increase in the length slope,

Soil moisture; As a natural factor, problems of excess moisture and cloudiness (limiting radiant energy for photosynthesis) in the monsoon season, and of moisture deficiency in the pre and post monsoon season (when there is plenty of light) limit the yield. High rainfall during monsoon causes excess runoff which goes away unutilised and aggravate the flood problem of plains.

Improper land uses; the Eastern Himalayan Hill region is a unique geographical area with a great diversity of soil climatic conditions influenced by altitude, presenting a wide variety of vegetation. However, the productivity of vegetation of economic value is considered relatively low. There is lack of reliable data on soil surveys, slope, depth of soil etc. for land capability classification and proper land use 'planning.

Land tenure system; Most of land under shifting cultivation is either community or privately owned and subject to annual cultivation. In some areas land are divided into clan lands or 'Akhings' with a clan chief known as 'Nakma'. Thus land does not belong to any individual or the actual tiller. This system, however, does not provide suitable environment for taking interest in proper management and development of land and water resources by the tillers of lands. It is administrative and social problem affecting other technical aspects.

PAST APPROACHES :

After independence, Govt. has tried in several ways to reduce or eliminate **jhuming**. At first in 1954, a Pilot Project for jhum control was established under forest department to encourage horticulture and cash crop cultivation. This was later expanded into soil conservation department. Later the department took up the work of developing land (terracing) for encouraging permanent cultivation. Since the fourth plan, follow up programme for the developed lands (i.e. seed, manure supply etc). have been taken up. Now expanded programme for preparing of land for permanent cultivation and settling the Shifting cultivators to such site alongwith follow up programme of not only seed, manure and fertilizer supply but also helping them in constuction of houses etc. have been taken up.

PROPOSED APPROACH :

Useful lessons have been learnt from past programme of **jhum** control and this has emphasised the need of an integrated approach and follow up programmes. The following steps are proposed for proper management of land and water resources of **jhum** affected areas.

Land use survey : Intensive work on preparation of an integrated inventory of land, water and other natural resources, area by area, and the development of scientific land and water use plan should be given highest priority. Land use survey may provide data on resource endowments which may be interpreted with the object to assess the constraints and potentials of production from land, Soil survey organisations of state and centre should be suitably strengthened for the purpose.

Watershed planning; Soil and water conservation projects should be developed on watershed basis as an integrated production Oriented programme of development all the way from ridge to the valley.

Terracing : Terracing is the most extensively used foundation measure which makes possible for using the land more intensively over years by reducing the danger due to runoff and soil loss. Following points may be considered for terracing.

- (a) It is not essential to convert entire watershed or hillock into bench terrace if slope and soil conditions does not permit it. It may be confined to say 1/3 rd or 1/2 bottom lands according to suitable area available.
- (b) If due to economic constraints bench terracing is not possible one may try Puertorican terracing which will be very much cheaper and in due course of time the area can be converted into level terraces. A combination of bench and puertorican terracing in a watershed or a hillock may also be followed.
- (c) Construction of bench terraces should be followed by its maintenance. The maintenance requirement is more during first year when filled soil remain loose.
- (d) Bench terraces should be inward slopy with shoulder bunds.
- (e) For stabilization and utilization terrace risers should be planted with suitable vegetation e.g. grasses, pineapple etc.
- (f) For puertorican terraces vegetative barriers e.g. pineapple grasses etc. may be planted on bunds made accross the slope.
- (g) Construction of bench terraces should start from bottom. It is helpful in increasing the chance of top soil to remain on upper surface of the terrace.
- (h) Sufficient (depending on availability) organic manures e.g. F.Y.M., compost should be added for rapid build up of soil fertility in newly constructed terraces. As per soil test use of inorganic fertilizers & micro nutrients should also be incorporated
- (i) The area for bench terracing and degree of slope upto which it can be done, may be decided according to needs of the State/Union territory.
- (j) The terracing work may be got done by the actual allottee of land under technical supervision of state Govt.. If economic condition does not permit this work, it may be financed by institution of the area and the money involved may be recovered later on in instalments.

Water resource development; There is need and considerable scope for water resource development for supplementary irrigation in the non rainy months. It is necessary to demarcate areas suitable for irrigation by properly conducted surveys.

Providing infra structure; Alongwith preparing the land ofor permanent cultivation, other facilities like housing, drinking water supply, communication, school, hospital marketing facilities etc. should be provided for the permanent settlement of **Jhumias**.

Legislation; Possibility of introducing legislation to wean away the people from **jhuming** of steep slopes need to be explored. Provision should be made to allot the land to actual cultivator families, so that they develop attachment with the properties. This will provide incentive to jhumias families for development and managment of allotted land.

Package of practices; After construction of terraces, it is essential that package of practices should be developed for jhum lands for increasing the production. These practices should be demonstrated to jhumias so that it becomes self replicating.

I.C.A.R. Research Complex for N.E. Hill Region, has taken up studies to develop alternative farming system to replace jhuming under leadership of the Director Dr. D.N. Borthakur, Quantitative data in respect of this region is not available on many aspects of jhuming. The study will provide answer to many problems whose answer is not known presently.

REFERENCES

1. Anonymous 1972-Report of the Irrigation Commission Vol. III (part I) P 197-253
 2. Bhatt, P.N. Gupta, O.P. and Teiwani, K.G. (1971) - Influence on cropping pattern and land use on plant nutrient losses in Doon valley. International symposium on soil fertility evaluation Vol. I-pp 541-547.
 3. Goel K.N. Khanna M.L., Gupta R.N. (1968) - Effect of degree and length of slope and soil type on plant nutrient losses by water erosion in the alluvial tracts of U.P. Jour Soil & Water Cons. India 16: 1-6.
 4. Goel, K.N. Khanna M.L. (1969) Effect of crop rotation in reducing the nutrient loss in alluvial tract in U.P. Jour Soil & Water Cons. India 17: 42-46.
 5. Gupta, R.N. and Singh N. (1967) Selectivity of erosion processes with respect to soil phosphorus in the alluvial tracts of U.P. 15: 261-268.
 6. Negi, L.S. 1973 - Status papers on Agricultural education and training in North-Eastern Region-Presented at Seminar held at Shillong from 23rd to 26th October, 1973.
-

Alternative system of Farming for increasing productivity in Jhum lands

Dr. D.N. Borthakur, R. P. Awasthi and
Dr. S. P. Ghosh.
I.C.A.R. Research Complex for N.E. Hill
Region, Shillong.

Jhuming or shifting cultivation is the most primitive form of agriculture which is still in vogue in most parts of the North Eastern Hill Region of the country. It may be defined as "the custom of cultivating clearings scattered in the reservoir of natural vegetation (forest or grass woodlands) and of abandoning them as soon as the soil is exhausted and this includes in certain areas the custom of shifting homesteads in order to follow the cultivators' search for new fertile land. "(FAO Paper 1957). According to rough calculation nearly two million people in India cultivate approximately eleven million hectares of land under shifting cultivation (Mukherjee 1974). The magnitude and severity of the problem in N.E. Region will be further evident from Table 1 which gives a detailed account of the total cultivated area, percentage area, total as well as percentage population dependent upon jhum.

Undulating topography, humid climate with thick natural vegetation, low pressure on land and community system of land tenure were perhaps primarily responsible for giving rise to this system of agriculture. It is the outcome of age old tradition and can be called as the best solution in those existing conditions when the human society was in transitional stage from hunting to agriculture and when there was no other methods known or systems developed for restoring the fertility of the soil. But adequacy of this system to meet the present food need of the ever increasing population and thereby raising the standard of living appears to be completely impossible. Besides its other harmful effects as enumerated in Table 2; lands of shifting cultivation can hardly support a population of more than twenty per square mile. This is one of the major concerns which warrants the idea of an alternative systems of farming for increasing productivity in Jhum Lands with an ultimate objective of permanent settlement.

Basic approach to solve the problem.

Shifting cultivation has been rightly held responsible for crippling the economy of the people of this region and therefore has attracted the attention of so many planners and administrators in the past, although without much success. The reason behind this being that most of the studies so far made on shifting cultivation mainly confined to anthropological and social aspects of the problem. The other studies are in the field of soil conservation and agro-economic surveys. Studies wholly devoted to the problems of agriculture and its production by agricultural scientists are very limited.

However before we think of any improvement some of the simple facts relating to jhuming has to be considered in order to appreciate the problem. Firstly, jhuming is the outcome of age-old tradition and thus has become the way of life; therefore people would not like to part away easily with it. Secondly, any improved technology should be such that could cater to the needs of the people and is easily accessible and acceptable to them. For example, some are of the opinion that permanent solution of this vexed problem lies in complete terracing of the whole area. While this may be an acknowledged

fact but in the present circumstances it is neither practically feasible nor going to be readily accepted by the jhumias as it involves a lot of expenditure in the very beginning for its construction and maintenance as well as for the development of infrastructure.

The same aspect has also been adequately stressed in many studies. Schlippe (1956) observed in his studies on the improvement of shifting cultivation in Africa that "the first step in the right direction is a thorough study of local agriculture. If we could only interpret a traditional practice in terms of its environment and traditional limitations we could certainly find the way to its improvement. Agriculture is that sector of human activity in which there is greatest interaction between the environment and the culture which has grown in and from it." Therefore he has advocated to find improvement without doing violence to the limiting framework of tradition and environment.

While Chaturvedi and Uppal (1953) observed that "the correct approach to the problem of shifting cultivation lies in accepting it not as a social evil, but recognising as a way of life; not condemning it as an evil practice, but regarding it as an agricultural practice evolved as a reflex to the physiographical character of land." Hence, they advocated that while planned land use measures should be taken up with top of hills with forest and lower-down with terraces in gentle slopes, the middle portion may be continued with jhum alternating with silviculture. As far as jhuming portion is concerned, they suggested that crop-planning and silviculture practices should be so designed as to (a) make full use of the inherent fertility and (b) to restore the fertility when exhausted.

Terracing, land use capability classes based on watershed, use of various crops to check erosion and improving productivity under jhum have also been suggested by other workers (Patnaik 1975, Tejwani, 1975, Gupta 1975 and Saha 1973).

With the above information as the background, let us think of some of the practical and scientific solutions of the problem which should aim for evolving such technologies and management practices or alternative systems of farming which could produce maximum per unit area of land without impairing its fertility as well as attract jhumias towards permanent settlement without disturbing their social structure. Programme for increasing productivity for jhum Land as well as alternative system of farming are detailed as per Table 3 and 4 and are discussed below :—

A. Steps for increasing productivity of Jhum Land.

A short term as well as long term programme would be required for improving productivity of Jhum areas with the ultimate objective of permanent settlements (Borahakur, 1976). These aspects will be discussed in different phases because the measures required to be adopted in the first year will differ from the measures adopted during subsequent years.

I. Short Term Measures.

The Governments of the various States and Union Territories have taken up some schemes to rehabilitate people permanently through development of terraces. These schemes while involving large sums of money will also take many more years to completely stop jhuming. The short term measures are therefore required to improve productivity, check soil erosion and allow the time required for developing terraces based on the resources of the farmer as well as of the country. The measures suggested are :—

(I) Proper land use planning based on land capability classification.

In most of these hill regions cultivation is done irrespective of the slope consi-

deration and one will be astonished to know that in certain cases, it extends beyond 100% slope. Therefore a detailed survey work should be undertaken keeping in view the nature of slope, soil depth and prevalent practices to reclassify the land for proper use. The various land use classification suggested by various workers may not hold good considering local prevalent practices. However, they may serve a guideline for reclassifying the land.

(2) Checking soil and fertility loss.

During the first year after clearing and burning there is an increase in the fertility of the soil as reported by many workers and is revealed from the following chemical analysis of soil from the Central Potato Farm, Upper Shillong (Awasthi, 1975).

		Available (Kg./hect).				
	PH	T.S.S.	Organic Carbon.	P ₂ O ₅	K ₂ O	C.E.C. (m.eq %)
Before burning	5.28	0.10	2.76	3.81	700	21.1
After burning	6.90	0.80	1.96	5.82	1680	17.5

Therefore to start with, our endeavour should be to utilise this increased fertility by raising successful crop. Since there is no soil work and crop mixtures are sown by dibbling the seeds, there is only chance of splash erosion which could be prevented by providing vegetative cover having good canopy before the erosive rain starts. Cowpea-beans, grasses etc., may serve as a good crop for this purpose. They will also be helpful in nitrogen economy of the soil.

(a) Mechanical measures. Puertorican type of terraces.

After clearing and burning the site, many big trees and trunks are left unburnt. These logs of wood can be utilised for making natural contour bunds. Efforts must be made to stabilize these bunds by planting natural grasses or suitable live hedges or horticultural crops like pineapple. In course of time these will turn into natural terraces. The practice will help in checking soil erosion by breaking steep slopes into number of short slopes and can be easily managed by the manpower of Jhumias family without involving much expenditure. This will not go against their sentiments because they can raise their crops in the same way as they are doing in Jhum Land. However, they can be persuaded to go for improved varieties of their crop mixtures.

Half moon terraces.

As far as planting of horticultural crops is concerned, it can be planted on slopes by making half-moon terraces which will permit use of fertilizers, check erosion and yet not require development of terraces.

Levelling and partial terracing.

Since from the third year onwards there is tremendous decline in productivity of the Jhum Land, the Jhumias are forced to think of other site for clearing and Jhuming. It may be desirable to terrace only one third of the total area towards the bottom of the slope. This will help to increase the yield as the jhumias can take their food crops like paddy, maize, millets etc. with better inputs like fertilizers, irrigation, better varieties combined with good management practices. In such a case, the yield obtained from these terraces may be equal to the yield obtained from the whole area. Because it has been found that yield per unit area increases nearly three times in terraces as compared to Jhum

Land. This will not only help to increase the yield but at the same time release other land for further use like fodder and horticultural crops to check erosion which will also be a source of extra income to the farmer. This will not involve much expenditure as it can be easily done by utilizing manpower from jhumias' families. This will also be good proposition for the Development Department who can cover three times more area in unit time and with the same amount they can settle more populations.

Water disposal system.

Suitable water disposal system should be developed. As far as possible, locally available material shall be used while developing such systems.

Water harvesting technology.

The excess run-off water may be stored at suitable locations and some may be utilised when there is scarcity of water for the crops being grown. This will serve as life saving supplemental irrigation.

(b) Soil management practices.

Cover crops.

This is the surest and cheapest way of avoiding the direct beating or striking effect of rain-drops on unprotected soil which otherwise will be detached and transported by runoff water thus causing erosion. Since crops vary in their effect on checking erosion by way of their growth habit, root system and canopy cover, their proper selection should be given due consideration keeping in view their adaptability to the environment and quick growing habit in relation to rainfall. Some of the crop which are ideal for this purpose include cow-pea, beans, leafy vegetables, fodder crops etc. They should be sown either singly or in rotation with the main crop in such a way that they form a good vegetative cover before the erosive rain starts.

Strip and mixed cropping.

Soil erosion loss on gentle slope can be appreciably minimised by sowing erosion permitting crops alternating with a strip of erosion checking crops. Depending upon the location, climatic conditions, such types of crops can be selected. Pineapple where feasible to grow, will serve as a good erosion checking crop besides providing an extra income to the cultivator.

Mixed cropping which is the most prevalent practice in this region should be encouraged. The selection of crops and sequence of cropping should be managed in such a way that the jhumias should get all their food requirements from the same field all round the year. The crop mixtures may include food crops like paddy, maize, millet, vegetable crops, pulses, oilseeds, tuber crops etc. Due to different growth habits of these crops, it will provide continuous cover to the field, and organic matter, fix nitrogen and thus will ultimately help in checking soil erosion and restoring fertility of the soil.

Relay cropping.

Since mixed cropping is already in practice by the local jhumias, relay cropping can be easily adopted. This is the best way of providing continuous protective cover restoring the soil fertility and increasing the per capital income of the farmer. Crops should be sown. However, while adopting this system, general principles of relay cropping should be followed.

pping should be strictly adhered to. For example, no two crops should be grown in succession which are likely to suffer from the same type of diseases and pests. If one crop is deep rooted, another one should be shallow rooted so as to exploit the nutrients from different feeding zones. For restoration of fertility at least one leguminous crop should be included.

Green manuring.

Normally the idea of growing crops purely for green manuring purpose in site may not gain favour from the cultivators. However, this can be done by raising the crops in some small portion of the land, cutting the green matter from this area and spreading the same in remaining portions of the entire land well in advance of rain showers and incorporate them in the field. This will help to increase the infiltration capacity of the soil by way of addition of litter which after accomposition will turn into humous and ultimately add to the fertility of the soil besides checking soil erosion.

(3) Improving productivity through crop management practices.

Improved variety.

Leaving aside all other measures for increasing productivity, introduction and adoption of suitable high yielding disease resistant varieties of different crops will contribute a major share in improving the productivity of the Jhum Land. However, the varietal requirements for different agro-climatic zones/regions will widely differ depending upon the altitude, rainfall and cropping pattern etc. Therefore, varieties should be developed keeping in view all these factors including disease resistance. Besides these attributes, duration should be also kept in mind so that it could be well fitted in the cropping sequence of the region.

Crop planning.

Defective crop planning results in low return per unit area by reducing crop yield while successful crop planning can improve the over-all economy of the farmer by sustained crop production. Therefore the selection of crops, to be grown, their sequence planting time, seed rate, spacing etc., should be so planned so as to produce maximum per unit area, meet their essential food and nutritional requirement all round the year and also distribute their labour input in a rational manner. With the existing method of growing crops under Jhum, the Jhumias can hardly meet their both ends throughout the year. Rather, out of 12 months in a year, nearly 3 months (from April to June), they have to survive on wild roots, jackfruits and be contented. Therefore, besides their Kharif crops, if they produce wheat by sowing it during August-September which will be ready for harvest during February-March, they can meet their food requirement throughout the year.

Use of manures, chemicals and fertilisers.

Since the fertility of the soil is greatly enhanced after clearing and burning, there is no need of adding any fertilizers in the first year of jhum land. However, in subsequent years when fertility starts depleting, it may be a desirable practice to apply fertilizers in order to exploit the full yield potential of the crop varieties grown, as judicious use of fertilizers supplying major nutrients is the surest way of increasing sustained productivity without impairing the fertility of the soil. But under the present circumstances, one significant aspect of fertilizer application should be borne in mind i. e. its application should be only restricted to the 1/3rd. bottom terraced area and that of half moon terraced area. The fertility of the rest of the hill slope area can however be maintained by manipulating the other agro-techniques of restoring fertility like inclusion of legum crops, ley farming

etc., otherwise, there is risk of washing away of all the nutrients supplied through artificial fertilizers on hill slopes. Since, the soil of most of these regions is acidic in nature, choice of different sources, their optimum combinations should be in accordance with the soil test crop response based on experimental findings. Thus judicious application of organic and inorganic manures, micro-nutrients and soil ameliorating elements like lime, bacterial and algal culture will go a long way in stabilising the yield at a higher level and effecting the over-all improvement of soil productivity.

Weed Control :

Weeds are one of the major problems of jhum and sometimes, it is said to be the main cause of abandoning the jhumland because it becomes uncontrollable by the manpower of jhumias family and involves a lot of expenditure besides its other harmful effect on the crops. Therefore, control of weeds through herbicides in feasible packets and by smothering effects of suitable crops in steep slopes offer great potentiality towards improving their yield as well as economic conditions. Because this will relieve jhumias to devote his time for some subsidiary source of income.

Water Management.

Water use technology based on watershed management should be worked out to make effective use of available moisture, its conservation for maximum benefit of the crops and human beings.

Plant Protection.

Suitable plant protection measures should be worked out to protect the crops from various pests and diseases.

Use of Implements.

Suitable implements should be designed to suit the local conditions for various cultural operations.

Long term measures.

(i) **Study of Rainfall Pattern :** The rainfall pattern, its intensity, etc., should be thoroughly studied in order to check soil erosion.

(ii) **Development of Terraces :** The gradient of the hill slopes, soil type, depth of soil etc., should be studied in order to relate development of terraces, the width and slope as well as their retention.

(iii) **Water Conservation :** To study various methods of conservation of moisture in terraces under different soil and gradient conditions, such as depth and method of ploughing mulching, crop coverage not to expose the ground etc., for recommending proper measures. Studies on watershed management water harvesting techniques should also be carried out.

(iv) **Cropping Pattern :** Cropping patterns under irrigated and rainfed conditions should be worked out. Since growing crops in a mixture is a common habit of the farmers, it would be worthwhile to work out the mixture of crops and their spacings based on crop compatibility studies.

(v) **Use of Implements :** Suitable yet hardly and easy to operate implements should be tested to recommend them in the farming system.

(vi) **Studies on Effects of Burning :** Reports indicate that the process of burning leads to increased yields. Further, there is indication that the pH of the soil also rises as a result of burning (Awasthi, 1975). It would be worthwhile to undertake basic studies on the effects of burning on land preparation, fertility pH, Micro-organisaml status, soil borne pathogens etc., to see if burning can be used to the advantage of the farmers.

(vii) **Building Up Soil Fertility :** Chaturvedi and Uppal (1953) suggested that although the 'Taungya' method of alternating agriculture with silviculture helps in building up the soil and fertility, the time gap required does not permit introduction of the system under the existing pressure of land. However, they advocated the use of leguminous plants like *Acacia* which fixes nitrogen, becomes mature in about eight years, when the bark can be used as a source of tannin while the wood can be used as fuel. Studies on such lines may be helpful to build up soil fertility quickly.

(B) Alternative System of Farming to replace Jhuming to permanent Cultivators.

Having discussed in length the various measures to increase the productivity of of jhum land, the question of how to replace this wasteful system of agriculture to permanent cultivation still remains to be answered. Some of the alternative systems which can be thought of, keeping in view the physiographic character of land, climatic limitations, food habits, natural resources, social customs and traditions and over-all generalised picture of the region as a whole, may be in the pattern of diversified farming and include a blend of system comprising of agriculture, horticultural crops combined with animal husbandry including fisheries and poultry farming. But this will be as phased programme and we have to move slowly adopting the policy of persuasion, demonstration and fundamental research of applied nature to win the confidence of Jhumias. Any haste or an attempt to solve this vexed problem at a pen stroke may result in dismal failure and the very philosophy of the whole concept will be defeated. Some of these phased programme of alternative systems of farming had been depicted in the chart.

Agriculture.

Problems of agricultural production on sustained basis may be solved by terracing the 1/3rd. of the bottom area by practising all improved technology of increasing production as has already been discussed in the preceeding paragraphs and therefore need no more elaboration.

Role of Horticultural Crops in Alternate System :

The whole of N.E.Hilly Region, wherever Jhuming is practised, is considered to be ideally suited for different horticultural crops. Fruit crops like citrus, banana pineapple, guava are well adopted crops for lower elevation situations, while temperate fruits like peach, plum, pear and apples are being tried successfully at higher altitude situations. In addition different vegetable crops, tuber crops like topioca (cassava) colocasia, dioscorea, sweet potato and plantation crops like arecanut, black pepper, coffee are also being cultivated successfully in different agro-climatic zones of N.E. Hills. Scientific cultivation of these well adopted horticultural crops may become quite remunerative in suitable regions and may very well be tried in jhum land for improvement of the Jhumias.

In jhum lands, as alternate system with horticultural crops, two types of farming practices may be suggested.

(a) Short-term till the permanent settlement of Jhumias :

Like the cropping pattern followed in West African humid tropic belts, in lower altitude of N.E. Hills, long growing starchy crops like tapioca (cassava), colocasia, dioscorea, fruit crops like papaya, banana (cavendish group), and vegetable crops like chillies, sweet gourd, beans etc., may be planted during the late growth phase of the 1st. cereal crops. As a result of the mixed planting, at the time when the first crop is ready the vegetative growth of the 2nd. crops will form a protective soil cover. Some of the 2nd. crops, will be ready by the 2nd. year, while the remainders may be allowed to grow further for 3 to 4 years to be harvested as required. This system will help in reduction of leaching and percolation of nutrients, will reduce the losses due to sheet erosion and will help in developing litter layer on the surface. The short duration horticultural crops mentioned above will also help in transferring sub-soil nutrients in the top soil. thus, the advantages of following for the period of 4-5 years may be attained to a great extent through this alternative system, with additional income for the Jhumias.

(b) Long-term permanent settlement :

The upper portion of the hills (above 30% slope) may be covered permanently with perennial horticultural crops species with suitable inter or companion crops. The fruit plants may be planted by making half-moon terraces and bench terracing may thus be avoided. Generally, in the low hills (upto 900m) crops like citrus, pineapple, banana guava, litchi, in medium hills (900-1500m) stone fruits like peach, plum, apricot, pear, persimmon and in high hills (above 1500m) fruits species like apple, pear, chestnuts, may be tried.

In citrus, Khasi mandarin, Assam lemon, sweet orange varieties like Valencia; in pineapple varieties like Kew and Queen; and in banana varieties like Jhaji and Champa are well adopted in N.E. Region. Scientific cultivation of these crops will be quite remunerative to the growers. From the observations on the performances of different temperate (stone and pome) fruits at Meghalaya (Shillong), it is reported that plum varieties like Elberta, Santarosa, Doris, Satsuma etc., peach varieties like Alton, Kiaora, pear varieties, William, Bon Chretien, Fertility, Conference,; apricot varieties; New Castle, Apple varieties, like William Favourite, Lady Sudely, Cox's Orange Pippin King of Pippin, Prince Albert etc., may be tried successfully in the N.E. Hills Region. In the comparatively warm temperate zones, low chilling requirement peach varieties like Sharbati, Sufeda, Florida. Sun; plum varieties like Alucha, Calcutta, Jardalu, Ladakh and pear varieties like Smith, La-conte may be found to be successful. Selection of suitable intercrop of companion crop is very important for young pre-bearing fruit orchards. As a general principle, the intercrops should be remunerative but the remuneration should not be at the cost of health and productivity of the main orchard trees. Shallow rooted leguminous crops which may develop thick soil cover during early monsoon period will be considered ideal for this region. Thick vegetative ground cover will protect the soil from erosion as well as they would control the weed growth considerably. Crops like soya bean, cowpea, beans, peas etc., can be safely tried in suitable agro-climatic zones. With proper care and substitution of extra fertilizers even crops like ginger, turmeric, certain vegetable crops like brinjal, tomato, sweet potato can be grown in the first few years of orchard life.

Among the plantation crops, coffee, arecanut, black pepper, rubber etc., have been found to be promising in the N.E. Hill Region. Coffee comes up well under semi-shady conditions, while black pepper may be successfully combined with arecanut. Rubber can be tried in comparatively degraded lands. In arecanut plantation, pineapple may be put as intercrops at the initial stage and even a planned mixed plantation of arecanut, black pepper, large cardamom and banana is possible for certain areas.

Development of Animal Husbandry including Fisheries and Poultry Farming.

Sources of subsidiary income will have to be encouraged in order to improve the standard of living of the jhumias as well as to infuse into them the idea of permanent settlement. Animal husbandry can be effectively introduced and popularised. The need for growing fodders will also help in checking soil erosion.

Conclusion.

Summarising the whole aspect of the problems of shifting cultivation, it can be said that the solution of the problem is not so simple as it appears to be. Indeed, the task is arduous and an onerous one. Yet, it is not beyond our perspective and certainly it can be solved though it may be little time consuming. With the known production technology in hand and sound research base, demonstration, training and extension efforts, we can change the gloomy picture of agriculture of the region to user in an era of prosperity and overall happiness.

Table 2 : ADVERSE EFFECTS OF JHUMING

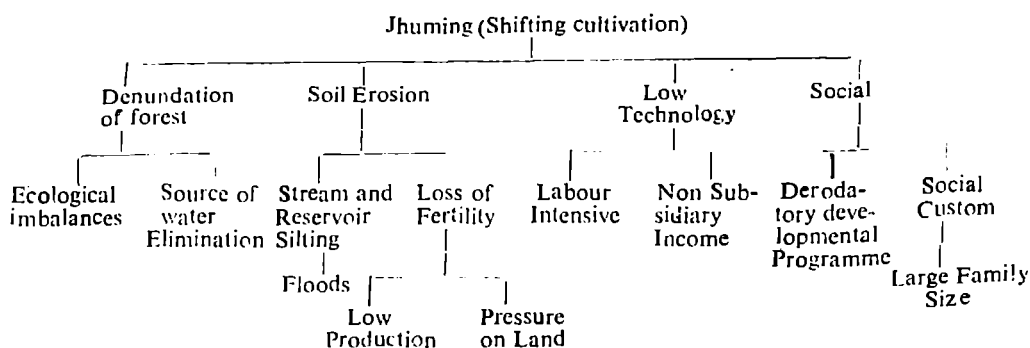


Table 1. Cultivated Area. Area under Jhum, Percentage Population Dependent on Jhum and percentage of Jhum Area of N. E. Region (1971)

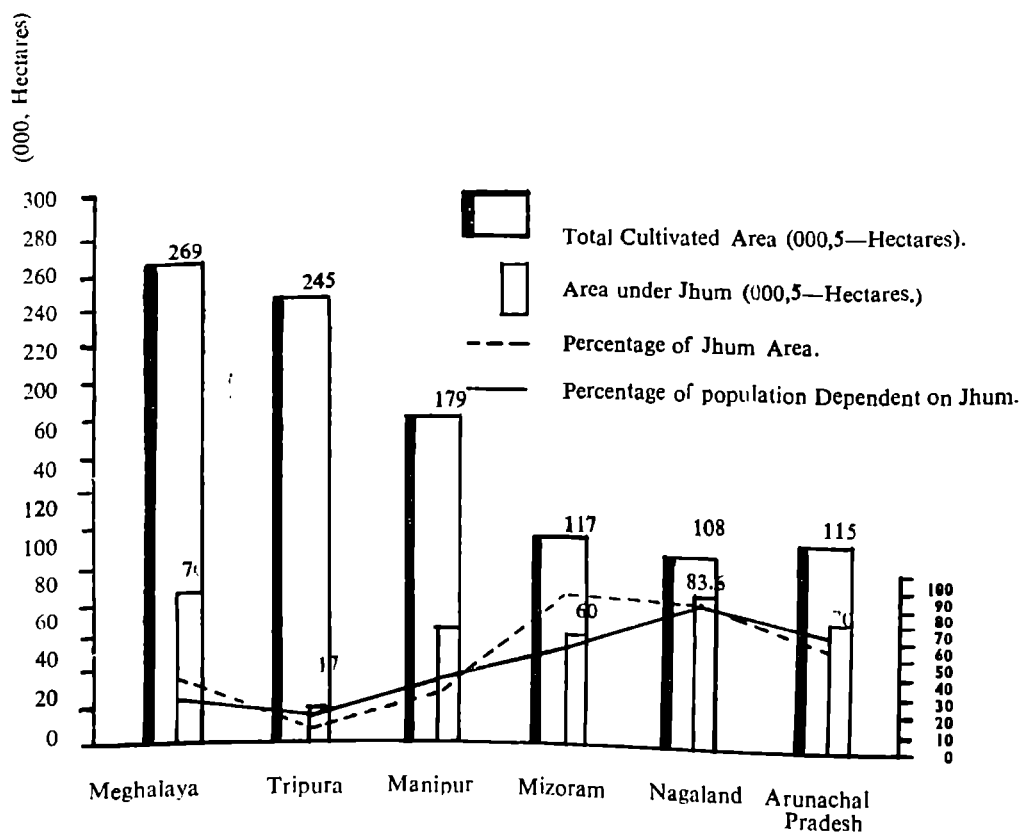


Table 3 : Programme for Improvement on Jhuming for High Production and Permanent Settlement.

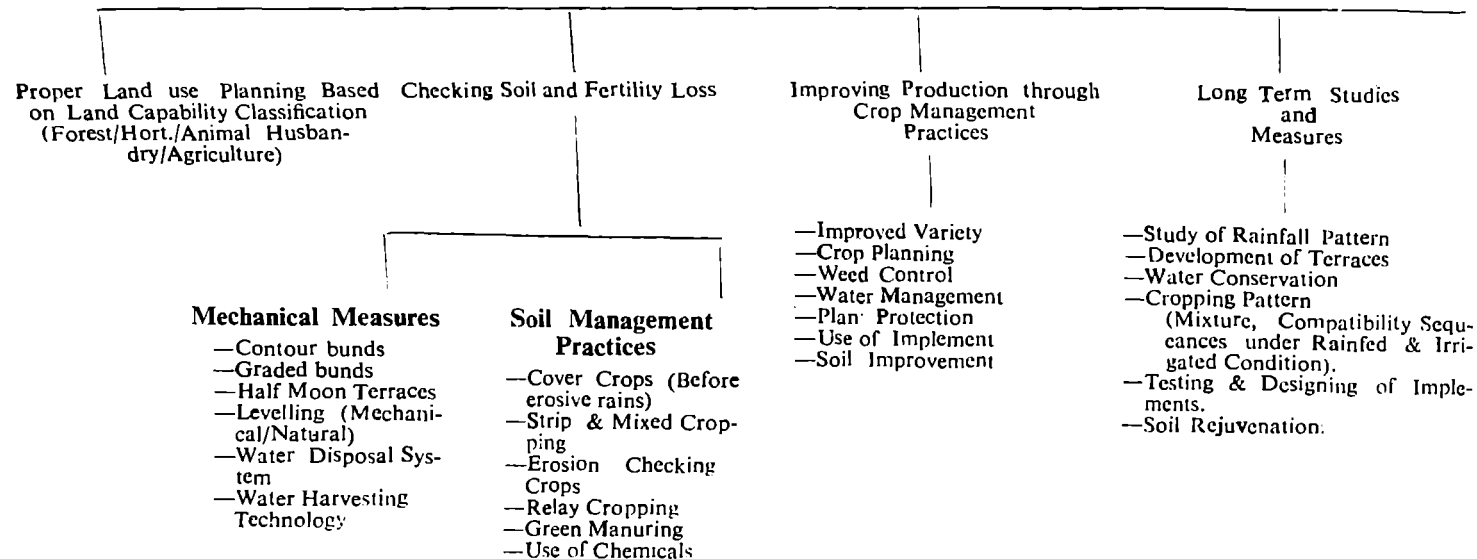
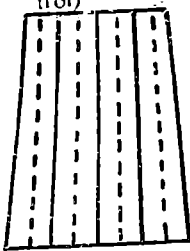
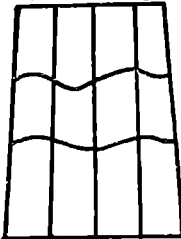
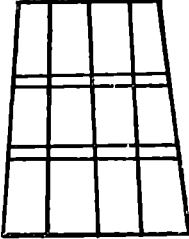
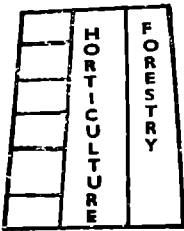
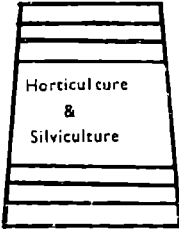
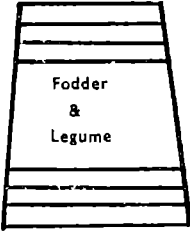
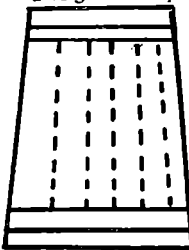
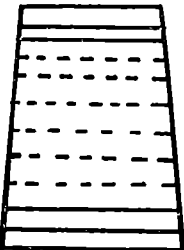
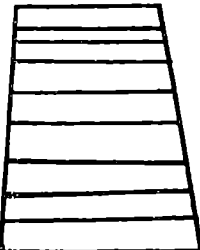


Table 4

T₁ No terracing. planting along the slope (Control) 	T₂ No terracing. planting to be done after contour bunding. 	T₃ No terracing, strip cropping at intervals with erosion checking crops 
T₄ Central Scheme Model. 	T₅ Partial terracing & Hort./Silviculture. 	T₆ Partial terracing Legume/fodder 
T₇ Partial terracing & planting along with slope. 	T₈ Partial terracing & planting across the slope. 	T₉ Full terracing 

REFERENCE :

- Ao.A & Roy Burman, B.K. (1961) Waromung, An Ao Naga Village : Census of India, Vol. I, Part VI No. 1.
- Awasthi, R.P. (1975) Personal Communication. Central Potato Research Institute Sub-station at Upper Shillong.
- Borthakur, D.N. (1976) Improving Productivity of Jhum Cultivation with special Reference to the North Eastern Hill Region; Paper presented at the 63rd Annual Session of the Indian Science Congress : Jan 3-7.
- Chaturvedi, M.D. & Uppal, B.N. (1953) A study in shifting cultivation in Assam; ICAR Research Series No. 2, New Delhi.
- Conklin, H. C. (1957) Hanunoo Agriculture -A report on an integrated System of Shifting Cultivation in the Phillipine, FAO Forestry Development paper, No. 12. FAO, Rome.
- Ganguli, J. B. (1966) Land Carrying Capacity under Jhuming in Tripura; Educational Miscellany (Journal of the Directorate of Education, Tripura); Vol. 3, No. 1 & 2.
- Ganguli, J. B. (1969) Economic Problems of Jhumias of Tripura; Bookland, Calcutta.
- Goswami, B.B. (1970) Relationship between Family Size and Agriculture in a Hill Region of Assam; Tribe, Vol. II, No. 3.
- Goswami, P. C. (1968) Shifting Cultivation and its Control in the Garo Hills. Assam; Soil Conservation Deptt. Assam.
- Goswami, P. C. (1971) Shifting Cultivation in the Hills of North Eastern India; Indian Farming, XXI(V) : 10-13.
- Gupta, R. K. (1975) Measures for the N.W. Himalayan Region; Indian Farming Vol. 24, No. II; 15-19.
- Hudson, N. (1971) Soil Conservation; B.T. Batsford Ltd., London.
- Majumdar, P.S. (1971) Plan Programmes of Hill Development in North Eastern India; Indian Farming; XXI(V) : 5-9.
- Mukherji, R. (1974) Problems of Shifting Cultivation; North Eastern Affairs; Vol. 3(1); 49-54.
- Palit, S.K. (1973) Shifting Cultivation in Orissa, Yojana, Vol. XVII No. 3.
- Patnaik, N. (1975) Soil Erosion -A Menace to the Nation; Indian Farming; 24(II); 7-11.

- Rai, R. N. (1975) Personal Communication, Soil Conservation Research & Training Institute, Dehra Dun.
- Roy Burman B. K. & Sharma, P. S. (Undated). Development of Agriculture in Tribal Areas; Tribal Agriculture in India; Memiograph article., Ministry of Home Affairs, Govt. of India.
- Saha, N. (1973) The Economics of Shifting Cultivation in North-East India; Ad-hoc Study No. 22; Agro Economic Research Centre for N.E. India, Assam Agricultural University, Jorhat.
- Schlippe, P.D. (1956) Shifting Cultivation in Africa, Routledge & Kegan Paul, London.
- Tejwani, K.G. (1975) Planned Use of Land & Water; Indian Farming; 24(11); 13-14.
-

Impact of Shifting Cultivation on Wild Life in Meghalaya

S. BISWAS and Dr. A.K. GHOSH

Eastern Regional Station, Zoological Survey of India, Shillong -3.

Widespread modification or destruction of tropical forests is of concern to scientists because of their ecological diversity, complexity of structure and richness in species. Within the tropical region, intimate relationships exist between the indigenous populations and the forest, and the forest is important for soil and water conservation. Because of their extent, biomass and dynamics, tropical forests also play an important yet little understood role in the global ecological and atmospheric balance of the biosphere¹.

The growing concern at the govt. level for the vanishing natural resources has become apparent only in recent years. The intricate but often much overlooked relationship of man and his surrounding nature has now been reasonably focussed, it wont be too much to expect that a conscientious Govt., would request advice on the potential environmental effects of a proposed or existing agricultural system for an area of tropical forests, or a construction of a irrigation dam in an arid Zone. The present paper, however, would focuss the view of Conservationist with regard to a ageold, traditional system of agriculture and its impact on a very important aspect of natural resource i.e. Wild Life.

The term wild life encompasses all faunal and floral wealth found in nature. The scientific value of Wild life has only been realised from the beginning of this Century after man has experienced the result of unlimited exploitation which often have left nothing but vast mass of barren arid area, eroded and bare land. All these led to extinction of a number of plant and animal species which have vanished from the surface of the earth forever and can not be recreated with all the scientific knowledge. The destruction of a habitat, the interruption of a food chain, interference with environment can produce devastating results; but in all cases, where there is direct competition for land use between human and wild animals, the animals inevitably loose.

The state of Meghalaya with its enormous natural wealth can now project the above facts. The fauna of Meghalaya (Primarily the mammalian fauna would be involved in this discussion) is exceptionally interesting from biogeographical point of view. The present day composition of the fauna can be said to be in a dynamic phase of biogeographical evolution intimately associated with the geomorphological evolution of the area and it required a rather long span of time for nature to reach this phase. It is from this north-east India, of which Meghalaya is a part, that the obliteration of Pre-tertiary Tethys sea began, producing in its wake a land connection between the Indian peninsula and the main Asiatic mass to the north. The region, then onwards, served as a great funnel gate way through which Indo-Chinese elements of the oriental fauna and also that of Palaearctic could spread to Indian subcontinent. Even in the Post tertiary period, Assam region remained a great pathway for faunal invasions. In the recent times a geological and climatic discontinuity can be observed between northeast India and rest of India and this is readily visible in the Garo-Rajmahal Gap which acts as a filter barrier in the effective dispersal of mammals in either way. Though primarily the fauna of Meghalaya are Indo-chinese origin, nevertheless it has a variable admixture of Peninsular elements, Ethiopian elements and Palaearctic montane elements and as a result a highly diversified

and complex assemblage could be seen; many of the relict species of the southern Peninsular India, mostly confined to the western ghats, have closely related species only in Meghalaya and adjacent areas, separated by a gap over one thousand and five hundred Kilometres.²

The tropical and subtropical moist evergreen forests ensured the survival of the rich mammalian fauna in Meghalaya region and perhaps enhanced the pace of the speciation by affording more ecological niches than was possible in the dry deciduous forest areas. The richness of the fauna can immediately be evidenced when one encounters the facts that more than 48% of the total number of mammalian genera, known from the entire Indian subcontinent, could be seen in the Meghalaya; at least 9 genera i.e. *Tupaia*, *Anourosex*, *Nycticebus*, *Hylobates*, *Atherurus*, *Rhizomys*, *Cannomys*, *Chiropodomys* and *Micronys* do not occur any where in India except in Meghalaya and its adjacent areas. It may be admitted here that the present knowledge, even about the larger animal groups, is far from complete but nevertheless Meghalaya can proudly present more than 106 species, out of about five hundred species known from India; this figure when compared with related figures 3 available from Assam (101), Arunachal (55), Manipur (26), Nagaland (50) and Mizoram (10) immediately indicate the unique position of the state even amongst its neighbours in Northeast India.

With above background informations one may now ponder over the fact how the traditional method of shifting cultivation could play any role in the depletion, destruction and long term disturbance in the total evolutionary process. It is wellknown that the shifting cultivation, originally followed, allowed a long period sufficient for regeneration of vegetation, after the initial felling and burning and before the initiation of next cycle. It may be presumed that the long interval allowed, atleast partially permitted the original habitant to readjust after initial disturbance. But the practice has since changed with ever increasing human population and consequent demand for more food supply. The process as a result is not only affecting the total output of per unit area of land (because of short interval between cycles) but also leading to quick depletion of the forest resources. Of the 22,500 sq. Km. of total area of the state, 8,500 Sq. Km. are under forest and reserved forest constitute only 900 sq. Km. The total forest area constitute about 38% whereas the forest policy of govt. of India recommended that hilly area should have atleast 60% under forest cover. 4. The figures amply exhibit the trend of forest exploitation. The absence of green cover and destruction of the virgin forest cause serious disturbance in the territory of the Wild animal and consequently they continue to make an attempt to survive initially retreating into the deeper forest but finally being left at mercy of the exploiters. The experience gained during extensive surveys in the area clearly indicate that at the present rate of shifting cultivation, we have already crossed the limit and the method is becoming less remunerative and to compensate this loss more land areas under forest cover is being utilised and even the difficult terrain, so far sustaining the relict virgin forest are now being destroyed. In a recent survey in Garo Hills the changing ecosystem showed that how the small river systems have been affected by the interference of man by way of felling of trees, destruction of the top soil and exploitation of catchment areas.

Process of afforestation presently persued by the Govt. may be regarded as a desirable step for soil conservation and also to replenish the depleted forest wealth. But the vast wealth of Wild life originally adopted to the virgin forest and being threatened every day with the increase demand of land, could never resettle themselves in man made forests due to lack of proper food trees, other animals for predations and proper cover. The long period through which an ecosystem has developed, offering excellent opportunity for evolution of a number of unique species, each adopted to particular ecological niche, could never be restored if once destroyed.

A number of species once distributed over large areas over the state have already found their place in the list of protected species as they are fighting a last battle for survival. These include some of the unique animal species e.g. Clouded Leopard / *Neofelis nebulosa* (Griffith), Golden Cat (*Felis temminckii* Vigors and Horsfield), Hoolock *Hylobates hoolock* (Harlan) Leopard Cat (*Felis bengalensis* Kerr), Slow loris *Nycticebus caucang* (Boddaert), Tiger *Panthera tigris* (Linn.), and Wild buffalo *Bubalus bubalis* (Linn.). All the foregoing animals have been included under the schedule I of Wild life (Protection) Act, 1972; similarly some more animals under schedule II and III of the same act may be cited e. g. Indian Bison (*Bos gaurus* H. Smith), Capped langur *Presbytis pileatus* (Blyth), Stump tailed Macaque *Macaca speciosa* (F. Cuvier), Flying Squirrel *Petaurista petaurista* (Pallas), Giant squirrel *Ratufa bicolor* (Sparrmann), Hog badger (*Arctonyx collaris* F. Cuvier), Indian elephant (*Elephas maximus* Linn.), Serrow *Capricornis sumatraensis* (Bechstein), Wild dog *Cuon alpinus* (Pallas) Leopard *Panthera pardus* (Linn.), Barking deer *Muntiacus muntjac* (Zimmermann), Chital *Axis axis* (Erxleben), Hogdeer *Axis procinus* (Zimmermann), Himalayan black bear *Selenarctos thibetanus* (G. Cuvier), Sambar (*Cervus unicolor* Kerr) and Sloth bear *Melursus Nrsinus* (Shaw). The continuance of the process of shifting cultivation would no doubt add enormous risk to their life and could even lead to total extinction of a number of already threatened species, not only from Meghalaya and adjacent areas but also from the face of the earth.

The solution to this problem would perhaps be as difficult to suggest as the problem itself. Paradoxically inspite of great wealth of scientific information available much of it is not used and infact in the monodiciplinary form in which it has been compiled is now being considered unuseable, for development planning. Perhaps it is easy to talk about the need to break down the barriers, but it is difficult to persue as the units of analysis employed differ considerably from one dicipline to another and an interdisciplinary efforts could only succeed if each research worker must adopt to the method of others and possess the flexibility of thoughts. With the implementation of man and Biosphere programme which has been formulated "to develop within the natural and social sciences a basis for the rational use and conservation of the resources of the biosphere and for the improvement of the relationship between man and the environment; to predict to the consequences of to-days action to tomorrows world", one may hope for some global action in limited MAB project areas. But in Meghalaya, the thoughts perhaps need to be translated into action without any further delay.

REFERENCES :

1. Batisse. M. 1975 Man and Biosphere, *Nature*, 256 : 156-158.
2. Mani, M.S. (ed). 1974. Ecology and Biogeography of India. Dr. W. Junk B.V. Publishers the Hague, 1 - XIX -1 - 773.
3. Kurup. G. U. 1968. Mammals of Assam and adjoining areas. 2. A distributional list. *Proc. Zool. Soc. Calcutta*, 21 : 79-99.
4. Jain, S.K. 1975. Forest vegetation - Prospects and constraints on utilisation. Paper submitted at Seminar on Problems of development of N.E. India, Shillong.
5. The Gazette of India, Extraordinary 1972. The Wild Life (Protection) act. Ministry of law and justice. Govt. of India, No. 61 Manager of Publication, New Delhi

A positive approach to the problem of Shifting Cultivation in Eastern India and a few suggestions to the policy makers

Baniprasanna Misra.

A discussion on shifting cultivation practices prevalent among the hill tribes, particularly of the north eastern region of India, has always been marked for the following:

- (a) It has persistently generated more heat than light on the question;
- (b) Shifting cultivation is held to be a primitive, and hence inferior, method of cultivation, pursued by the primitive people, notwithstanding the danger of circular reasoning involved in such argumentation;
- (c) Broad generalisations are made without any reference to objective data which in most cases are just not available;
- (d) The familiar cliques of soil erosion and deforestation are cited a infinitum to rationalise and justify a ban upon shifting cultivation;

Why shifting cultivation should go ? The reasoning that primitive people practise primitive method and hence that shifting cultivation must be primitive is no valid argument whatsoever. the shifting cultivator in the north eastern India is a hill-land cultivator who produces paddy, cotton, sesamum, mesta and vegetables, etc. together from the same hill-bed. Keeping the type of hill bed and the crops constant if it could be demonstrated that the same can be raised in the same area without the aid of jhuming, then the argument has some meaning. But that is seldom done. The advice extended is in favour of forestry and horticulture that prohibits the use of land for the production of paddy, cotton, etc. Needless to say, this course of reasoning is futile for demonstrating even in a very general way that shifting cultivation is a backward technique. The argument has some relevance for those areas only where the alternatives for producing the same crops are either (a) shifting cultivation through slash and burn, or (b) permanent cultivation through terracing, contour bunding, etc. To take the extreme case, if it could be shown that in all hill areas, where shifting cultivation is done at present, terracing and contour bunding was feasible, and hence permanent cultivation of crops, then obviously, shifting cultivation is thereby proved to be a backward technique. This is after all not true, and exceptions are there. To take the example from Tripura, such tracts may be seen in areas south of Anandabazar in Kenchanpur police station, south of Chowmanu in Manu police station, the entire Ganganagar area in Teliamura police station, eastern sector of Gandacherra police station, and many other parts of the territory. Even by Tripura government's own admission the scope for permanent cultivation by terracing or contour bunding is very limited in those areas, and hence, either the tribals should be persuaded to give up in favour of permanent horticulture, or be allowed to do jhum on scientific lines so as to cause minimum soil erosion, loss of soil fertility, and destruction of forest wealth.¹

The destruction of forest wealth is a familiar argument advanced against shifting cultivation. Undoubtedly the jhumia burns away the forest as a part of his pre-sowing preparation of the hill bed. In Mizoram and Tripura they burn but only bamboo for-

ests for this purpose. What are the alternative uses of these bamboos in the deep interior of the hills ? If bamboo based paper mills, for example, were set up, then a demand for these bamboos would be generated. The jhumias would soon discover that the bamboos which they burn indiscriminately have a market value. They may begin cultivating the bamboos for sale instead of burning them away.² Till that time the burning of bamboo forests for the purposes of producing food crops may not be regarded as altogether an irrational behavior.

To an extent it is the national forest policy which perhaps is responsible for some of the unplanned criticism of the shifting cultivator. The National forest policy prescribes that one third of the national land surface should be under forests. In much of the plain areas of the country there are not much of forests left any longer. The plainsman will presumably be reluctant to grow forest in one third of the territory under their possession, and, thereby, forego the alternative uses of the land.³ The tribals living in hill areas can, in such a situation, be asked to sacrifice their living for forest areas, and thus make up the losses incurred in the plains.

The felling of forests becomes necessary in the context of clearing the hill bed for cultivation. Burning of the same may, however, be viewed from two angles. Firstly the hill slope is not ready for sowing till the accumulated debris is somehow or other disposed off. Secondly the burning of forests provide the soil with potash, a much needed manure of which the hill soil of the north eastern India is generally deficient⁴. The clearing of forests is a necessary condition of shifting cultivation, but the supply of potash is possibly the sufficient condition for the same. This may be the reason why even when the ground is clear of the jungles at the end of a year or two of shifting cultivation, it has to be abandoned for such period as is necessary for the growth of forests to be reconverted into potash. Instead of looking down upon burning of forests as a primitive phenomenon it remains for a suitable agency to experiment with alternative sources of fertilizers. Prima facie there is no reason why substitutes should not do.

II

Clearing the jungle :

In the literature on shifting cultivation it is often times the same critic who accuses the jhumias of causing deforestation in the hills, and advises them to switch over to (a) either terraced cultivation, or (b) horticulture. They pay little attention to the fact that both terraced cultivation and horticulture preclude the use of land for forestry. The shifting of grounds on the part of the critic is no answer to the malady of shifting cultivation. In fact there should be some method and consistency in all criticism. The following chart may tentatively be thrown as a guide in this regard.

A guidechat for the critic on shifting cultivation :

If the argument is	then prove the following	and suggest.
1	2	3
Deforestation	1 More of forest is needed 2 Growing forest is cheaper here 3 Market for forest exists 4 Forest growing is more profitable than crop growing 5 Any cutting & burning of forest is bad howsoever long the jhumcycle may be	settle elsewhere ; cultivable land exists elsewhere ; employment in other occupations feasible, desirable and more remunerative; in case of continued stay in same place engage in growing forest.

Soil erosion	1 Rate of soil formation is less than that of soil erosion 2 Without jhuming soil erosion stops 3 With jhuming it won't stop 4 Horticulture prevents erosion and market for horticulture exists.	Land is fit for terraced cultivation; same as items 2-4 in column 2; practise horticulture or forestry.
Primitive technique	1 There exists more efficient tools and implements for growing same crops in same hill-area.	Adopt improved implements
Low Productivity	1 Yields are less here than in other dryland farming 2 Input-output ratios show inefficiency of production 3 There exists no way to increase productivity.	Apply improvements to increase productivity; Adopt forestry or horticulture, as the case may be, if thereby value added may be, if thereby value added is more.
Low Income	1 Income of a jhumia is less than that of comparable people 2 Higher income could be obtained from occupations other than shifting cultivation. 3 More remunerative occupations are available.	Join more remunerative occupations; Adopt other subsidiary occupations.
Lack of social amenities	1 Shifting cultivators are shifting villagers as well. 2 Education and medical aid cannot be provided if villagers are shifted 3 Doing forestry or horticulture in the same area instead of jhum makes it possible to provide social amenities.	Don't shift village site; Join forestry or horticulture.

To sum up, if the argument against shifting cultivation is that it causes deforestation the alternative suggestion cannot be terraced cultivation of horticulture. If the argument is low productivity and primitive technique, improved technology should be suggested. The absence of social amenities in a tribal village cannot also be corrected immediately if only the tribals opt for forestry or horticulture. They should rather be persuaded not to shift their village site even if they do shifting cultivation. The abuse of soil erosion is, however, a formidable one. But long ago, Chaturvedi and Uppal had written, "The notion, widely held, that shifting cultivation in the region is responsible in the main for large scale soil erosion, needs to be effectively dispelled. A fairly well distributed rainfall of about 100 inches, high humidity and the peninsular character of rock formation provide climatic and soil conditions so conducive to the growth of vegetation that no sooner is a patch of ground left to itself than it is rapidly covered with a thick blanket of vegetation. The only time when the soil does get washed away is when it is under agricultural crops. The surprise, therefore, is not that there is soil erosion in the Shillong plateau, but is that there is so little. In the Garo hills riddled with age-long jhum (shifting) cultivation, one still sees streams carrying clear water after heavy showers."⁵ One only wishes that there were more of follow-up studies in this direction.

Horticulture comes handy as an alternative occupation for the shifting cultivators suggested by the critics. It is possibly not widely known that as against a yield rate of around 5 and 10 tonnes per hectare of pineapple in Meghalaya and Assam respectively the average yield in Kerala, for example, is around 40 tonnes per hectare. Further about 65 per cent of the pineapples and 53 per cent of the citrus fruits grown in the north-eastern region is already surplus, and there exists no organised marketing structure in the region to lift the existing surplus at any reasonable price. The goods are sold to middlemen traders with the result that the primary producer receives barely 10 per cent of the retail price of the fruit. Moreover, it has been estimated that the average cost of producing one tonne of processed fruits in this region is nearly 10 per cent higher than that in the country as a whole. Added to this would be the transportation costs of the goods to the consuming centres elsewhere.⁶

The terracing of land and permanent cultivation of the same is often suggested as a remedy for the evils of shifting cultivation. The essential pre-requisite for terracing is soil-survey. A soil survey, and a soil map based on it, will not only help assessment of soil potential for agriculture and other ventures, but will also help in locating problem areas, such as those effected with erosion, salinity, acidity, alkalinity and water-logging. This will also help in separating out land areas which are suitable for agriculture and other uses and those that are not so, but can be used for the purposes of pasture development, horticulture, and forestry, etc. From a report on soil survey it is known that till the middle of 1972 no area has been soil-surveyed in the States of Meghalaya, Nagaland, Manipur and Mizoram. In the Mikir hills and Arunachal Pradesh the extent of surveyed soil was negligible, and, in fact, was less than even one per cent of the territory. It was only in Tripura that little more than one-third of the surface stood soil-surveyed in 1972.⁷ Till soil survey is concluded, it is needless to say, discussions can go on indefinitely about terracability and soil erosion without ever ushering in any tangible conclusion. Bali and Parsai, two experts of the government of India on the subject gave their considered opinion while on a tour in the Manipur Hills that only terraces of a minimum of 15-20 feet width should be constructed so that bullocks and power tillers can be used for cultivation. Also bench-terraced cultivation should be restricted to slopes less than 40 per cent⁸. Thus if the given slope of the hill is 40 per cent and a terrace of 15 feet width is to be obtained from it, then the vertical interval would be determined at 10 feet if the riser slope is kept at 1:1. This assumes a soil depth of at least 10 feet. Even if the soil is that deep the structure & texture of the soil would be determined if that large a vertical interval can sustain itself. The vertical establishment will have to be protected with vegetation, or supported by pitching or retaining walls. That it would be difficult for such a high vertical interval to be durable is amply demonstrated by the frequent landslides which one is familiar with in any recently constructed roads throughout this region. A road constructed in a hill slope is comparable to a terrace and the stability of such roads is a rough indicator of the stability of the proposed terraces. A pious wish for terraces is not always amenable to be translated into action. However supposing that the terraces are constructed and that they are durable, it may be worked out that the total farmable area in a hill slope with terraces will be about half of the total area required without it. This is under the assumption of a constant fertility, although Bali and Parsai are of the opinion that due to disturbance of the top soil in levelling operations, initial setback to fertility would be expected in the newly terraced land. Because of the compulsions under a changed crop pattern and a new way of living, and also because of soils of varying texture, depth and fertility, the total land requirement may be put not less than two times the land put under jhuming. If, as has been estimated by the North Eastern Council, the annual land area under shifting cultivation is 457,000 hectares, then the total hill area to be terraced may be estimated to be about one million hectares. The relevant question to be asked is whether such a large land mass of less than 40 per cent slope is available in the North Eastern region, and if so, what would be the cost of bringing it under terraces. If the cost of terracing and incidental land develop-

ment is put at Rs. 3,000 per hectare,⁹ the total cost of terracing the required quantum of land would be not less than 300 crores of rupees. The soil conservation department of the Government of Assam has recently estimated that there exists about 240,000 hectares of terraceable land in the Mikir and North Cachar hills.¹⁰ It is also known that the annual jhum area of these two hill districts is about 70,000 hectares. Thus, as per the calculation made by us, the total requirement of terraced area is in the neighbourhood of 140,000 hectares. Provided, therefore, that finances are available, the switchover to terraced cultivation appears to be feasible. However, for a conclusive answer to the question, the report on soil survey of this region has to be awaited. It is heartening to note that the North Eastern Council has taken some initiative in this regard, and the All India Land Use and Survey Organisation under the Indian Council of Agricultural Research has been asked to do the work.

And supposing everything goes well in the desired direction, and with the urgency and attention that it has been demanding for some time, a switch-over from shifting cultivation to terraced cultivation, forestry and horticulture is materialised sooner than later, what are going to be its impact on the overall economic panorama of this region. The hill-people are not as isolated from the national market as they are sometimes supposed to be. Only one aspect of the great disequilibrium that is going to follow is mentioned here. The shifting cultivator of the region has been producing a number of cash-crops for a long time. The peculiar farming practice of his enable him to produce large quantities of cotton, and a number of oil-seeds like sesamum, mustard and castor seed. All these are valuable cash-crops produced under jhuming. The Tripura jhumias were, for example, producing, way back in the 1930s, about 1,000 tonnes of cleaned cotton, and about 1,700 tonnes of oil seeds, viz. sesamum. In a total revenue of about 16 lakhs earned by the State of Tripura, the export duties on cotton and oil-seed fetched to the state exchequer a sum of about one and a half lakh of rupees. In 1918-19 it was observed that the Dharwar variety of cotton grew well in the rainy season and experiment was made to introduce it in the jhums. The result of the trial was reported to be good in 1923-24. The jhum cotton was sent to the Government Economic Botanist at Dacca, the Central Cotton Committee. Bombay, the Banga Lakshmi Cotton Mills, Messrs Kettlewell Bullen and Co., and the Dhakeswari Mills. The reports received were encouraging. The Central Cotton Committee Bombay stated that the Jhum cotton fetched Rs. 5.00 per maund less than the price obtained by the Bombay growers, the difference being due to unclean picking. The Economic Botanist remarked that with careful and clean picking, the problem of long-staple cotton for Bengal would be satisfactorily solved.¹¹

However in about 40 years from then these hopeful notes appear to have been forgotten. The production of cotton in Tripura has dwindled down to a mere 400 tonnes reportedly.¹² Is it in keeping with the gradual decline of a primitive practice? It is fervently hoped that a survey would before long be made into how much of cotton ginning, pressing and manufacturing activities go on throughout the North Eastern India and elsewhere on the basis of raw materials produced by the shifting cultivator, and also what impact the stoppage of shifting cultivation will have upon them.

II

Burning the Debris :

What is the extent of shifting cultivation practices in the north eastern India ? The following figures have of late gained wide currency in this regard among the academicians by virtue of their being used in the North Eastern Council plan documents.

**Table - 1 : Extent of shifting cultivation in North Eastern India
(in thousand hectares) :**

State	Geo. area	Area under shifting cultivation			
		annual area	% of geo. area	Total area	% of geo. area
1	2	3	4	5	6
Arunachal	8149	92	1.13	248	3.04
Assam Hills	1535	70	4.56	498	32.44
Manipur	2236	60	2.68	100	4.47
Meghalaya	2253	76	3.37	416	18.46
Mizoram	2108	62	2.94	604	28.65
Nagaland	1649	74	4.49	508	36.87
Tripura	1067	23	2.16	221	20.71
Total :	18997	457	2.40	2695	14.19

From the above it will be noticed that in less than three percent of the total area of the whole region the practice of shifting cultivation is prevalent in any particular point of time. Little less than one-sixth of the total geographical area of the region is at present vulnerable to shifting cultivation. However in Arunachal and Manipur huming is practised over the cycle in less than five percent of the total territory.

The annual area under shifting cultivation as given by the NEC sources and presented above and the net area sown in each of these territories are presented side by side in Table 2. It will be noticed from there that the area under shifting cultivation is more than the net area sown in Arunachal, Mizoram and Nagaland. The area under shifting cultivation should, under normal situations, be viewed as a component of the net area sown which in its turn should include areas sown by other than shifting cultivation also. If it is so, the situation presented in Table 2 is definitely anomalous and needs correction.

**Table 2: Area under shifting cultivation and net area sown annually
(in thousand hectares).**

State	area under shifting cultivation	Net area Sown
1	2	3
Arunachal	92	70
Assam Hills	70	86
Manipur	60	179
Meghalaya	76	158
Mizoram	62	61
Nagaland	74	47
Tripura	23	236
Total :	457	837

The Agricultural Census of Nagaland puts the area annually put to jhuming at 84 thousand hectares.¹³ The Agricultural Census of Arunachal gives the data for net area cultivated and also area under permanent cultivation. Subtracting one from the other the area under shifting cultivation works out to be 134,000 hectares.¹⁴ The Government of Mizoram gives that 67,000 hectares of land are under cultivation, of which about 54,000 hectares are under jhum cultivation.¹⁵ The plain document of the Government of Assam puts the figures for net area sown at 68,000 hectares, and says that the annual jhum area of 70,000 hectares are not included in it.¹⁶ If this is so, then the total area sown in the Assam hill districts adds up to 138,000 hectares, and the figure for net area sown as given in Table 2 and obtained from the World Agricultural Census stands to be corrected. The earnestness of the authorities should get reflected in their proper assessment of the problem through a continuous collection and dissemination of facts. The literature on shifting cultivation would be richer if only the policy makers care to call for all relevant information before embarking upon a policy proposal.

In Table 1 the area at any point of time and the total area over time of shifting cultivation are given in Columns 3 and 5. The jhum cycle should be arrived at by dividing then, the total area by the annual area. Table 3 gives the estimated jhum cycle for the various States in the north eastern region.

Table 3 : The Jhum Cycle assumed by the North Eastern Council :

State	Jhum cycle in years.
Arunachal	2.69
Assam Hills districts	7.11
Manipur	1.67
Meghalaya	5.47
Mizoram	9.74
Nagaland	8.22
Tripura	9.61
Region	5.90

Mizoram and Tripura are having the longest jhum cycle of over nine years, followed by Nagaland and the Assam districts of Mikir Hills and North Cachar Hills. In Meghalaya the estimated jhum cycle is between five to six years. The shortest possible jhum cycle occurs in Arunachal and Manipur. If the jhum cycle is between one and two years in Manipur, and between two and three years in Arunachal, it may perhaps be surmised that shifting cultivation in those places have gradually lost its essence and is tending to become settled cultivation. But, why ? Arunachal, in particular, is not known to suffer from a scarcity of land for the shifting cultivator. Why then should he refuse to shift ?

There are so many other estimates that it is difficult to judge which of them is correct; in the absence of knowledge as to how they were arrived at they are often-times as good as useless. According to Guha, the jhum cycle is about four to five years in Meghalaya, 5 years in Mizoram and 10 years in the Mikir hills of Assam¹⁷. Guha's estimate for Meghalaya happens to agree with that obtained by the N.E.C. data. However this accidental coincidence is no guarantee for the accuracy of the figure. The agricultural Census of Meghalaya puts the jhum cycle of the State a little shorter at between three to five years¹⁸. According to its department of agriculture, the cycle of shifting

cultivation varies between 3 to 5 years in Mizoram¹⁹. Bali and Parsai wrote that in the Sangsak area of Manipur, where jhuming is done by the Tangkhule, the jhum cycle is about 7 years. In Chassed area of the State jhum cycle is about 10 years. In the Phungheat-Phaitsit blocks inhabited by the Tangkhul Nagas the jhum cycle is of 10 years duration²⁰. From the estimated figure as given in Table 3 it will, however, be observed that Manipur is having the shortest possible jhum cycle. For the Garo hills Goswami's estimate of the jhum cycle was around 10 years²¹. In Table 3 the estimate for Assam has been obtained as about 7 years. The Agro-economic Research Centre Jorhat, observed that the jhum cycle is about, 10 years duration in the Mikir hills of Assam²². The Soil Conservation Department of the Government of Assam is also of the same opinion²³. The Planning and Development Department of the same Government, however, asserts that the jhum cycle in the Mikir and North Cachar hills is only of 2 to 3 years²⁴. The Plan document for the hill areas of Assam state that, "In the old days when pressure of population on land was not so great as it is today, the jhum cycle consisted of 8 to 10 years. But along with the increase of population and consequent decrease of cultivable land, the jhuming cycle has now come down to two to three years only"²⁵.

This line of reasoning, howsoever unfounded it may be, has its academic protagonists as well. Saha remarks that the available statistics on the hill areas of Assam, Meghalaya and Mizoram together show that 64 percent of the area in the hills are either barren or uncultivable, and therefore, the increasing population affects the carrying capacity of land and also presumably the jhum cycle adversely²⁶. The fact is however ignored that practically all areas except some reserved forests are subject to jhuming in the hill districts of Assam²⁷. Also that the area under jhum cultivation comes under the category of barren and uncultivable land in the Land Utilisation statistics of the State, and that this area is not assessed to any degree of accuracy even by the Assam Government's own admission²⁸. The effort to prove that there exists a dearth of jhumable land from the land utilisation data is therefore futile. There are no agreed norms to decide as to where the jhumable land should be entered in the land utilisation statistics. Whereas in Assam they go under barren and uncultivable land, in Arunachal they are enlisted as fallow, other fallow, culturable waste, or area under cultivation, as the case may be. In the case of Tripura the problem is cut short by simply classifying them under the category of forests²⁹.

The Yield rates of jhum paddy are presented in Table 4, from which it will be noticed that the jhum yield compares favourably well with the average yield of the country as a whole.

Table 4 : Yield of jhum paddy in Tripura (in per hectare)³⁰.

Year	Yield
1955-56	1203
1960-61	1230
1965-66	1200
1970-71	1137
1971-72	1151

The average for the whole of India in 1971-72 was 1145 kilograms per hectare. The Agro-economic Research Centre, Jorhat conducted jhum-villages surveys in Mikir

hills, Garo hills, Mizoram and Arunachal Pradesh. from where it is known that the jhum yield of paddy per hectare varied generally between 800 and 900 kilograms. A number of other crops were raised, of course, from the same hectare of land. The return per hectare in value terms was as presented in Table 5.

Table 5 : Income from jhuming in certain villages : ³¹.

Village	Year	Size of farm (hectare)	jhum income as % of total income	Return per hectare (Rs).
Kanther Terang (Mikir)	1965	1.72	71.2	693.35
Banshidua (Garo)	1963-64	1.04	22.4	607.04
Himunpui (Mizo)	1964-65	1.27	58.6	654.87

Both size of farm and per hectare income from jhuming increase with the increase in dependence of shifting cultivation, as is indicated by the series on jhum income as a percentage of total income. Saikia wrote that the income of Kanther Terang could be compared at the per capita level with Assam and also All India. "It seems that the per capita income in the village is better than the national or regional average. Certain factors have contributed favourably to the increase of income of the villagers. Kanther Terang has a fairly high proportion of its total population in the economically active category. Moreover...the forest area provides them with many additional benefits which are not available to the plains people"³². The economic condition of the villagers of Kanther Terang is definitely not the representative picture for the whole tribal people in the North-east India. But nonetheless it helps to highlight the fact that any generalisation to the contrary may be misleading. The mode of production in shifting cultivation does not permit of the accumulation of large surplus. If anyone is left with any surplus after meeting current expenses, he usually disposes of it by purchasing guns and other fancy articles³³. Further the jhumias spend annually on an average from 10 to 16 per cent of their income on drinks, intoxicants, and ceremonies³⁴. It is the cash nexus with the rest of the economy entered by them through the production of cash crops and borrowing of money that tends to impoverish them³⁵.

In the light of above the following generalisations unfounded and unsubstantiated-made by the Planning and Development Department of the Government of Assam in their Fifth Plan document for the hill areas of the State appear strange, full of fury, but signifying nothing. It is said that the "high incidence of jhuming is indicative of the **primitive nature of agriculture**. The level of agrarian technique is **exceedingly low** and tools and implements are **primitive** in nature and **inefficient**. The result is **low yields per acre** and obviously **little or no surplus**. This **subsistence level of cultivation** leads, as a consequence, to **low income per head** and **zero savings** for the large mass of people. The little saving which may be there goes to the **landholding class** but this little saving is not conducive to investment in industry, commerce, etc. The composition of the working force data reveals **absolute over-population in agriculture** as 84 per cent of the working force is engaged in the primary sector. This, by inference is the evidence of **disguised unemployment**, obviously due to lack of employment opportunities outside agriculture."³⁶

III

Sowing Seeds :

The present paper does not offer any apology for the shifting cultivator, and the purpose in writing it will be lost if understood accordingly. We have, however, the following suggestions to offer.

1. The familiar and monotonous use of stock-phrases and cliques should give way to mature and sober thoughts flowing through fresh air of scientifically collected facts. It is regretted that even the available studies at the moment are not utilised properly by the policy-makers.
2. The jhumias should immediately be persuaded to give up occupying all lands above 40 percent slope.
3. The reservation of forests by the Government in this region should be restricted only to those lands above the slope of 40 percent. This necessitates an immediate re-formulation of the forest policy for the hill regions. The creation of extensive reserved forests in one block may have to be given up.
4. The village site of the tribals should be tried to be kept in one place even if they resort to shifting cultivation. It is already so in many places, and there is no reason why it should not be possible in others.
5. Once the villages are fixed and re-grouped in areas having less than 40 percent slope the social amenities and infrastructure should be provided to them without delay.
6. The soil and land use survey currently being conducted by the North Eastern Council should give priority to the areas having less than 40 per cent slope. It may be possible, then, to know which among them are amenable to terracing, depending on soil depth and texture. Such areas should gradually be taken up for terracing.
7. Selected groups of jhumias should, meanwhile, be given requisite training in permanent cultivation. Agricultural schools should be opened where even the adult jhumia can undergo a practical training course with appropriate stipend and allowances for their family.
8. It is presume in this scheme of things that the people will pursue shifting cultivation for quite some time to come. Hence experiments should be conducted to improve the farming practices in jhum and to reduce its evils.
9. Industries based on forest products should be set up on a priority basis throughout the hill regions. To wait for the jhumias to stop burning the forests before industries, for example the papermills, could be started is nothing but an excuse for the cart-before-the-horse policy that needs to be discarded. With the paper mills, for example, coming up in different areas of the north eastern region, the tendency to preserve forests will grow as the forest products will have a ready market. In fact the setting up of such industries will revolutionise the economy in tribal areas, and will have an impact upon the jhuming practice.
10. A North Eastern Horticultural Council should be established to organise the production and marketing of the horticultural commodities.
11. An appropriate mechanism should be devised to help extension of bank

credit to the jhumias even though the property relations prevailing among them prevents it. It is not necessary that the banks should give loans only when land is held as security³⁷

Notes and References :

1. **Socioeconomic Adjustments of Tribals - a case study of Tripura Jhumias**, by B.P. Misra, (Peoples Publishing House, Delhi), P. 106.
2. **Jhuming in Tripura and future approach to the problem** (Forest Deptt., Govt. of Tripura, 1973) pp. 13-15.
3. A news item in the **Indian Nation**, June 14, 1976 said, for example, that Kishanganj and its neighbourhood which abounds in forestry and mango trees in particular are being denuded of them at present. With the reported curbs on felling of fruit trees in West Bengal, wood merchants and suppliers are said to have shifted to this part of Bihar. They are hewing down fruit trees on a massive scale with the result that parts of Kishanganj which abounded in plantations now appear to turn into a barren land.
4. Soil Fertility and Fertiliser Use Pattern in Assam, Meghalaya and Mizoram by P.K. Bora (**Journal of the North Eastern Council**, August, 1975). pp. 38-49; also Fertility Status of the Soils of North Eastern Region, by P.K. Barua and P.K. Bora (**Journal of the North Eastern Council**, May 1975) pp. 21-26.
5. **A Study in Shifting Cultivation of Assam**, by M.D. Chaturvedi and B.N. Uppal (Indian Council of Agricultural Research, 1953) pp. 4-7.
6. Factors inhibiting the Growth of Horticultural Crops in the North Eastern Region, by Miss F.K. Wadia (**Journal of the North Eastern Council**, August 1975) pp. 27-33.
7. **Interim Report of the National Commission of Agriculture on Soil survey and Soil Map of India** (Ministry of Agriculture, Govt. of India, 1972) pp 5,35,55-56.
8. **Control of Shifting Cultivation in Manipur Hills-tour note of J.S. Bali and P.S. Parsai** (Ministry of Food and Agriculture, Govt. of India, 1969) p 11, and also Annexure IV.
9. Bali and Parsai had estimate the cost of terracing in Manipur hills in 1969 as Rs. 800 per acre. *Ibid*, p 18.
10. **Fifth Plan Approach**, Soil Conservation Dept. Govt. of Assam, 1972. p 6.
11. Misra, *Op cit*, p 56.
12. Level of Development in Agricultural Sector in North Eastern Region by S.N. Mehrotra (**Journal of The North Eastern Council**, August 1975) p 5.
13. **Report on the Agricultural Census of Nagaland. 1970-71**, p 29.
14. **Agricultural Census 1970-71, Arunachal Pradesh**, pp 15-16.
15. **Annual Plan, Deptt of Agriculture, Mizoram, 1976-77**, p i.
16. **Draft Outline, Fift Five Year Plan, Assam (Hill Areas) Vol. II**, p 2.

17. Amalendu Guha, Geography behind History (North Eastern Affairs, Vol.2,i, 1973.
 18. **Report on Agricultural Census 1970-71, Meghalaya**, p 11.
 19. **op cit**
 20. **op cit**, pp 4-6.
 21. **Shifting Cultivation and its Control in the Garo Hills**, by P.C. Goswami (Soil Conservation Dept. Govt of Assam, 1968) p 6.
 22. **The Economics of Shifting Cultivation in North Eastern India** A.E.R.C. Jorhat 1973, Ad hoc Study No. 22), p 31.
 23. **Scheme for Permanent Settlement of Jhumia Cultivators through Development of Plantation Crops, Fifth Five Year Plan** (Soil Conservation Dept. Govt of Assam 1973) p 3.
 24. **Op Cit**, Vol. I p 5.
 25. **op cit**, Vol. II, p 6.
 26. The Carrying Capacity of Land under Shifting Cultivation, Results of a few surveys, by N. Saha (North Eastern Affairs, Vol. 2, iv, pp 33-34.
 27. **Fifth Plan Approach**, Soil Conservation Dept. Assam, **op cit**, p 6.
 28. **Fifth Plan, Assam (Hill Areas)**, **op cit**, Vol. II, p 2.
 29. **Agricultural Census, Arunachal**, **op cit**, pp 37-38; Also, **State Report on World Agricultural Census, Tripura, 1970-71**, p 12.
 30. **Ibid.** pp 13-14.
 31. **Op Cit**, pp 25, 30-32.
 32. **Changes in Mikir society**, by P.D. Saikia, 1968 pp 52-53.
 33. **ibid**, p 54.
 34. A.E.R.C. ? Ad hoc Study No. 22, **op cit**.
 35. B.P. Misra, **op / cit**.
 36. **Draft Outline, Fifth Plan, Assam (Hill Areas)**. Vol I, p 3. The emphasis is of the present author.
 37. Some Social Constraints to Agricultural Development in North Eastern India By Ranjit Mukherjee (North Eastern Affairs. Annual Number, 1975), pp 43-50; Mukherjee is of opinion that there is hardly any need for agricultural credit for shifting cultivation. However the present author believes that there should be more of follow up studies to tackle the problem referred to by the Talwar Committee in this regard. The Jhumias need credit for cash crops and also some time for meeting consumption expenditure.
-

Development and change in an area under Shifting Cultivation

Dr. Saradindu Bose,
Anthropological Survey of India
Calcutta.

INTRODUCTION :

Shifting cultivation is not always destructive as claimed by some experts. It has its merits and demerits. Some authors are of opinion that it is a lazy process of earning livelihood. It requires only cutting of jungles, firing of the trees cut down, and sowing of crops by broadcasting. After that a person may sit comfortably without any work in the expectation of a good harvest. But one who has watched the clearings of jungles, specially in thickly wooded area, will not say that shifting cultivation is easy. Moreover, the work of cultivation is not completed merely with the sowing of seeds. In forest areas wild animals destroy a good portion of the crops. Farmers have therefore to keep guard day and night all through the season. This involves hard labour.

Some experts are of opinion that this system of cultivation is very harmful as it destroys forests and lowers the value of the soil. In areas of extensive exploitation by shifting cultivation, it has been noted that the soil is rapidly washed away and trees can no longer grow there in future. A bad-land topography has been developed. Experts are therefore of opinion that unless this system of land usage is suspended or controlled devastation would creep in over the areas concerned. Others are of opinion that shifting cultivation is not necessarily a harmful practice. They argue that shifting cultivation need not necessarily lead to a gradual degeneration of the soil. If due regard is given to the nature of the soil, slope of the land and sufficient time is allowed for regeneration of forest, then soil erosion can be prevented.

In many hilly areas like the Juangpirh and Bhuinyapirh of Keonjhar district in Orissa, there has been considerable degeneration of forest on account of shifting cultivation. The pressure of population in the Keonjhar hills is so high that the recuperative cycle has been shortened to a great extent, resulting in repeated clearing of the hill-slopes at short intervals and denudation of the forest. But in other parts of the country like Arunachal Pradesh and Mizoram, where a different picture is obtained, there is not much pressure of population on land in these areas and therefore degeneration of forest has not taken place to a great extent.

It is the opinion of many anthropologists that shifting cultivation is a way of life for the tribal people and as such any suggestion regarding suspension of shifting cultivation and introduction of terraced or permanent cultivation in its place is not accepted by the tribal people.

Shifting cultivation is associated with the tradition of communal ownership of land. A Plot remains under cultivation for one or two years. After that it is abandoned and the household concerned clear up another patch of land for shifting cultivation. After a lapse of a number of years they may return to the same area for cultivation. But the same household may not have the same holding this time which was cultivated by him previously. He has only usufructuary right over the land. So a person is not concerned about the maintenance or protection of land from degeneration.

By and large, shifting cultivation is based on low technology and under utilisation of human resources. It is already accepted by many experts that this destructive land-use system should be gradually controlled. Though in every case this system of land-use is not destructive yet at least in Keonjhar we are convinced that land degradation has been continuing at an alarming rate. There are different recommendations like re-settlement of tribals in a new place through colonization, change of cropping pattern-introduction of terraced cultivation, introduction of Taungya system of cultivation introduction of horticulture etc. Some of these ideas are also tested in different parts of the country. Failures of these schemes are also known to us.

The first point to be considered is that the problems of shifting cultivation are not similar to all regions. So, the subject should be discussed separately for each region. Accordingly, special schemes are also to be recommended for each region.

Secondly, land-man ratio should be studied thoroughly in its ecological perspective. As already stated, in some places, where the pressure of population on land is less and due to ecological factor growth of vegetation is more, shifting cultivation does not pose any serious problem. Contrasted to this, in places like Keonjhar, where pressure of population has crossed the critical limit of carrying capacity of land, the problem is very serious.

Thirdly, man's attitude towards change should be known, and his capacity to adopt new ideas should be assessed. If the extent of willingness or the nature of resistance is known it becomes easier to devise plans which will be to the liking of the people.

CASE STUDY :

A bench mark study of one village named Kadalibadi in Keonjhar district was made in the year 1961. * In 1974 we again surveyed the village on the lines to know about their attitude towards change and the nature and rate of change within 13 years time.

Our study ** of the Juang country showed that the carrying capacity of land per sq. mile in the Keonjhar hills was 24.7 in 1961, whereas the present density per sq. mile is 63.2. When the balance of land-man ratio is disturbed people try to adjust to the situation in different ways either by peaceful means or by revolt. Those who follow peaceful methods, try to adopt new techniques for more and better production from limited extent of land. There are other short term adjustments also.

At the beginning they capture more land, which may be of inferior quality for cultivation. Land, which is not suitable for cultivation previously, is brought under cultivation. Naturally they do not get much out of it.

The recuperative cycle is shortened and full growth of plants is not allowed. Naturally, while cultivating the land, deposition of ash content becomes too meagre due to non-availability of full grown trees. There are villages in Keonjhar where people are not able to produce more than three quintals of paddy per acre.

* This is part of the study entitled "An Integrated Tribal Development Plan for Keonjhar District" by Dr. N. Patnaik and Dr. Saradindu Bose from N. I. C. D., Hyderabad - 1975.

** Bose, Saradindu - "Carrying capacity of land under shifting cultivation Calcutta - 1968.

Moreover, in this region, land is cultivated for two years. Particularly during the second year cropping, when the land is bare of vegetation, the thin and porous soil becomes vulnerable. A process of soil erosion or land degradation takes place during every rainy season. There are places in Juang country which are completely devoid of vegetation.

Lastly, when all possible ways of taxing the land fail the people finding no other way (a) emigrate to rich villages, (b) borrow money or crop cash loan, (c) work as hired labourers in nearby rich villages and (d) reduce the rate of consumption of food.

All the four temporary adjustments are in practice in the Juang country. Of course they have been trying to adopt new techniques of agriculture also.

TABLE - I.
POPULATION OF KADALIBADI (only Juang) :

Year.	No. of families.	Male Child.	Male Adult.	Female Child.	Female Adult.	T o t a l
1961	22	10	32	15	32	89
1974	26	21	36	15	33	105

It will be seen from the Table I that within a period of 13 years, population has increased from 89 to 105 or in other words 1.2 percent rise of population per year is recorded in this village. If the data on migration which we have not included in the calculation, are taken into consideration, the rate of increase of population would be still higher than that which is mentioned above.

TABLE - II.
LOAN PATTERN OF KADALIBADI VILLAGE PEOPLE :

	1961.	1974.
Paddy	95 Khandi	37 Khandi 15 pai
Rupees	204/-	513/-
Rice	NIL	2 Khandi 10 pai
Millet	NIL	16 Khandi 15 pai
Mustard	NIL	19 pai

Table II shows a comparative picture of their loan pattern. With the increase of population, loan also has been increasing. But items of loan are not similar to prior days. In 1961 they had a loan of 95 Khandi of Paddy and cash of Rs. 204/- only. But in 1974 they have borrowed not only - 37 Khandi 15 pai of paddy and cash of Rs. 513 but also other items of rice of 2 Khandi 10 pai, millet of 16 Khandi 15 pai and mustard of 19 pai.

If we exclude the cash loan from the account then we notice that the quantum of import of food crop per unit of population has decreased to some extent. Cash loan is not comperable because of change of money value. The pattern of loan as given in Table II shows that the people are borrowing millet, a practice not followed previously.

TABLE - III.

LAND USE OF KADALIBADI VILLAGES :

		(Acres)	
		1961	1974
Juangs			
	Ist year Taila (Oil seed)	49	42
	2nd year Taila	41	31
	Homestead land for maize and mustard	16	0.50
	Wet paddy (ordinary)	4	1.00
	(Under construction)		
	Wet paddy (Taichung)	0	2
	Wheat	0	1.50
		110	78
Rented			
(a) Hill top.			
Land to	Oil seed (Ist yr. Taila)	0	1.78
Gauras.	Maize and Mustard	7	6.57
Hill Paddy.		0	0.58
Rented		7	8.93
Land to			
(b) Valley			
Gauras.	Maize and mustard	8	6.77
	Wet paddy	0	0.54
		15	16.24
		6	6
	Settlement	34	34
	Forest	47	47
	Bad land and Rocky	494	524.76
	Current fallow		
		706	706

It appears from Table III (Landuse pattern) that the importance of 2nd year Taila cultivation has been decreasing. In 1961, 41 acres were under 2nd year Taila cultivation, while in 1974 it has come down to 31 acres only. In the first year they cultivate cash crops of oil seeds. In the second year they cultivate food crops of paddy, millet pulses etc. (mixed). But it was noted that in the second year the rate of production of crops has fallen at least by 20 per-cent. One of the factors which contributes to the decrease of yield from second year land is soil erosion.

Realising this difficulty they are now trying to switch over to permanent cultivation. They have very carefully reclaimed the land on either side of the hill stream flowing close to their village and have divided it into several plots held individually by them. They have dug a two mile long water way along which water flows into the plots through openings made at several places. In these irrigated strips of land they grow high yielding

varieties of paddy such as Taichung and hybrid wheat. They have started applying fertilizer and pesticide to protect their crop and increase production.

They cultivate maize and mustard as usual in the same plot by rotation near their hut or homestead land. These are permanent fields. But these fields need atleast manures for replenishing soil fertility. Being homestead lands these are situated in the hill slopes at higher level than permanent paddy fields at the valley bottom. It is noted from field survey that by and large these hilly regions can be divided into three sub-divisions on the basis of soil classification, namely, flat hill top area, hill slopes nad valley bottom. Soils a e formed from the decomposition of basalt and laterite and is generally blackish on the hill top, red on the hill slope and brown in the valley bottom. On the hill top the soil is thin, in the valley bottom the soil is deep and on the hill slope it is thin and at the same time too stony. The hill slopes for obvious reason are not suitable for permanent cultivation. The Juangs have come to know this and prefer permanent cultivation in the valley bottom to shifting cultivation on the hill slopes.

Another significant change has come about in the village. The non-tribals of Goura community had in 1961 only homestead land in this village in a limited scale. They used to grow only maize and mustard in this land. But in 1974 we observed that these non-tribals have extended their cultivation widely to cover even some portion of best lands near the hill stream. They are now growing paddy, maize, mustard and till extensively. Ther lands are more fertile than those of the tribals because they apply cowdung manure which they have in plenty. Their water management is also most skillful. Formerly, they were cattle herders. But they have become the best farmers in the locality. Perhaps their improved farming has been a sort of result demonstration which has made the Juangs interested in permanent cultivation. In short, the changes which are taking place in the Juang village are :—

1. There is a tendency among the Juangs to concentrate their agricultural activity more on the plains of the valley bottom.
2. They prefer permanent wet cultivation.
3. They are gradually reducing the acreage under second year Tailaland.
4. They continue the 1st year Taila for producing cash crops.
5. They have adopted new agricultural practices such as transplantation of Taichung paddy, irrigation, application of fertilizer and pesticide.
6. They grow, wheat, a new crop not grown previously.
7. They seek for technical guidance from extension agents like VLW.

CONCLUSION :

On the basis of these finding, cartographic analysis of land potentialities and our field experience we recommend the following measures for controlling shifting cultivation and as well as for developing agriculture.

1. The Juangs may be approached and asked to stop second year Taila cultivation in the hill slope. But they should be allowed to continue the first year Taila cultivation for some time to come.

It is recommended that land having upto 3 percent slope should be brought under

permanent cultivation immediately. This area will be utilized for intensive agricultural developments by providing necessary inputs like irrigation, quality seed, pesticide, fertilizer etc. Many villages have perennial sources of water. Wherever minor irrigation is possible it should be taken up in right earnest and the land available nearby should be brought under cultivation. The Juangs have already started putting dams across hill streams and by other indigenous methods they are harnessing the hill streams to irrigate the land under permanent cultivation. Any government help in this regard will hasten the transformation from shifting to settle cultivation.

2. Once the flat valley bottom is developed or permanent paddy fields are available, the taila cultivation for first year can be restricted within a range of slope, initially between 12 percent and 20 percent for coming 5 years. After that period the category of land for Taila may come down to between 8 and 12 percent. During the initial stage Taungiya system horticulture should be encouraged. In the first year Taila land they sow the seeds of niger (oil seed) in the month of July. After the sowing season is over for both Taila or permanent fields they should be encouraged to plant mango, jackfruit, papaya, banana trees which are already grown in their area. These trees may be planted just before the end of monsoon so that these will grow satisfactorily without disturbing the growth of oil seeds. The fruit trees should be planted along the ridges of the Taila lands so that they do not interfere with the growth of the cash crops. By the harvesting time these trees will come up to a height of safe growth and when they attain full growth they would prevent further soil erosion and at the same time provide fruits to the tribals. Improved varieties fruit trees should be grown.

3. In the second stage, say, after 4 years, when all land between 12 and 20 percent slope will be brought under horticulture people will gain knowledge in it and take pride in the maintenance of individual orchards. At that time encouragement should be given to them to capture land having slope between 8 and 12 percent.

Two categories of land namely, land having slope from 8 percent to 12 percent land having slope from 12 percent to 20 percent, may be captured at a time side by side according to the availability of such lands in each village with the idea that ultimately only 1st year Taila will be continued for some time to come and 2nd year Taila cultivation will be stopped in course of five years. First year Taila will be restricted within the 2nd category of land having slope from 8 percent to 12 percent only.

4. In order to control 2nd year Taila cultivation alternate sites for permanent cultivation should be developed simultaneously. These sites are available in flat valley bottoms and within gentle slope area having 3 to 8 percent slope. The valley bottom must be reclaimed immediately and distributed among the tribals. Those tribal families who would be willing to give up second year Taila cultivation should be eligible to own land in valley bottom and should be given all help to carry out cultivation.

5. Terraced fields also can be developed in the land having 3 to 8 percent slope. The greatest handicap of developing terraced fields is the heavy financial investment. Even if the financial problem is solved by providing hundred percent subsidy, terracing has another problem. It is a time consuming process. A tribal cannot wait for two or three years until he gets return from such lands. In such a situation our recommendation is that the government should develop the terraced fields without insisting on people's participation and distribute them among the beneficiaries as and when the terraced fields are ready for cultivation. This will come in the later stage of development when the tribals will already give up second year Taila land cultivation and start wet cultivation in the valley bottom in full fledged manner.

6. Land having above 20 percent slope may be utilised for development of forest and pasturage.

7. The tribals should be provided with muzzle loading guns to protect the crops from the devastation caused by wild animals. Otherwise all attempts at improving agricultural practices as recommended above will be futile.

In 1974 as we have observed, the whole crop of Taichung paddy grown in the valley bottom by the Juangs of Kadalibadi village was destroyed by elephants, and no assistance was provided to them to keep these animals in check. They tried their best to protect their crops by whatever indigenous devices they had at their command. But when they failed in their attempts, they had nothing more to do but to keep quiet and bear their loss of the crop.

8. As already stated, due to the geological formation the hills above 2600 ft. or so are flat topped. These flat topped hills have a thin layer of black soil, and are not used for cultivation of cash crops. Cultivation of hill tops should be banned forthwith because it causes degeneration of forest and soil erosion. These hill tops should be taken up for afforestation. We feel that the tribals will not put any resistance against the forest department who will develop these hill-tops to a belt of reserved forest.

Shifting Cultivation - Maladies & Remedies

Dr. G. P. Gupta,
Soil Conservation, Directorate,
Central Water Commission
Faridabad.

Land & Water are two major natural resources on which depend the social and economic structure of a Country. If these two resources are misused or mismanaged, the entire base of the society is disturbed, when man starts misusing the land, he puts the natural forces against it which results in its destruction. The neglect of soil had led in the past to the disappearance of once flourishing civilizations. In our country mismanagement of these resources have already contributed very significantly to the impoverishment of the land and the people.

Wanton denudation of vegetative cover which creates an ecological balance in nature has taken place owing to pressure on land for social expansion, nature being unable to regenerate as fast as the process of destruction. Mountain ecosystems have been seriously damaged in almost all parts of India. In the hilly areas of north eastern India (Assam, Manipur, Nagaland, Tripura, Meghalaya, Mizoram and Arunachal Pradesh) where tribals constitute the majority of population, an age-old method of crop husbandry known as shifting cultivation or **Jhuming** is practiced. A similar type of cultivation prevails in the hilly forests of Orissa and Andhra Pradesh where it is known as **Podu** cultivation. They clear a patch of land by cutting and burning the vegetation of steep hills-sides consisting mainly of bushes and trees. The area is cropped for a short period and then abandoned. The pressure of population on the land has progressively hastened the process of shifting cultivation and a cycle of operations of 20-30 years in the past is completed at present in 4 to 6 years or even earlier. Consequently shifting cultivation has resulted in degeneration of land and severe damage to the soil resources of these regions. The area thus affected had been currently estimated at 3.4 m ha. which is as under :—

S. No.	State	Area affected by shifting cultivation ('000 ha.)
1.	Assam	498
2.	Meghalaya	416
3.	Manipur	100
4.	Tripura	221
5.	Nagaland	608
6.	Mizoram	604
7.	Arunachal Pradesh	248
8.	Orissa.	498
9.	Andhra Pradesh	240
Total :		3433

MALADIES.

Shifting cultivation has affected the socio-economic structure of the region immensely.

The process has already converted fairly extensive areas in various parts of the country into veritable wastes where nothing can grow. The intense and more variable run off due to high rainfall in the region has resulted into accelerated erosion which creates multi-facet effects.

REMEDIAL MEASURES :

There is a great urge for development of the hilly areas and to improve the socio-economic condition of the tribal people to enable them to join the mainstream of economic progress in the country. To make agriculture in the hills paying, it has to be linked up with the systematic programme for introduction of new and better crops which would give more economic return to the local people on a sustained basis.

New crops of economic importance have to be searched and their cultivation should be extended in the hilly areas. Mountain topography and the high rainfall of these areas demand intensive erosion control measures for successful culture of the selected plants. Orissa has made commendable experiment in the development of hilly areas by introduction of commercial crops like agave, cashewnut etc. The cultivation of the plants of economic importance immediately offers employment to the tribal community and helps them to wear away from shifting cultivation.

Stopping or regulation of shifting cultivation should be ended by a progressive programme of inducing local people to take to settle agriculture on land suitable for the purpose, properly treated with Soil Conservation measures and provided with irrigation wherever possible where as rest of the areas vulnerable to this abuse should be brought under permanent vegetal cover.

It is also necessary to bring in a regulated system of land use in these hilly areas. Very often correction of existing terraces or adoption of certain water disposal system would correct the main malady. A cropping pattern with higher inputs which will enable greater yields to be obtained per unit area will detract the tribals from uncertain way of life.

It is of urgent necessity to carry out pilot experiments in the **Jhum** or **podu** areas to conduct research for testing the validity of the premises of the problem as formulated for implementation of the solutions posed. Socio-political influence which is operative favouring continuance of the hazardous type of cultivation in these erosion-prone areas has to be countered by demonstrations.

The problems of rehabilitation of the Jhumiya families in the hill areas of Assam

B. N. Bordoloi, M.A. (Gau.), C.T.W.A. (Bombay)
District Research Officer,
Mikir Hills, N.C. Hills & Cachar Districts, Diphu.

AN INTRODUCTORY NOTE :

The shifting cultivation, otherwise known as Jhumming, which has been practised by the tribal people living in the hill areas of Assam from time immemorial is the only means of sustenance for them. As such we may not decry it as the most harmful practice without taking into account the feelings and sentiments of the people and the religious rites attached with the practice of Jhumming. (Instead certain) suggestion at constructive alternatives which are practically feasible and at the same time acceptable to the people may be offered.

The hill areas of present Assam refer to the two Autonomous Hill Districts only, namely, the Mikir Hills District and the North Cachar Hills District. These two districts are chiefly inhabited by the Karbis (Mikirs) and the Dimasas Kacharis. Besides these two principal tribes there are small groups of tribal people belonging to the Rengma Nagas, Zemi Nagas, Khasis, Jaintias, Garos, Kukis, Hmars and the Mizos.

The Mikir Hills district has an area of 10,332 square kilometres and consists of two Sub-divisions, namely, the Diphu Sub-division and the Hamren Sub-division. The total population of the district is 379,310 as per 1971 Census out of which 210,039 persons belong to the Scheduled Tribes, and their percentage to the total population of the district is 55.37 only. As per 1971 Census the density of population in this district is 37 per square kilometre.

The North Cachar Hills district has an area of 4,890 square kilometres. As per 1971 Census the total population of the district is 76,047 out of which 52,583 persons belong to the Scheduled Tribes. The percentage of the Scheduled tribes population to the total population of the district is 69.15. As per 1971 Census the density of population in this district is 16 per square kilometre.

EXTENT OF JHUMIYA FAMILIES :

As per 1971 Census the total number of households in the Mikir Hills district is 65,340. As the total population of the district is 379,310 as per 1971 Census, the average family is found to consist of 5.8 members approximately. The total population of the Diphu Town as per 1971 Census is 10,200 distributed into 2,004 households. Therefore, the total number of rural population and the total number of rural households in the Mikir Hills district are 369,110 and 63,296 respectively. This also shows that the average number of family members in a rural household comes to 5.8 approximately. The reports of the Socio-Economic Surveys carried out by the Department of Economics and Statistics in the year 1964 and by me in the year 1967 show that the average number of family members is 5.93 and 6 respectively. Hence for our purpose, we may now assume that an average family in this district consists of 6 members approximately.

As per 1971 Census the total population belonging to the Scheduled Tribes in the Mikir Hills district is 210,039. If we divide this figure by 6, the total families belonging

to Scheduled tribes in 1971 would come to 35,000 approximately. To this figure we shall have to add the number of families that might have come up during the last five years that is to say, from 1971 to 1976. During the decade 1961-1971 the population belonging to the scheduled tribes had increased from 168,129 to 210,039 in this district, the rate of growth being 25 percent. If we assume the same rate of growth during the last 5 years also, that is from 1971 to 1976, we shall have to add an additional figure of 26,255 persons to 210,039. (The additional figure shown here might be more or less depending on the actual rate of growth which is not possible to find out at present). The additional figure of 26,255 persons would mean 4,376 additional house-holds. Thus the approximate number of families belonging to the scheduled tribes in the Mikir Hills district at present is 39,376 (35,000 + 4,376) and for our convenience's sake we would make it a round figure, that is, 39,000. It would however be quite wrong to say that all these 39,000 tribal families are practising Jhumming. In the Mikir Hills district the approximate ratio of hills to plains is 60:40. Applying this ratio to the total number of tribal families in the district we are now in a position to say that the approximate number of Jhumiya families in the district is 23,400 at present. The number of family members of the Jhumiya families would be round about 140,400 distributed into 870 Nos. of villages in the district. (The figure of approximate number of Jhumiya villages in the district is arrived at by applying the same hills-plains ratio -60:40 to 1,451 Nos. of inhabited villages).

From the above analysis it now appears that in the Mikir Hills district our problems are directly connected with the rehabilitation of 23,400 Jhumiya families approximately.

As per 1971 Census the total number of households in the North Cachar Hills district is 14,954. The total population of the district being 76,047 as per 1971 census an average family is found to consist of 5.1 members approximately. From the total population of the district if we deduct the population of the Haflong Town, which according to 1971 Census is 5,197 only, and from the total number of households of the district if we deduct the number of households of the Haflong Town, which according to 1971 Census is 1,126, the total number of rural population & the total number of rural households would come to 70,850 and 13,828 respectively. It also shows that the average number of family members in a rural household comes to 5.1 approximately. For our purpose we may now assume that in the North Cachar Hills district an average family consists of 5 members only.

It has already been stated that the total population belonging to the scheduled tribes in this district is 52,583 as per 1971 Census. If we divide this figure by 5, the total families belonging to the scheduled tribes in the North Cachar Hills district in 1971 would come to 10,516 Nos. During the decade 1961-1971 the population belonging to the scheduled tribes had increased from 43,202 to 52,583, the percentage of growth being 22. If we assume the same rate of growth for last 5 years also, that is from 1971 to 1976, the population belonging to the Scheduled tribes in this district in 1976 would come to 64,151 approximately and the total tribal families, would be about 12,830 Nos. As the lands suitable for wet-land cultivation in the N.C. Hills district are two scarce, we may also assume that about 90% of the tribal families practise Jhumming in this district. This would lead us to the fact that in the North Cachar Hills district about 11,547 Jhumiya families or to say 11,500 jhumiya, families with an approximate population of 57,500 distributed in 432 villages (the total number of inhabited villages in this district is 480 as per 1971 Census) need rehabilitation.

Our main problems are concerned with the rehabilitation of 34,900 Jhumiya families in the hillareas of Assam.

SOME IMPORTANT SOCIO-ECONOMIC FACTORS :

Any scheme or programme undertaken for execution with a view to rehabilitating the Jhumia families in this region should take into consideration the following important socio-economic factors :—

(I) In the Mikir Hills district the villages of the Karbis (Mikirs) are small in size and they are not situated in compact areas. They are scattered kilometres apart. Most of the Karbi villages practising shifting cultivation are in the habit of shifting their villages to the new Jhum sites when the present Jhum sites are exhausted.

Because of the shifting nature of the villages and their sizes as well, development works of permanent nature cannot be fully executed which in their turn have retarded the progress of the people.

(II) The shifting cultivation is associated with communal ownership of land. But in case of some tribes there has been private ownership of land also. As for example, among the Zemi Nagas of the North Cachar Hills there are traditional land owners called KADEPEO. KADEPEO's land not only includes Jhum sites and land suitable for settled cultivation situated in and around the village, but village sites as well. For occupation of land at village sites and for cultivating land at Jhum sites the villagers have to pay rent in kind to the KADEPEO usually @ 5 kg. of paddy per annum. There are also lands which are exclusively owned by the six clans of the Zemis. Only the remaining Jhum sites are owned by the community.

Any rehabilitation programme for the Zemi Jhumias dealing with the taking over of KADEPEO's lands and clan-lands will have to tackle with the question of private ownership first. Otherwise the whole programme might result in chaos and unfruitful labour.

(III) Although Jhumming is not an economically sound proposition also, but it has been an integral part of their life and culture. In fact many social, cultural and religious factors are associated with it. Any programme of rehabilitation of the Jhumias minus Jhumming must take into an account of all these socio-cultural and religious factors first.

SCHEMES FOR REHABILITATION : 1. MODEL VILLAGE OR ADARSHA GAON :

As a first step for the rehabilitation of the Jhumias the Mikir Hills District Council had established model villages (Adarsha Gaon) in different areas of the district wherein Karbi Jhumias were brought down from the hill tops and settled in the plains portion of the district. The scheme is only partially successful. The reasons for partial failure of the scheme, according to my opinion, are the following :

First, there has been no follow-up programme at all. After the establishment of a full fledged model village providing all the basic amenities nothing has so far been done to induce the people to stay there. As a consequence, many Karbi families have already left the model villages and gone to their old hill top habitats.

Secondly, since the construction of the houses no repairing has been done by the people in spite of abundance of building materials near their abodes. In fact the size of the typed house is too big for a family to manage.

Thirdly, it is found that many families instead of living in the houses given by the District Council, are putting up in houses constructed by themselves in the back-yards in their traditional pattern. The typed house constructed by the District Council are not only too big but are quite different from the traditional pattern also. The people would not have abandoned these houses had they been constructed in traditional pattern with improvement. Thus in rehabilitating the Jhumiyas in the model villages, these sociological factors have not all been taken into consideration.

2. CASH CROP PLANTATION SCHEME :

The experiments carried out by the Soil Conservation Department of the Government of Assam have proved that the soil in the Mikir Hills district is very much suitable for rubber cultivation while that of North Cachar Hills district is very much suitable for coffee cultivation. For the purpose of cultivating rubber and coffee in a large scale the Assam Cash Crop Plantation Development Corporation was set up on 1st September 1974. In the Mikir Hills the Corporation has fixed the target of rubber plantation in 2600 hectares and coffee plantation in 2300 hectares and in the North Cachar Hills rubber plantation in 300 hectares and coffee plantation in 920 hectares. To be economically viable the area of each centre should not be less than 80 hectares.

To cultivate rubber and coffee in a large scale in these two hill districts on commercial basis is only the secondary aim of the Corporation. The primary objectives of the Corporation are (1) the economic development of the tribal people of the hill areas at a very fast rate and (2) the rehabilitation of the Jhumiyas.

Plantation of coffee rubber in Borgaon, Hamren, Burapahar, Rongagorah, Chatianala, Ouguri, Baithalangso Centres in the Mikir Hills district and Mahur, Lassang Gunjung and Bor-ar-kap centres in the North Cachar Hills district has already been started.

3. SCHEME FOR COMPOSITE PROJECTS :

Since the plantation Corporation will be providing employment to two adult members of each Jhumiya family and that too for 250 days for coffee and 150 days for rubber plantations in a year, it would be necessary to have agriculture or horticulture as a subsidiary occupation near the plantations. Even if the two adult members of each Jhumiya family in the neighbourhood of Plantations are given employment round the year, nevertheless, there might be other family members who will have to continue to work on food crops. Hence a scheme has been drawn up in these two districts to open up a good number of composite projects in co-operation with the Development Departments, like Agriculture, Irrigation, Forest, Public Works Deptt. etc. In these projects, terraced, reclaimed and well irrigated lands with approach roads will be provided to the Jhumiyas for settled cultivation. This will be supported by subsidiary occupations like animal husbandry, horticulture, sericulture, weaving, etc. These projects will cover all the plantation centres. Some composite projects are being taken up in those areas where plantations are not likely to come up in future with a view to rehabilitating the Jhumiya families in settled cultivation.

4. SCHEME FOR ERI CONCENTRATION CENTRES :

Rearing of Eri is an important household industry among the tribal people living in the Hill Areas of Assam. A special scheme has been taken up in the North Cachar Hills district to accelerate the development of Eri centre. This scheme is intended to

provide employment to the Jhumiyas specially in their off days, to supplement their family income and to reduce the undue pressure on Jhuming.

CONCLUSION :

Except the model villages the other schemes mentioned above are still in their infancy. In every stage of their implementation new problems are likely to arise. It is therefore, not possible at this stage to evaluate the success or failure. Personally I believe that if the schemes are implemented with earnest zeal, unexhausted patience and with follow-up programmes and by involving the support of the tribal leaders-both traditional and modern-the success will be surely ours. Of course, the publicity machinery which is very often neglected, has to play a great role in the successful implementation of any scheme for Jhumiya rehabilitation.

The Burning Problems of Shifting Cultivation (Jhumming) in Meghalaya

P. R. Mawthoh,
Department of Soil Conservation
Govt. of Meghalaya
Tura

Meghalaya comprised of three separate Hills districts of Khasi Hills, Jaintia Hills and Garo Hills. It has a total geographical area of 22,500 sq. Kilometres and a population of 10,11,699 by 1971 Census. The population density is about 44 persons per sq. kilometre.

The new State is predominately tribal. The tribals constitute more than 80% or total population. The three main tribes are the Khasis, the Jaintias or Syntengs or Pnars and the Garos or Achiks. Of the total population 7-8 out of every 10 persons earn their living by cultivation. According to a survey conducted by the Agro-Economic Research Centre for North-East India, Jorhat, Assam, (1961) under the title 'A study on the problems of agricultural development in the Hills areas of North-East India' the estimated percentage of Jhumias in Meghalaya was given as 40, that is 25% in the then United Khasi & Jaintia Hills and 67% in the Garo Hills. Assuming that the percentage of population depending on Jhum remained the same, the present Jhumming population would be about 3,23,744, which, taking an average of 5 members per family, would cover about 64,748 or say, 65,000 families. Again taking a rough average of about 1½ Hectares of Jhum cultivation per family, the area covered by jhumming cultivation annually would amount to about 97,500 hectares. The problems, therefore, of weaning way and settling down this huge number of jhumming families is indeed a gigantic one. The problem is also such that it warrants immediate remedial measures, guidance and assistance from all possible agencies in order to free these poor people from the clutches of perpetual near-famine condition and erosion of the all important land resources.

There are two very important and significant features involved in jhumming which we should specially take notice of—

(1) The 'Slashing and burning part of it. Fire has all the destructive force of annihilating all the living plant and animal world - in this case, particularly the plant life that serve as protective cover of the soil and prevent it from being eroded and washed away. However, burning is itself would not have produced such serious effect were it not for the presence of the second more important feature - the slope of the land.

(2) The second feature is the slope of the land. Invariably by the very nature of the hilly topography, jhumming cultivation is carried on the slope of the hills. If burning is to be carried out only on flat or level land then perhaps the destructive force to the soil would not have been so devastating as the soil at least would remain in the same place. But on the hill slopes the practice assumes the danger of the first degree importance. Slashing and burning render the soil bare of any protective cover and being situated on the soil is consequently exposed to all the powerful forces of nature like wind, rain, sun etc. which make erosion at an enhanced rate and gradually render the land barren. And when the soil is washed away naturally one cannot expect any plant life to sustain an barrenness. This, in fact, is the crux of all chronic ills of hills agriculture,

Evils of Jhumming :— The following are the chief evils of jhumming :— (1) Indiscriminate cutting and burning of forests - destroying - literally burning - lakhs of rupees worth resources every year in terms of timber, firewood etc. lost.

(2) Destruction of forests means destruction of potential sources of raw materials for the setting up of such industries requiring these materials such as paper-pulps factory etc. It deprives the people of potential employment and is definitely a big drain to the state economy.

(3) With the destruction of vegetative covers (forest trees, grasses, etc.) the land is exposed and made barren. The result is that the water-retention capacity of the soil is reduced. The resultant effect is that the water availability in the lower reaches, both for drinking and irrigation, becomes greatly diminished.

(4) Jhumming upsets the balance of nature. It reduces rainfall precipitation from the rain-bearing clouds which pass over the area where there is no obstruction of trees, etc. Besides, it drives away or destroys the animals, the birds and the insects. We lose their services and utility, the very purpose of their creation. And we lose the sweet music of the beautiful refrain. Over and above this, we lose the service of the green leaves for absorption of the carbon-dioxide which man breathes out and which in turn produce oxygen or refreshed air for the benefit of man himself.

(5) Without resorting to conservation measures jhumming facilitates enhanced erosion of fertile top soil and ultimately expose the subsoil and even parent rocks, making it unfit for further cultivation. They become unproductive land of no return e.g. areas in Cherrapunji, Mawsynram, Mawkyrwat, Siju and other places.

(6) Jhumming necessitate shifting of cultivation sites at regular intervals -leaving the old place fallow by starting jhumming destruction and cultivation at new sites.

(a) Leaving the land to rest or in fallow for 10-15 years for purpose of recuperation means a great national waste. In the whole state there are square miles upon square miles of such areas where nothing is grown while the land is given the so called rest. Thus, lakhs of hectares of productive land are lost for 10-15 years on end. These very same areas could have produced lakhs of tonnes of good for the people had they been utilized by simply resorting to such conservation measures like terracing, bunding, etc. which would enable establishment of permanent and continuous settled cultivation in such areas.

(b) With the rapid rate of increase of population as it is now, there will be little areas to shift to and land availability will become critically limited.

(7) As is all know the yield from hum harvest is so pitifully and uneconomically low that it needs no elaboration. It is this in fact that has brought the vicious circle of poverty, ignorance and diseases to the masses of our farmer/cultivators.

(8) Jhum fire has been known to accidentally destroy even residential villages and other important installations of the modern world like the telephone and telegraph posts, wire, etc. - causing not only wastage but also inconvenience and at times misery to the affected. More serious and important is the effect of jhumming on the life-span of River Valley or Hydro Project. In Meghalaya we have the Umtru and the Umiam (stages I,II,III & IV) Hydro Electric Projects. Through the actual figure of sedimentation of these projects are not readily available, yet it can be safely assumed from general observation and experience that the rate of siltation is very high. If the following figures of their such major and important projects in India are any indication then surely with the

conditions of jhumming prevailing in the catchment areas of the Umtru and the Umiam projects the rate of siltation will be not less if not more. The life-span of the dams is very much shortened :—

	Present silting rate annually		Design figures annually.
1) Bhakra	- 125 acre ft/100 sq. mile	-	90 acre ft/100 sq. m.
2) Panchet Hill Dam (DVC)	- 220 „ „ „	-	71 „ „
3) Maithon Dam (DVC)	- 275 „ „ „	-	92 „ „ „
4) Sivajisagar	- 320 „ „ „	-	140 „ „ „
5) Mayurakshi	- 346 „ „ „	-	112 „ „ „

(9) Jhumming also necessitates shifting and scattering of homesteads or villages and with reduced number. Such scattered and small villages are a great impediment to the provision of the modern amenities to the rural people such as schools, dispensaries, drinking water supply, and the like - a great handicap indeed for the developmental and administrative machineries to function.

Another important aspect of jhumming or shifting cultivation which may be taken as its accompanying twin is that the possibility of a fixed or permanent settlement is reduced to practically zero. Under such circumstances and viewed from the modern standpoint the situation is charged with many uncertainties. The authorities are bound to face many a difficult and serious problem in trying to introduce any effective planning toward developmental programmes such as setting up of schools and dispensaries, provision of health and sanitation facilities, extending new ideas in improved practices in agriculture and other trades for the over all improvement of man and his surroundings. Administrative machineries as such suffer a serious set-back and other normal consideration for the welfare of man as an integral constituent of a society, a state or a country are held at a great disadvantages.

Let us list down a few reasons that might prompt the cultivators to shift from the place to place:

(i) **Order of Head or Chief :** For some reasons or other the head or Chief of the village or clan may order his people to shift or move away to other place. This is specially true in the case of people who were or are far from the influence of modern civilisation and where the mode of living is still conformed to the primitive pattern of society.

(ii) **Repeated Misfortunes :** It may also so happen that the repeated incidence of misfortunes like deaths, sickness, etc may prompt the people to move enmass from one homestead site to other.

(iii) **Repeated failure of crops :** The consecutive failure of crops due to unforeseen circumstances such as climatic and other vagaries of nature are usually attributed to evil influences and disfavour of the spirits, and call for a change of place.

(iv) **Wholesale calamity :** The people are also made to shift to new place when some wholesale calamities like earthquake, flood, elephant raid, epidemics etc take place in settlement.

(v) **Dwindling Crop yield :** We know that continuous cropping in a particular plot of land for number of years without supplementing it with the addition of plant

food nutrients taken up by the crops will gradually and progressively lead to diminished return of uneconomic value. This is but a simple phenomenon of soil exhaustion or progressive reduction of soil fertility. To a primitive jhumia it serves only as a Green Signal to shift to another fertile place. He leaves the plot to regain its strength before he comes back to cultivate it again.

Thus, with the exception of reason number (v) above, all the others do not take the form of regular occurrence. They are, at best, commonly infrequent. Factor number (v), on the other hand is quite different. It is invariably recurrent and generally takes a regular pattern which, under primitive conditions, is more specially so. As mentioned, the reason the land does not give a profitable return is because its fertility has dwindled to the point of exhaustion and/or the top soil, in case of hill slopes has been eroded and washed away down.

Therefore, the approach to controlling jhum or shifting cultivation and stabilise hill agriculture will have to be based on this strategy. First and foremost is to devise measures to prevent the soil from being eroded.

It is very essential that the jhumia is provided with land where he can cultivate and derive profits permanently. In hilly areas such as our hill districts, and where the rainfall is high, the question of preventing the soil from being eroded away assumes the magnitude importance of the first degree. Once the retention of the soil is ensured then the question of augmenting the soil fertility through the addition of manures and fertilisers or use of improved seeds and pesticides etc. will be meaningful.

There are various conservation measures devised to suit various exigencies. In these hilly areas, one of the most common measures that can and has been adopted to advantage is the construction of terraces. These are structures constructed in the form of benches across the slope of the hill at regular intervals for the purpose of preventing or reducing the soil from being eroded and washed away down hill by wind or rain. These structures ensure the retention of the soil in one place and thereby facilitating the process of building up and retaining the fertility of the soil through the addition of natural or artificial manures and adoption of improved practices, so that production can be maintained at an economical level. Different types of terraces can be adopted to fit in with a particular type of requirement. These terraces have a definite advantage toward achieving permanent cultivation, unlike those unprotected or untreated hill slopes where the soil is continuously washed away down hill, leaving the hill sides completely barren and useless in the course of only a few years.

Besides terracing, other conservation measures, like bunding, trenching, check-damming, gully plugging, etc. can be adopted according to the need of the area. Equally important is the creation of protective covers like forest or fruit trees, suitable cash crops, grasses and leguminous crops especially on high slopes. In short, land use planning should be based according to its (land) capability and suitability, (taking all the existing local condition like soil, slope of the land, rainfall, agricultural practices etc into account).

Once the idea of a permanent cultivation becomes established then, with a certain amount of care and foresight, the process of planning for regrouping of these settlements to suit the need of the regrouping jhumias can be effectively put into practice. The process of regrouping of villages is not as simple as it sounds. In fact it is very complex as it involves many a sensitive factor so dear to man both of traditional and current. The love and reverence for one's hearth and home and his land, the sense of security in the atmosphere of the old society, the sense of belonging to a particular society, group or village, the sense of propriety of the hills and vales around him, the feeling of snug safety in the infallibility of his old village structure and traditions. Whereas on the

other side there is only uncertainty-what kind of a home will one have? How much land would be available for him to sustain his family? With what kind and type of people will he be thrown in to live together with? What will be his place and position in that new conglomeration of human heads? And such like questions would automatically come to one's mind. Over and above these, the system of land tenure or ownership existing in the area will have to be reckoned with at the very outset.

In Meghalaya such scheme of development and allotment of permanent cultivation land and regrouping of the small and scattered villages has been taken up by the Soil Conservation Department. This Jhum Control Scheme has been taken up since 1974-75. In the line of the above observations, the scheme provides for distribution of two (2) hectares of developed land (terraced and / or flat land) per family, with priority given to irrigation wherever and whenever facility for such exists. The scheme also includes grouping of families from the smaller and scattered villages into bigger units of at least not less than 50 households per unit. A sum of Rs. 2,000/- also is given to each family as subsidy toward cost of materials for construction of houses in the new site. Besides, drinking water supply together with link road to the settlement and cultivation sites are also provided. In conjunction with the other development departments co-ordinated both at the State and District levels the scheme also urges for the coming in of these departments for setting up of schools, dispensaries, public health and other civic amenities in order to give added incentives and insure permanency of these settlements, which, in point of fact, will also serve as growth centres.

Though the idea of this kind of regrouping of the scattered settlements is very much necessary and advantageous to the settlers themselves yet, human as we all are it needs a great deal of patience understanding and sincere hardwork to convince them that these changes will ultimately help them reap the permanent benefits of modern civilization. There are, of course, problems and initial set back but this is understandable as it must be remembered that primarily we are dealing with very sensitive elements of human sentiments and of age - old traditions and customs which were heretofore their way of life. Breaking such barriers is no easy task - it takes time and patience. God willing and with sincere hard work a new day of progress, prosperity and happiness will surely dawn.

A two-day seminar on the Socio-economic problems of the Shifting cultivation in the north-east India organised by North-East India Council for Social Science Research was held on 18-19 June, 1976 at Shillong. From the deliberations the following consensus emerged :—

1. The seminar agreed that the shifting cultivation has to be replaced by improved form of land management, but the switch over has to be in a phase manner and should be gradual and smooth causing least disturbance to the people concerned. It is agreed that the shifting cultivation is a way of life, and as any way of life is subject to change due to the changed circumstances: the way of life of the Jhumiyas is also undergoing changes. However the forces of change should preferably emanate from within the society, even though the role of state help, particularly in the form of technical and scientific guidance and funds, cannot be denied to accelerate the pace of development. The provision of infrastructure of development including roads, credit and marketing facilities will play an important role in bringing about the desired changes.

2. While bringing the change from shifting cultivation to settled cultivation, there will necessarily come about some changes in the social and land reforms. Special care should be taken so that there is no undesirable social consequences.

3. It is essential that data on shifting cultivation practices should be collected for a correct interpretation of the situation and suggestion of proper remedies. The autho-

ities should refrain from basing their strategies, as far as possible, on inadequate information of the subject.

4. Any suggested change in shifting cultivation will have a bearing upon the forest policy. The forest policy may be suitably reformulated with special reference to the north-eastern hill regions.

5. The possible impact of the gradual decline in the production of the cash crops like cotton and various oil seeds consequent upon the decline of shifting cultivation, upon the national economy should be studied.

6. Horticulture as an alternative and subsidiary occupation may be desirable and feasible provided there is an adequate organisation to cater to the production and marketing needs.

Terracing is costly and cannot be immediately resorted to in many steep hills of the north-eastern India. However, the soil survey should help in identifying the areas where it can be undertaken.

7. Immediate action should be taken to identify potential locations, by some rapid soil survey technique and photo interpretation, where the integrated approach for control of shifting cultivation can be tried.

8. The scope of animal husbandry raising of plantation crops in the hill areas should be further explored.

9. Where settled land management is being introduced, adequate protection measures, including soil conservation should be adopted. Integrated area development should be the firm policy. The settled land management should be supported by effective supply of inputs including seeds, manures, fertilizers, tool and implements etc. as well as by an effective follow-up programme.

10. But since the switch-over from shifting cultivation will take sometime it is necessary to undertake studies meanwhile, to improve the farming practices of the Jhumias so as to cause minimum soil erosion and loss of soil fertility.

Enquiries should be conducted into the crop compatibility, water-management and also the possible association of occupations in shifting cultivation.

11. The loss of and degeneration to flora and fauna as a result of shifting cultivation should be studied in greater details, and the loss of the same from other sources should also be identified and estimated.

12. The seminar has made a strong plea for an integrated research on the basic problems connected with the shifting cultivation by scientists of all the disciplines, including social scientists.

19th JUNE, 1976.

B. Datta Ray,
SECRETARY.

**NORTH-EAST INDIA COUNCIL FOR SOCIAL SCIENCE RESEARCH ,
SHILLONG.**

Two-day seminar on the Socio-economic problems of the Shifting Cultivation in the north-east India organised by North-East India Council for Social Science Research held on 18-19 June. 1976 at Shillong:

LIST OF PARTICIPANTS.

DIPHU

- ANDAMAN AND NICOBAR ISLANDS.** 10. Mr. B.N. Bordoloi,
District Research Officer,
P.O. Diphu, Mikir Hills.

1. Mr. Lathan Zama, I.F.S.,
Chief Conservator of Forests,
Port Blair.

JORHAT

ASSAM

Gauhati.

2. Prof. M.C. Goswami
Professor and Head,
Department of Anthropology,
Gauhati University, Gauhati - 14.
3. Dr. T.C. Sharma,
Reader, Department of Anthropology,
Gauhati University, Gauhati - 14.

4. Dr. D.N. Majumdar,
Department of Anthropology,
Gauhati University, Gauhati - 14.

5. Dr. K. Alam,
Department of Economics,
Gauhati University, Gauhati - 14.

6. Dr. P. Goswami,
Professor,
Department of Folk-lore Research,
Gauhati University, Gauhati - 15.

7. Dr. (Mrs) R.P.M. Bordoloi,
Professor and Head,
Department of Botany,
Gauhati - 781001.

8. Dr. B.N. Saikia,
Joint Director of Horticulture (Hills),
Department of Agriculture,
Government of Assam, Gauhati - 22.

9. Prof. Bijon De,
Department of History,
Gauhati University Gauhati - 14.

11. Dr. P.C. Goswami,
Professor and Head,
Department of Agricultural Economics,
Assam Agricultural University,
Jorhat - 785013.

12. Dr. P.D. Saikia,
Director,
Agro-Economic Research Centre,
Jorhat - 785013.

13. Dr. N. Saha,
Agro-Economic Research Centre,
Jorhat - 7850013.

MIZORAM

14. Prof. M.L. Sharma,
Department of Economics,
Lunglei College,
Lunglei - 796106.

NAGALAND

15. Mr. V. Kirekha,
Working Plan Officer,
Directorate of Soil Conservation,
Nagaland, Kohima.

16. Mr. T. Yaden,
Soil Survey Office,
Directorate of Soil Conservation,
Nagaland, Kohima.

ARUNACHAL

17. Mr. K. Bhattacharjee,
Statistical Inspector (Agriculture),
P. O. Daporijo,
Subansiri.

MANIPUR

18. Mr. O. Ghanashyam Singh,
Asstt. Engineer (Soil Conservation),
Directorate of Agriculture,
Imphal.

TRIPURA

19. Dr. J.B. Ganguli,
Principal,
Women's College,
Agartala - 799001.

NEW DELHI

20. Dr. D.D. Narula,
Director,
I.C.S.S.R.,
I.I.P.A. Hostel,
Indraprastha Estate,
Ring Road, New Delhi - 110001.
21. Mr. D.C. Das,
Deputy Commissioner (Soil Conservation)
Ministry of Agriculture and
Irrigation, Krishi Bhawan,
New Delhi - 110001.

WEST BENGAL**Calcutta**

22. Dr. Amalendu Guha,
Professor of Economic History,
Centre for studies in Social Sciences,
10, Lake Terrace, Calcutta - 700029.
23. Dr. Saradindu Bose,
Senior Ecologist,
Anthropological Survey of India,
2, Ripon Street,
Calcutta - 16.
24. Dr. P.K. Bhowmick,
Head, Department of Anthropology
Calcutta University,
35, Ballygunge Circular Road,
Calcutta - 700019.
25. Mrs. P.K. Bhowmick,
727, Lake Town,
Calcutta - 70055.

MEGHALAYA**Shillong**

26. Dr. (Mrs) I. K. Barthakur,
Head, Directorate of Economics and
Statistics,
Govt. of Arunachal Pradesh,
Shillong - 793003.
27. Mr. K.C. Kar,
Asstt. Director of Census operations,
Govt. of Arunachal Pradesh,
Shillong - 793003.
28. Mr. A.K. Paul,
Tabulation Officer,
Directorate of Census operations,
Arunachal Pradesh,
Shillong - 793003.
29. Dr. S.D. Jha,
Directorate of Census Operations,
Arunachal Pradesh,
Shillong - 793003.
30. Mr. K.K. Sinha, I.A.S.,
Secretary to the Govt. of
Meghalaya, Soil Conservation
Department, Shillong - 793001.
31. Mr. B.J. Syiemlich,
Principal,
U.G.S.T.C.,
Upper Shillong - 793009.
32. Mr. K.P. Das,
Research Officer,
Department of Agriculture,
Meghalaya, Shillong - 793001.
33. Dr. Satyabrata Bhowmick,
Adviser (Agriculture),
North-Eastern Council,
Shillong - 793001.
34. Mr. A.K. Sarma,
Director of Agriculture,
Meghalaya, Shillong - 793001.
35. Mr. G.M. Kanth,
Research Officer,
North-Eastern Council,
Shillong - 793001.

36. Mr. P.S. Ingty, I.F.S.
Director, Soil Conservation, Govt.
of Meghalaya, Shillong - 793001.
37. Dr. G.S. Aurora,
Professor, Department of
Sociology, North Eastern Hill
University, Shillong - 793001.
38. Dr. B. Pakem,
Reader, Department of Political
Science, North-Eastern Hill
University, Shillong - 793003.
39. Dr. Mrinal Miri,
Head, Department of Philosophy,
North-Eastern Hill University,
Shillong - 793001.
40. Dr. (Mrs) Sujata Miri,
Department of Philosophy,
North-Eastern Hill University,
Shillong - 793001.
41. Dr. J.B. Bhattacharjee,
Department of History,
North-Eastern Hill University,
Shillong - 793001.
42. Dr. S.N. Guhathakurta,
Department of Economics,
North Eastern Hill University,
Shillong - 793001.
43. Dr. A.K. Ghosh
Officer-in-Charge,
Eastern Regional Station,
Zoological Survey of India,
Risa Colony, Shillong - 793003.
44. Mr. S. Biswas,
Zoological Survey of India
Risa Colony, Shillong - 793003.
45. Dr. G.H. Bhoumik,
Botanical Survey of India,
Eastern Circle, Shillong - 793003.
46. Mr. P.K. Hazra,
Botanical Survey of India,
Shillong - 793003.
47. Dr. A. Chatterjee,
Geneticist,
Botanical Survey of India,
Shillong - 793003.
- . Mr. J.K. Singh,
Assistant Director,
National Sample Survey
Organization, Shillong - 793001.
50. Mr. K.G. Singh,
Market Intelligence Unit,
Ministry of Agriculture and
Irrigation, Government of India,
Keatinge Road, Shillong - 793001.
51. Mr. L. Rynjah, I.F.S. (Rtd),
C/o Pinemount School,
Shillong - 793001.
52. Mr. N.K. Dutta,
37, Lachumiere, Shillong - 793001.
53. Rev. B.M. Pugh,
Mawlai, Shillong - 8
54. Rev. Br. R.B. Vieyra,
Principal,
St. Edmund's College,
Shillong - 3.
55. Dr. D.N. Borthakur,
Director, I.C.A.R.,
Research Complex for N.E. Hills
Region, Shillong - 793001.
56. Dr. S.P. Ghosh,
Senior Horticulturist, I.C.A.R.,
Research Complex for N.E.
Hills Region, Shillong - 793004.
59. Dr. Arun Varma,
Animal Nutritionist, I.C.A.R.,
Shillong - 793004.
58. Dr. R.N. Rai,
Agronomist, I.C.A.R.,
Shillong - 793004.
59. Dr. J.N. Sachan,
Senior Entomologist, I.C.A.R.,
Shillong - 793004.
60. Mr. A. Singh,
Agricultural Engineer, I.C.A.R.,
Shillong - 793004.
61. Dr. G.B. Manna,
I.C.A.R., Shillong - 793004.

62. Dr. R.P. Awasthi,
Agronomist (Crop Production),
I.C.A.R., Shillong - 793004.
63. Dr. A.N. Varma,
I.C.A.R. Research Complex,
Shillong - 793004.
64. Mr. J.G. Varshney,
Junior Agronomist, I.C.A.R.,
Research Complex
Shillong - 793004.
65. Dr. S.K. Gangwar,
Junior Entomologist, I.C.A.R.,
Shillong - 793004.
66. Mr. B.S. Sharma,
Statistician, I.C.A.R.,
Research Complex,
Shillong - 793004.
67. Mr. B.B. Das,
Junior Entomologist, I.C.A.R.,
Research Complex,
Shillong - 793004.
68. Mr. M.D. Singh,
Junior Agricultural Engineer,
I.C.A.R., Research Complex,
Shillong - 793004.
69. Mr. H.S. Sabambi,
Senior Plant Pathologist,
I.C.A.R., Shillong - 4.
70. Mr. I.J.S. Jaswal,
Assistant Anthropologist,
Anthropological Survey of
India, Lachumiere,
Shillong - 793001.
71. Dr. R. Deka,
Assistant Anthropologist,
Anthropological Survey of India,
Lachumiere, Shillong - 1.
72. Mr. Sangjib K. Chakrabarty,
Anthropological Survey of
India, Shillong - 1.
73. Mr. K.D. Saha,
Anthropological Survey of
India, Shillong - 1.
74. Mr. B.C. Datta,
Research Associate,
Anthropological Survey of
India, Shillong - 1.
75. Mr. Ranjan Ray Choudhuri,
Anthropological Survey of
India, Shillong - 1.
76. Mr. S.H. Ahmad,
Anthropologist,
Anthropological Survey of
India, Shillong - 1.
77. Mr. M.M. Das,
Anthropological Survey of
India, Shillong - 1.
78. Dr. R.D. Pathak,
Anthropological Survey of
India, Shillong - 1.
79. Mr. D.C. Bhowmik,
Anthropological Survey of
India, Shillong - 1.
80. Mr. Pabitra Gupta,
Superintending Anthropologist,
Anthropological Survey of
India, Shillong - 1.
81. Mr. S.K. Mukherjee,
Anthropological Survey of
India, Shillong - 1.
82. Mr. A.R. Das,
Anthropological Survey of
India, Shillong - 1.
83. Mr. P.K. Guharay,
G.S.I. (Geological Survey of
India), Shillong - 3.
84. Mr. A.B. Goswami,
G.S.I., Shillong - 3.
85. Dr. S.C. Talukdar,
G.S.I., Shillong - 3.
86. Mr. M.K. Das,
G.S.I., Shillong - 3.
87. Mrs. Minati Dattaray,
B.T. Hostel, Shillong - 3.

88. Mr. N. K. Dhar,
A.I.R., Shillong - 1.
 89. Dr. B.P. Misra,
C/o Mr. P.K. Misra,
Planning Inspector, P.M.G's
Office, Shillong - 1.
 90. Prof. M. Kar,
St. Edmund's College,
Shillong - 3.
 91. Dr. B. Datta Ray,
St. Edmund's College,
Shillong - 3.
 92. Prof. S. Sen,
Shillong College,
Shillong - 3.
 93. Prof. B.B. Datta,
St. Anthony's College,
Shillong - 3.
 94. Prof. A. Begum,
St. Mary's College,
Shillong - 3.
 95. Prof. J. P. Singh,
St. Edmund's College,
Shillong - 3.
 96. Dr. K.S. Singh,
St. Edmund's College,
Shillong - 3.
 97. Prof. G.P. Bhakta,
St. Edmund's College,
Shillong - 3.
 98. Prof. D. Mukherjee,
Shillong College,
Shillong - 3.
 99. Prof. O. Lyngdoh,
St. Edmund's College,
Shillong - 3.
 100. Dr. M. Barman,
Lady Keane College,
Shillong - 1.
 101. Prof. R.K. Talukdar,
Sankardev College, Shillong - 3.
 102. Prof. (Miss) D. Dhar,
St. Mary's College,
Shillong - 3.
 103. Prof. (Miss) K. Devi,
St. Mary's College, Shillong - 3.
 104. Prof. D. Bhagawati,
St. Edmund's College,
Shillong - 3.
 105. Prof. B. Ahmed,
St. Edmund's College,
Shillong - 3.
 106. Prof. (Mrs) N.B. Pathak,
St. Mary's College, Shillong - 3.
 107. Prof. P.K. Datta,
St. Edmund's College,
Shillong - 3.
 108. Prof. D.K. Lahiri,
St. Edmund's College,
Shillong - 3.
 109. Prof. Bimal J. Dev,
St. Edmund's College,
Shillong - 3.
 110. Prof. R.P. Panigrahi,
Lady Keane Girls' College,
Shillong - 1.
- JAINTIA HILLS**
111. Prof. P. Passah,
Jowai Government College, Jowai.
- GARO HILLS**
112. Mr. P.R. Mawthoh,
Joint Director, Soil Conservation
Deptt., Meghalaya, Tura.

