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3. A Review Note on Shifting Cultivation in Meghalaya

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3.1 Chapter-I: Introduction:

The state of Meghalaya is situated in the north-eastern region of India. It is a land locked territory lying between the latitudes of $25^0$47' N and $26^0$10' N and longitudes of $89^0$45' E and $92^0$47' E. The state is made up of three hills namely, Khasi Hills, Jaintia Hills and Garo Hills. The altitude of the state varies between 100 to 1900 m from mean sea level. Meghalaya is bounded in the south and west by Bangladesh. The state of Assam surrounds the state in north and east. The Meghalaya plateau is highly dissected and has irregular terrain in the western and northern sides. With an area of 22,429 sq km, it is predominantly inhabited by tribal people who account for eighty nine percent of the total population. The state has 11 districts and thirty eight blocks.

Meghalaya is an agricultural state of our country where more than 85 per cent of the people live in village and depend on agriculture for their livelihood. Although agriculture occupies an important place in the economy of the state, only a little more than 8 per cent of the total geographical area is available for cultivation and only 13 per cent of the cultivated land produces more than one crop. The rainfall in the state is sufficient for agriculture but due to rugged topography and less productive soil it has been able to give satisfactory result, except in valleys and border areas which are a part of Brahmaputra valley.

Objective of Study:

- To study about the concept of shifting cultivation.
- To study about the impact of shifting cultivation on environment and economy.
- Efforts to overcome the problems and suggestions.

A. Cultivation Practices:

The ethnic communities of Meghalaya follow two major types of agricultural practices such as shifting cultivation or slash and burn agriculture, and terrace or bun cultivation. Shifting cultivation is practiced in and around forests, and terrace cropping is practiced in valleys and foothills, and inside plantation forests.

These traditional systems of cultivation practices are well adapted to the environmental conditions and the traditional knowledge of indigenous communities growing cereals and other agricultural crops have enabled them to maintain an ecological balance.

Enormous increases in human population have led to massive coverage of land under shifting cultivation. Besides shifting cultivation and bun agriculture, there are some other potential indigenous farming systems in northeast India developed by the tribal farmers using their ingenuity and skill.

These techniques and systems have a sustainable agriculture base and are practiced since centuries in some isolated pockets of Meghalaya and other northeastern states. These farming systems make use of locally available resources and there is need of an in-depth study to know the secrets of their success.

B. Terrace or Bun Cultivation:

Bun cultivation on hill slopes and valleys is a settled cultivation system being practiced for last three decades, to provide improved production system, to conserve soil moisture and also to prevent land degradation and soil erosion. In this system, bench terraces are constructed on hill slopes running across the slopes. The space between two buns is leveled using cut and hill method.

The vertical interval between the terraces is not usually more than one metre. Such measures help to prevent soil erosion and retaining maximum rainwater within the slopes and safely disposing off the excess runoff from the slopes to the foothills.

C. Shifting Cultivation:

Shifting cultivation or slash and burn agriculture is the most prevalent form of agricultural practice of the ethnic people and is commonly called Jhum or Swidden cultivation, which is one of the most ancient systems of farming believed to have originated in the Neolithic period around 7000 BC.

This system is a primitive cultivation technique and is transition between food gathering and hunting to food production. The system of farming is still in vogue in Meghalaya as well as whole northeast Himalayan region. About 350,000 people practice shifting cultivation on about 4,160 km² of un-surveyed land.

Shifting cultivation is a very wide term covering a number of very different forms of land use, it's essential feature beings that the land is cleared and agricultural crops are grown for a limited period, which may range from one to over ten years, after which the cultivation is moved to a new site. The cultivators may or may not intend to return to the old site after the fertility of the soil has recovered.

Shifting cultivation, though a rudimentary technique of land and forest resource utilization, represents an intricate relationship between ecology, economy and society (Kerkhoff & Sharma, 2006).

Shifting cultivation is identified as a way of life for the societies practicing it. In fact, it is found that the jhum fields surrounded by forests and nature offer two alternative sources of livelihoods to the population practicing shifting cultivation.

In case, the jhum crops are not good or fail due to external vulnerabilities like fire and landslides, the surrounding forest resources support the shifting cultivators by augmenting their food supplies.

Moreover, these shifting cultivators, who practice piggery and keep swine, use vegetable wastes and inferior grains from the shifting cultivation fields as their feed.

Shifting cultivation implies the systems involving a few years of cultivation alternating with several years of fallow to regenerate soil fertility.

This primitive form of agriculture is known by different nomenclatures in different parts of the globe. Among the Khasis, this system is known as *Thang shyrti* or Thang bun and among the Garos, this system is known as Jhum *Kheti* or *aba-oa*.

Shifting cultivation is widely practiced food production system in Meghalaya over 407.32 sq km involving more than 2, 64, 960 number of families residing in 3, 610 villages.

Shifting cultivation is the oldest form of agriculture and is as old as the agriculture itself. The prehistoric shifting cultivation used fire, stone, axes and hoes, while in the present day shifting cultivation, stone tools have been replaced by iron digging sticks, iron tools, dao, hoe and knives etc.

The system in brief consists of the set of operations. The first and foremost operation is the clearance of the vegetative cover of the piece of land and drying of the slash thereafter at the spot and later set on fire.

The ash so collected is then spread over the entire patch before the onset of rains and that works as manure in the jhumland. Having prepared the land in this manner, seeds are dibbed in the soil with the help of pointed bamboo sticks or other primitive implements.

The crops in the jhumland are raised for one to three years and later that soil is abandoned to recoup naturally.

Cultivation is then shifted to another plot and the "*jhumias*" returns to the original plot after the completion of the cycle during which all the favourable plots are cultivated from one year to three years.

Thus under jhumming, the cultivation moves in a cycles, around the settlement which forms a permanent nucleus.

Steps Involved in Shifting Cultivation:

Figure 3.1: Selection of Sites on Hilly Slopes

Figure 3.4: Burning of Jungle

Figure 3.2: Jungle Cutting in Dec/Jan

Figure 3.5: Jungle Cutting in Dec/Jan

Figure 3.3: Creation of Fire Line

Figure 3.6: Sowing of Various Crops

3.2 Chapter-II: Magnitude of the Problem:

Shifting cultivation has been trapped in a low-level and unstable equilibrium owing to two equally unviable paradigms that operate at the policy and institutional levels. The dominant perspective is that shifting cultivation is a wasteful and ecologically dysfunctional system, detrimental to forests and soil, and hence needs to be eradicated by inducing cultivators to adopt other forms of livelihood.

When such efforts meet with failure, the other paradigm comes into play, according to which shifting cultivation is a legitimate practice that ensures the survival of people living on marginal lands and hence should be allowed to carry on as it is without external influence. As a result, shifting cultivators fall through the crack between marginalization and traditionalism. Almost the entire state has been or is being influenced under shifting cultivation, except for some pockets of valley bottomlands, and reserve forests. Shifting cultivation destroys the protective and productive vegetation in preference to a very brief period of immediate crop production and this result in soil loss and other consequential damages.

It has been reported that soil erosion from the hill slopes of 60-70% is as follows:

1st year of Jhum - 146.6 tonnes/ha/yr

2nd year of Jhum - 170.2 tonnes/ha/yr

Abandoned Jhum - 30.2 tonnes/ha/yr

(1st year)

Bamboo forest - 8.2 tonnes/ha/yr

Thus from the erosion point of view, the second of year of Jhumming cycle is more hazardous than the first year.

No reliable and adequate information is available on the coverage of jhum cultivation in statistical publications of the Directorates of Economics and Statistics. The last and the so far latest available estimates are based on the study conducted by the Task Force on shifting cultivation by the state Government to study the problems shifting cultivation:

Sr. No	Name of the District	Annual Area under Jhum in km^2
1	East Khasi Hills	4.90
2	West Khasi Hills	44.60
3	Ri-Bhoi	47.86

Sr. No	Name of the District	Annual Area under Jhum in km^2
4.	Jaintia Hills	10.25
5.	East Garo Hills	92.61
6	West Garo Hills	144.69
7	South Garo Hills	62.41
Total		407.32

Shifting cultivation has continued for thousands of years and stood the test of time. This practice has an in-built mechanism of sustenance and conservation. However, due to anthropogenic pressure on land use for shifting cultivation adversely affecting eco-restoration and ecological process of forests. This leads to degradation of land causing soil erosion and finally converting forests into wastelands. The shifting cultivation practice has socio-economic relevance for production of agricultural crops in Meghalaya. There is no other alternative means of livelihood for the ethnic peoples of the area because of their poor economic condition and this compels them to still practice this system and they are bound to reduce *Jhum* cycle for their need. The people who follow the *Jhum* cultivation are called *Jhummias*, the district wise Jhummia families of Meghalaya are listed in the following Table3.2.

Table 3.2: (Year - 2001) District-Wise Jhummia Families of Meghalaya

Name of District	Total Population (Rural)	Jhummia Families Dependent on jhum	Jhummia Population Dependent on jhum	Percentage of the Jhummia Population from the total Rural Population	Annual Area under Jhum in Sq. Km.	Percentage of Annual Jhum Area from the total Geographical Area
East Khasi Hills	383027	721	3605	0.94	6.20	0.23
Ri-Bhoi	179630	4351	21755	12.11	27.40	1.53
West Khasi Hills	260595	5374	26870	10.31	46.19	0.88
Jaintia Hills	270669	1366	6830	2.52	11.74	0.31
East Garo Hills	211652	13630	68150	32.20	117.15	4.50
West Garo Hills	457422	18086	90430	19.77	155.45	4.19

Name of District	Total Population (Rural)	Jhummia Families Dependent on jhum	Jhummia Population Dependent on jhum	Percentage of the Jhummia Population from the total Rural Population	Annual Area under Jhum in Sq. Km.	Percentage of Annual Jhum Area from the total Geographical Area
South Garo Hills	90462	7900	39500	43.66	67.87	3.67
Total	**1853457**	**51428**	**257140**	**13.87**	**442.00**	**1.97**

3.2.1 Jhum Cycle:

The period before a family returns to the same plot for cultivation or the interval between one phases of cultivation to another phase of cultivation on the same plot of land is called jhum cycle. The cycle normally depends upon the availability of land with particular community and population in village. The practice of shifting cultivation is short and has a variable fallow period. After a piece of land is selected, trees or bushes are cut down partially or fully, left to dry and then burnt in situ. In the cleared land, seeds of crops are dibbled into holes or broadcast, without using ploughs or animal power. When the crop yield begins to decrease after some years, the cultivator moves to a new patch of forest to repeat the process, and allows the abandoned land to recuperate. After a period varying from 2-20 yrs., they return to the same land for cultivation. The cultivation cycle in shifting cultivation is very important and varies considerably. The longer cycle is better for restoring soil fertility and it also stops soil erosion. At present Jhum cycle has reduced to 4-6 yrs., inadequate to provide recuperation to the site and repair the ecological damage. Shifting cultivation on short cycles decreases soil productivity due to excessive loss of soil nutrients and imbalance in the socio-economic set up of the village communities. Earlier, a cycle of fifty years or more was adequate to maintain ecological balance. Initially, the duration of cycle was as long as 30 to 40 years mainly due to better fertility of the soil and limited population dependent on jhumming. At present the duration of the jhum cycle in Meghalaya varies from 3 to 5 years, this may be due to overwhelming pressure on land. Shifting cultivation is mostly practiced in community forests of Meghalaya. In the state, the village council commonly called Dorbar Shnong owns the land, and allots the forestland for cultivation. The main interest of the cultivators is to produce almost everything that they need to fulfill their requirement.

- **Crops of Shifting Cultivation:**

So far as the cropping pattern goes, the shifting cultivators in the State have been found to have adopted mixed cropping with respect to growing different crops, but it varies from tribe to tribe. In mixed cropping, soil exhausting crops like rice, maize, millets and cotton are grown along with the soil enriching crops like legumes. Since the soil exhausting crops and soil enriching crops have different harvest periods, these crops supply food to the tribal communities almost throughout the year.

Even when the fields are abandoned for the next cycle, intermittently, they provide residual crops to the farmers, thereby taking care of the nutritional aspect of the tribal communities. The shifting cultivators across the State are mostly found to grow food grains and vegetables, and on rare occasions, some cash crops are also grown. Among food grains, the coarse varieties of rice, maize, job tears and small millets are the principal crops grown. Ginger, turmeric, cabbage, linseed, rapeseeds, sesame, oranges, pineapple and jute are the important cash crops grown in the shifting cultivation fields. Among vegetables, soya-bean, potato, pumpkins, cucumbers, yams, tapioca, chilies, beans, onion and arum are mostly cultivated.

The choice of crops among the shifting cultivators is mostly consumption oriented. Meghalaya produces a variety of agricultural crops such as food grains, commercial crops, horticultural crops, etc. Of the total agricultural land in Meghalaya, 62% is used for food grains, 25% for cash crops, 9% for horticultural crops and the rest 4% is used for raising miscellaneous crops.

Rice (*Oryza sativa* Linn.), the most important food crop occupies about 44 % of the total agricultural land. About 40 % of rice is cultivated from the *Jhum* fields. Sung valley of the *Jaintia Hills* is considered as the fertile paddy fields of Meghalaya. Meghalaya produces three cropping seasons for rice, autumn rice, winter rice, and spring rice. Winter cropping covers 67 % of the total production. Maize (*Zea mays* Linn.) is the next important agricultural food crop of Meghalaya.

It is grown in about 8 % of the cropped area and cultivated mainly in the plains of *Garo* hills, Mairang (West *Khasi* hills), Mawphlang (West *Khasi* hills) and Laskein block of *Jaintia* hills. Wheat (*Triticum aestivum* Linn.) is confined in some pockets of the lower elevation of *Garo* hills of Meghalaya. Pulses (gram, tur and few others) are less important in the agricultural economy of the state. Pulses occupy 1.3 % of the cropped area and are confined only in some pockets of remote areas of the Garo hills.

Potato (*Solanum tuberosum* Linn.), the most important commercial agricultural crop, covers about 7 % of the total agricultural area of the state. It was introduced in *Khasi* hills by David Scott in the early part of the 19th century and grown mainly in the terrace fields of the high altitudes of *Khasi* hills. Oil seeds are grown mostly in the plain areas of the *Jhum* fields of *Garo* hills. Among the oil seeds, mustard (*Brassica nigra* Koch), rape (*Brassica campestris* Hook. f.), castor (*Ricinus communis* Linn.), sesamum (*Sesamum indicum* Linn.) and soyabean (*Glycine max* Merrill) are grown. Fibre crops, cotton (*Gossypium* sp.) and jute (*Hibiscus cannabinus* Linn.) are grown in the *Garo* hills. Ginger (*Zingiber officinale* Rosc.) is mainly grown in *Jaintia* hills and some pockets of *Khasi* hills. Sugarcane (*Saccharum officinarum* Linn.) is confined only in plain areas of the state and grown in *Jhum* fields.

The soils and climatic conditions are suitable for the production of horticultural crops. Pineapple (*Ananas comosus* Merrill), litchi (*Litchi chinensis* Sonn.), guava (*Psidium guajava* Linn.), mango (*Mangifera indica* Linn.), banana (*Musa paradisiaca* Linn.) and jackfruit (*Artocarpus heterophyllus* Lam) are grown at low altitudes, and orange (*Citrus reticulata* Blanco), plums (*Prunus domestica* Linn.), peaches (*Prunus persica* Batsch) and pears (*Pyrus communis* Linn.) are the major horticultural crops of high altitude.

Tapioca (*Manihot esculenta* Crants) is one of the subsidiary food crops and is grown in western part of Khasi hills. Turmeric (*Curcuma domestica* Valeton) is famous for its quality and has a great demand. It is widely grown in the *Jhum* and Terrace field of *Jaintia* hills.

Rice (*Oryza sativa* Linn.) and maize (*Zea mays* Linn.) are the major food crops. Important fruits grown are orange (*Citrus reticulata* Blanco), pineapple (*Ananas comosus* Merrill), lemon (*Citrus Limon* Burm. f.), guava (*Psidium guajava* Linn.), jack fruit (*Artocarpus heterophyllus* Lam.) and bananas (*Musa* sp.). Potato (*Solanum tuberosum* Linn.*)*, jute (*Hibiscus cannabinus* Linn.), cotton (*Gossypium* sp.), arecanut (*Areca catechu* Linn.), ginger (*Zingiber officinale* Rosc.), turmeric (*Curcuma domestica* Valeton), betel leaf (*Piper betle* Linn.) and black pepper (*Piper nigrum* Linn.) are the chief commercial crops.

3.2.2 Causes of Jhuming:

Shifting cultivation is recognized as a catalytic force for community life across the State. The social organization of the tribes living in the hills is mostly built around community ownership, participation and responsibility. Shifting cultivation is deep rooted in the way of life of the tribal of the region and it forces one to investigate the social and economic compulsions involved in continuance of this system. The system came to be pursued in a natural environment which is inhospitable and rather hostile in many instances and inhabited by simple and backward communities. Land given shifting cultivation is by and large confined to rainy low land areas, dense rain forests, hills and other infertile tracts. The physical environment in such areas favours quick and luxuriant growth of vegetation. Thus, hardly any pocket of land devoid of dense vegetative cover is available for cultivation. The hill sides contrary to the plain tracts are thinly covered by forest and can be easily cleared. Cleared trees and bushes after being burnt with fire got converted into ash are obviously rich in organic matter and can support some crops for 1 to 3 years without being regularly manured.

Therefore, such regions inhabited by primitive tribes that lack innovative devices and orthodox outlook towards live, have to be infested with this type of agricultural system. The specific reasons, other than the one explained above, responsible for the system, may be summed ups as follows:

- History stands as witness that in many parts of the world, the original inhabitants i.e. aboriginals are inhabited in an inaccessible forest and mountainous areas. Being ignorant, these people who are already the victims of poverty and socio-economic backwardness are obviously reluctant to shun traditions and learn better methods.
- Many tribal communities have socio-cultural ties with the land and because of these socio-religious bonds, they dare not to disturb or break the prevalent system.
- In these sub-mountainous, ravine infested, and rainforest areas, there has been an utter lack of alternative means of employment. On the other hand a fairly high capital investment is needed for cattle, implements, manure and reclamation/ terracing of land etc. The agricultural economy being in the traditional stage cannot turnout capital required for having and maintaining settled cultivation. Thus, the tribals are compelled by the vicious circle that originates from their inhospitable surroundings and ignorance, to pursue shifting cultivation.

3.3 Chapter-III: Impact on Environment:

Various scholars have described the several merits in the system that wisely regulated jhumming could be carried on indefinably without causing deterioration to the soil and land erosion. The relevance of jhum, however, has to be seen with reference to time frame and larger developmental perspective. In good old days, when jhum cycle was 30 years or more, it used to allow vegetation and help preservation of forests and soil erosion etc. But, when the jhum cycle has just reduced to two years with least production levels, there should be no doubt for calling jhum cultivation as one the greatest obstacles in the development of agriculture in the state. The evil effects of jhumming can be briefly summarized as follows:

a. The shifting cultivation has led to destruction of forests in Meghalaya.

Sr. No	Name of the District	Annual area affected by jhum (Km^2)
1	East Khasi Hills	24.50
2	West Khasi Hills	223.50
3	Ri-Bhoi	239.30
4.	Jaintia Hills	51.25
5.	East Garo Hills	463.05
6	West Garo Hills	723.45
7	South Garo Hills	312.05
Total		2036.60 Km^2

b. Further, the destruction of forests as a result of shifting cultivation coupled with high rainfall in the region, has led to heavy soil erosion and siltation in major rivers of the region which in turn have been responsible for floods in the lower reaches of the main river systems

c. Loss of soil from jhum plot is much more in some of the areas where clean cultivation is practiced involving de-weeding of slopes two to three times in a season, contributes about 22% of the total soil loss in a year.

d. Although vegetation grows quickly after the jhum plot is abandoned, the successive growth deteriorates from large tress to shrubs and bamboos, and ultimately to coarse grass, resulting finally to the exposure of inert material in the form of rocks and gravel on the slopes, thus making such areas unfit for cultivation.

e. Besides, loss of top soil, loss of inherent fertility due to burning of weed cover contributes to decline in production because burning has been found to cause substantial reduction in organic matter content.

f. Removal of forest and resultant soil erosion drastically reduce the water balance of the sub soil and underground water balance of the sub-soil and underground water. Consequently, the springs and the wells located at the foot-hills go dry. In areas where the streams are not snow fed, the drying up of springs in summer acute shortage of even drinking water. The case of Cherrapunjee is a classic case of this kind.

One of the most important negative environmental impacts of shifting cultivation is the damage that it causes to the soil system. It accelerates the soil erosion manifolds. Besides causing air pollution due to burning, shifting cultivation is responsible for loss of soil nutrients and useful fauna and microbes. Burning of slash lowers soil acidity, organic matter and total nitrogen but enhances phosphorous. Most shifting cultivation practices are subsistence level farming system having very low output/ input. The clearing of forest areas at regular and frequent intervals for shifting cultivation results in the loss of primary forests and formation secondary forests. This causes to substantial loss to trees diversity and associated vegetation. Due to shortening of jhum cycle, quite often, the secondary forests do not get adequate time to regenerate. The repeated use of land with short jhum cycle finally converts the jhum fallows into degraded wastelands. Therefore shifting cultivation is considered to be the single most important factor causing deforestation.

3.4 Chapter-IV: Controlling Shifting Cultivation: The Initiatives and Strategies:

Clandestinely, shifting cultivation is being practiced on the Revenue, Reserve Forests and protected forests. Although shifting cultivation is a non-viable resource-utilization practice, tribals are still clinging to this primitive practice to sustain themselves and their families mainly due to non-availability of timely employment avenues. The major initiative was started only in 1975 when the Indian Council of Agricultural Research (ICAR) established an Agricultural Research Complex for NE hills region at Shillong with the subsequent set up of its centre in the states of NER as well as its major objectives to study the shifting cultivation system in details and suggest various alternatives to replace the age-old practice. Some of the schemes of jhum control programmes are:

- Soil conservation and land reclamation for permanent agriculture in hills
- Setting jhummias on wet terraced land or valley (WTRC)
- Allotment of dry/wet terraced land along with some sloppy land for growing horticulture crops
- Engaging cultivators as wage earners in the cash crop plantations and setting them on forest land on small pockets with some provision of basic amenities like schools, sale depots etc. and watershed management schemes with integrated programmes of agriculture, forestry and animal husbandry.
- Providing variety of post rehabilitation incentives as assistance for purchasing power tiller and so on.

Various attempts have been made by the Government to settle the tribal people involved in shifting cultivation. Arable land is provided to the tribal for carrying out agriculture and also to settle in the area; a few schemes are being implemented under integrated tribal development programme in some parts of Meghalaya. These schemes have however, not yielded the desired results perhaps because of the ignorance of the authorities about the socio-economic and agro-ecological conditions of shifting cultivation and also due to minimal involvement of Forest Department officials, who are more informed about the above factors, in implementation of the scheme. Failure of the scheme led the National Commission of Agriculture to reformulate the schemes only after considering the impact of the forest management.

3.4.1 The Strategies:

a. Providing employment opportunities and income generation on a regular basis through proper utilization of the land resources, i.e. by equitable distribution of waste land among the tribals. But, the various schemes of the Government, under the tribal plan, will have to pump in sufficient resources for proper reclamation and development of the wasteland through agro-forestry and silvi-pasture practices.

b. By encouraging cooperative efforts for carrying out forest-based activities, i.e. basket making, rope making, cane furniture processing of minor forest produce, honey collection, etc. have to be made commercially viable by providing proper marketing facilities. This will not only discourage tribals from practicing shifting cultivation but will also help them monetarily.

c. By forming Village Forest Committees for the protection and development of the degraded forests. These committees by providing suitable incentives to the tribals, after the time of harvest can divert some of the tribals away from the shifting cultivation. Generating employment opportunities during the lean season of forestry operations will also prevent tribals from shifting to other areas. Employing the tribals in the various rural employment schemes is also the need of the hour.

d. By ensuring implementation of total literacy campaign, which due to remoteness and un-supportive attitude of the tribal people, has not been successful. For educating tribal women and children, services of various non-Governmental organizations and voluntary agencies, besides the regular Government machinery, are on required sustainable basis rather than with a targeted approach.

3.5 Chapter-V: Conclusion:

Shifting cultivation practices are linked with the ecological, socio-economic, and cultural life of the people and are closely connected to their rituals and festivals. Shifting cultivation in Meghalaya is not only the way to earn livelihood of rural tribes but also it contributes to the state domestic product substantially. But due its evil effects on environment and ecological balance in the region, the time comes to think about the alternative of this traditional system. Thus, to control jhumming completely, it will require huge investment and many years. Under this situation, short term measures should be undertaken to improve productivity and also to check soil erosion. ICAR has already suggested in this line. Considering the physiographic characters of land, climate conditions, social customs, food habits etc. alternative system of farming like diversified farming should be introduced. This would require a system which includes agriculture, horticulture along with animal husbandry, fishery and poultry farming etc. success of this alternative farming depends upon the gaining of confidence of jhummias over this alternative system through persuasion, demonstration and applied fundamental research to be conducted very slowly without any haste.

The problem of shifting cultivation needs a holistic approach for its solution and for such approach adequate data base in the form of time series is necessary.

The jhum cultivation has been subject to review and the governments both at the center and state have tried various schemes to wean away jhummias in the last 30 years, mainly through the introduction of schemes on soil conservation, afforestation, water management projects, land development and terracing projects to assist jhummias for alternate settled cultivation, introduction of plantation crops such as rubber, coffee, tea, black pepper, cashew nut etc. These have met with potential success. However, no schemes can really be effective unless food security is assured and the question of alternate livelihood is incorporated with full involvement of the people.

- Less success towards shifting the jhummias for cultivation due to:
- New settlement cut into their socio-cultural life abruptly.
- Farmers are not used to cultivation on terrace/ using bullocks/implements.
- Low production on newly built terraces during first years.
- Lack of viable production technology for terrace cultivation; and
- Lack of dedicated workers to serve rural areas.
- Lack of coordination.
- Testing of schemes as pilot projects is necessary before its large scale implementation.
- Popularization of high value cash crops.

Considering the high cost, labour and energy input involved in terrace cultivation, and in absence of other viable alternatives to shifting cultivation, the majority of the population of Meghalaya depend on shifting cultivation for their subsistence livelihood. Due to limited arable land and increasing population growth, the farming on ecological fragile and marginal mountain slopes will continue. If shifting cultivation is allowed to continue, land degradation and the resources are bound to worsen with time. Considering the adverse impacts of the shifting cultivation such as loss of precious top soil, nutrients and forest biodiversity, destabilization of slopes and its low productivity, sustainable farming alternatives need to be developed and implemented.

3.5.1 Suggestions and Remedial Measures:

Traditional land practices exacerbated by poverty and associated with a lack of technical knowledge is the main cause for the continuation of unsustainable shifting cultivation. Population pressure, inadequate land for cultivation, low education levels, policy planning and implementation without local participation are all factors that influence farmers' decision to continue shifting cultivation. Considering the evil and deleterious effects of shifting cultivation, it is quite important to adopt a broad based strategy for changing the status of such cultivation in the mind of the tribal people as well as to motivate this tribal people from their nomadic agricultural practices into a settle and permanent agricultural practice. The following measures are to be helpful to control shifting cultivation in the region:

- In controlling of shifting cultivation, a successful way is to settle the jhum on an irrigated terrace by channelling water from mountain streams. This type of cultivation is known as terrace cultivation which is very much popular in Khasi, Jaintia hills of Meghalaya. Thus, adequate steps must be taken to introduce irrigated terrace cultivation in the other parts of the region.

- Solution to the problem of shifting cultivation requires the settlement of tribal families on permanently settled agriculture. This will require development of land for regular cultivation which again requires a huge investment and many years. Considering the physiographic characters of land, climatic conditions, social conditions, food habits etc., alternative system of farming like diversified farming should be introduced. This would require a system which includes agriculture, horticulture along with animal husbandry, fishery, poultry farming etc.
- The State as well as Union Governments and promotional agencies should come forward with forefront initiative to take up intensive and extensive cultivation of plantation crops (tea, coffee, rubber, pineapple etc.) and for the development of non-forest wasteland in the region. Recently, in Assam the Government has decided that a large area of the non-forest wasteland would be brought under 'rubber block planting' scheme where more than 65% of the total investment would be contributed by Rubber Board of India and the rest would be financed by the state government. This type of scheme should be implemented for other plantation crops in the all states in the region so that it increases the employment opportunity in the hill region.
- To reduce the population pressure on cultivable land in hill areas, Government should make adequate legal provisions to keep in check the flood of infiltration from other parts of India and the neighbouring countries. So that the benefit of controlling measures of shifting cultivation and employment opportunity will be enjoyed by the local people. Besides, the degraded jhum land should be developed into Special Agricultural Zones (SAZ).
- Under the present context, the concept of 'Sustainable Agricultural Development' can be an effective strategy for ensuring adequate supply of food, Fibre, fuel and other amenities to the growing tribal population in the region. This strategy will pave the way for improving the living standard of the tribal people and also create a sense of security in their life as well.

  This concept of sustainable development of agriculture will also give due recognition to the geophysical and environmental factors of the region for developing a sound agricultural pattern for the people of this hilly region. Scientific studies suggest that mixed land use system is quite suitable for hilly areas from the point of view of production as well as conservation.

  In this context, the latest and most effective land and water management techniques, popularly known as 'Watershed Management programme' along with land development, soil conservation, agriculture, horticulture, plantation crop, forestry, animal husbandry and fishery can safely be considered as most vital and important strategy.

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