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## **Shifting Cultivation in North-East India: Growth and Progress**

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### **Abstract**

*The agricultural production systems in the hilly areas differ from the plough cultivation in the plain areas. The term shifting cultivation refers to a certain method of farming. In this particular method, land is widely used to cultivate crops for a few years, then allowed to lie fallow for several years after which it is reused again. Shifting cultivation is said to be one of the unsustainable land uses contributing significantly to environmental degradation. Across South and Southeast Asia, a large number of people depend fully or partly on shifting cultivation for their livelihood and food security. In the Himalayan region of the north east, the agricultural practice of shifting cultivation also known as jhum cultivation or rotational agro-forestry, prevalent since prehistoric times, is being carried out by traditional tribal societies even today. The objective of this paper is to study the growth and progress of shifting cultivations in North-Eastern India.*

**Keywords:** *Cultivation, Jhumias, Livelihood, Shifting Cultivation, Tribal People.*

### **Introduction**

The word *Jhummay* be the most misunderstood term among the environmentalists, scientists and others concerned with natural resource management (Kalita & Bhowmick, 2011). The term shifting cultivation refers to a certain method of farming. In this particular method, land is widely used to cultivate crops for a few years, then allowed to lie fallow for several years after which it is reused again. The practice is characterised by a cultivation phase, which involves clearing of primary or secondary forest and crop cultivation for one to three years, followed by a fallow phase, during which cultivation is suspended to allow recovery of soil fertility (Karthik et al., 2009).

Shifting cultivation is said to be one of the unsustainable land uses contributing significantly to environmental degradation. Clearing forests for shifting cultivation can contribute to climate change, biodiversity loss, reduced timber supply, flooding, siltation, soil degradation and change of forest vegetation from primary to secondary and eventually to grassland. Slashing and subsequent burning are preconditions for Jhum cultivation. Slashing of vegetation for cultivation is done during January-February. Shifting cultivators may possess a highly developed knowledge and understanding of their local environments and of the crops and native plant species they exploit. Shifting cultivation is a land-use practice that reflects indigenous knowledge accumulated through centuries of trial and error, an intricate balance between product harvest and ecological resilience, and an impressive degree of agro-diversity.

### **Shifting Cultivation in India**

In India, shifting cultivation is still practised in the hill areas of North-Eastern Region, Sikkim, Bihar, Orissa, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, Kerala, Karnataka and Maharashtra. But among all these states, such practices are still prevalent in the hill areas of North-Eastern states, Orissa and Andhra Pradesh. The people of eastern and north-eastern region practice shifting cultivation on hill slopes. Shifting cultivation is an age-old practice, particularly being practised in the Eastern Ghats. Orissa accounts for the largest area under shifting cultivation in India. Shifting cultivation is locally known as the podu cultivation.

Crocklin (1961) described shifting cultivation as use of human labour, use of stick or hoe, short periods of soil occupancy alternating with long fallow periods. It served as the economic mainstay. The tribals were totally dependent on it for survival. It is widely practised in the northeastern states of India. In India about 10 million hectares of tribal land stretched across 16 states is under shifting cultivation. Based on satellite image, Forest Survey of India estimate 1.73 million hectares of land is affected by shifting cultivation.

**Table1:** Shifting Cultivation in Different States of India

Sl. No.	State	Tribal Families (Million)	Total Area (Million hectare)
1.	Andhra Pradesh	0.11	0.15
2.	Arunachal Pradesh	0.43	0.21
3.	Assam	0.31	0.31
4.	Bihar	0.23	0.19
5.	Madhya Pradesh	0.19	0.38
6.	Manipur	0.36	0.26
7.	Meghalaya	0.61	0.47
8.	Mizoram	0.40	0.19
9.	Nagaland	0.19	0.12
10.	Orissa	2.00	1.60
11.	Tripura	0.19	0.49
<b>Total</b>		<b>5.02</b>	<b>4.37</b>

**Source :** ICAR.

In the Himalayan region of the north east, the agricultural practice of shifting cultivation also known as jhum cultivation or rotational agro-forestry, prevalent since prehistoric times, is being carried out by traditional tribal societies even today (India Today, 2006). It is being practised 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 mountain eco-systems of these regions with shifting cultivation practice have to be made ecologically sustainable.

Formulating an eco-development plan for the region for environmental sustainability, could consider completely replacing agricultural practice with farm forestry. Agricultural practices are at the cost of loss of biodiversity resources; estimates indicate that one unit of energy in agronomic production costs loss of greater energy from the forests (Ranjan & Upadhyay, 1999). Shifting cultivation is practiced in some form or other in almost all the tribal areas of Orissa. A number of tribes inhabiting different areas of the state are practicing shifting cultivation. These tribes are Bondo, Didayi, Koya, Gadaba, Paroja, Soura, KutiaKondha, dongariaKondha, Kandha, Parenga, Jatapur, Juang, Paudi Bhuyan, ErengaKolha, etc. The problem of shifting cultivation is perhaps most acute in Orissa than any other State in the country. Although at present an accurate data on the areas under shifting cultivation is not available, yet some rough estimates have been made (Dash, 2006).

### **Shifting Cultivation in North-East India**

Jhum cultivation is a local name for slash and burn agriculture practiced by the tribal groups in the northeastern states of India like Arunachal Pradesh, Meghalaya, Mizoram and Nagaland and also in the districts of Bangladesh like Khagrachari and Sylhet. This system involves clearing a piece of land by setting fire or clear felling and using the area for growing crops of agricultural importance such as upland rice, vegetables or fruits.

Shifting cultivation is the oldest system of cultivation of crops and the first step in transition from food gatherer to food producer. In India the total area under jhum cultivation is 0.94 m ha whereas North East India itself accounts for 80% of the jhum area (0.76 m ha). It affects the forest cover adversely by clearing of the hill slope through slash and burning of vegetation. In the north eastern region, the Jhum cycle is reduced to 2-5 years from 20-30 years, a jhum cycle of 15-20 years is sustainable.

**Table 2:** Cultivated Land in Northeastern States of India

(in lakh hectares)

State	Reporting Area	Net Area Sown	Area Available for-Jhuming
Arunachal Pradesh	57.93	0.70	2.48
Assam	78.81	21.98	4.98
Manipur	22.11	0.79	1.00
Meghalaya	27.79	1.58	4.16
Mizoram	16.54	0.61	6.04
Nagaland	13.51	0.47	6.08
Tripura	10.66	2.36	2.21
<b>Total</b>	<b>227.35</b>	<b>29.49</b>	<b>26.95</b>

**Source :** Economic Survey of India.

The cycle of agricultural operation in all these areas of North-East Region is marked by the following stages: (1) Selecting the forested hilly track; (2) Cleansing the forest tract by cutting down the jungle during December–January; (3) Drying and burning of fallen shrubs/trees into ashes during February–March; (4) Fencing the cleared plots; (5) Worship and sacrifice; (6) Dibbling and sowing of seeds for mixed cropping; (7) Weeding operation; (8) Watching and protecting the crops against depredation by wild animals, pests, etc.; (9) Harvesting; and (10) Threshing and storing.

**Table 3:** Shifting Cultivation in the North-Eastern Region of India

State	Annual Area under shifting cultivation (Sq. Kms.)	Fallow period (in years)	Minimum Area under shifting cultivation one time or other (Sq. Kms.)	No. of families practicing shifting cultivation
Arunachal Pradesh	700	3-10	2100	54000
Assam	696	2-10	1392	58000
Manipur	900	4-7	3600	70000
Meghalaya	530	5-7	2650	52290
Mizoram	630	3-4	1890	50000
Nagaland	190	5-8	1913	116046
Tripura	223	5-9	1115	43000
<b>Total</b>	<b>3869(1.5 Per cent)</b>		<b>14660(5.7 Per cent)</b>	<b>443336</b>

**Source:** RTFSC (1983); Basic Statistics of NER, 2002; Government of India.

As per an old ICAR review the total estimated area under shifting cultivation was 5.42 lakh hectares and about 26.441 lakh tribal populations were engaged in it. Report of the Dhebar Commission revealed that nearly 5.41 lakh hectares of area are covered per year by the shifting cultivation and about 25.89 lakh tribal populations are depending on it. Again as per the estimates of Vidyarthi, about 2.6 million tribal people are engaged in shifting cultivation covering nearly 1.35 million acres of land scattered in different parts of India.

In north-eastern region, the estimates framed by the state departments of the region in 1974 reveals that shifting cultivation is prevalent in nearly 2.4 per cent of the total area of the entire NE Region at a point of time. About 2.7 million hectares of area i.e., about 14.19 per cent of the area of the entire NE Region is at present available for

shifting cultivation and out of which only 16.8 per cent (i.e., about 4.3 lakh hectares) of the area is cultivated at one point of time leaving the rest area for natural regeneration of fertility. Further, about 4.25 lakh tribal families of the entire NE Region are found engaged in shifting cultivation and total area cultivated per tribal family in the region is 1.07 hectares. As per a recent estimate it is found that total area under shifting cultivation in a year in all north-eastern states is nearly 4.16 lakh hectares in comparison to that of 9.89 lakh hectares of area in whole India.

**Table 4:** North-East India: Jhum Cycle, Period of Occupancy and Duration of Fallowing

Tribe/State	Average Annual Rainfall (in cms)	Duration of Cropping	Fallowing Period
Ao/Nagaland	150 cm	One year	5-8 years
Garo/Meghalaya	125 cm	One year	5-10 years
Hmars/Manipur	130 cm	One year	5-10 years
Idu-Mismi/Arunachal Pradesh	250 cm	Two years	5-10 years
Jaintia/Meghalaya	250 cm	One year	4-8 years
Khasi/Meghalaya	300 cm	One year	4-6 years
Konyak/Nagaland	140 cm	One year	5-10 years
Lakher/Mizoram	125 cm	One year	6-12 years
Lotha/Nagaland	145 cm	Two years	10-15 years
Lushai/Mizoram	185 cm	Two years	8-15 years
Mikir/Assam	150 cm	One year	5-7 years
Pawi/Mizoram	210 cm	One year	8-10 years
Rengma/Nagaland	150 cm	Two years	7-15 years
Sema/Nagaland	155 cm	Two years	6-10 years
Sherdukpen/Arunachal Pradesh	125 cm	Two years	6-10 years

**Source :** Economic Survey of India.

The superiority of jhum cultivation over some forms of sedentary cultivation partly explains the persistence of this form of agriculture in North East India. Other reasons include the economic security provided by jhum and its cultural importance to indigenous tribes. Poor access to markets, capital, and technical knowhow of more



commercially rewarding alternatives such as horticulture and cash crop cultivation also hinders the transition to other occupation. In the northeastern region of India, comprising the states of Assam, Manipur, Meghalaya, Nagaland, Tripura, Arunachal Pradesh and Mizoram, shifting cultivation is largely practiced in the hilly areas.

**(a) Manipur**

The characteristics of jhum cultivation in Manipur are as follows: (i) Cutting and clearing of forest areas and burning of the dried biomass by fire, (ii) rotation of jhum land every four to seven years, (iii) use of human labour as the chief input, (iv) non-employment of animals implements or machinery, (v) collective ownership of land, (vi) reciprocal labour sharing and (vii) mixed cropping system. Women predominate in seed selection and planting, weeding, and other operations, while operations such as cutting of the jungle, clearing, burning of the cut undergrowth, etc., are done by men. Both men and women participate in harvesting. The produce is transported from the jhum land to the village by head-loading.

In 1984, the Central Forestry Commission estimated that 6.7 million ha of cultivable area was affected by jhum in India. According to the Task Force on Shifting Cultivation, as many as 70,000 families in Manipur practiced jhum cultivation bringing 90,000 ha under this method of cultivation annually. The continuance of jhum in the state is closely linked to ecological, socio-economic, cultural and land tenure systems of tribal communities. Since the community owns the lands the village council or elders divide the jhum land among families for their subsistence on a rotational basis. In the hilly areas of Manipur, shifting cultivation is widely practiced, with settled terrace farming in foothill or low slope areas, above the adjacent rivers and streams.

Depending on the slope, wet broadcast on banded fields or dry broadcast on unbanded fields is practised. In the plains wet paddy rice cultivation is prevalent. Traditional methods of production are still widely used by the farmers, especially on the hill slopes. Estimates for the area under jhum vary widely. The Registrar General of India and the Principal Chief Conservator of Forests, Manipur, reported an average

40,000 hectares in the 1990s, while the Agricultural Census, Department of Agriculture, Government of Manipur, reported an average of 90,000 hectares and the Directorate of Economics & Statistics reported around 44,000 hectares in the same period. The most widely quoted estimate is that of the study by the 'Task Force on Shifting Cultivation, Ministry of Agriculture, according to which, 90,000 ha are cultivated by 70,000 families in the state. Much of the area under rice in the hills, and about 40 per cent of it in the state as a whole is under jhum cultivation.

The planning department of Manipur has laid considerable emphasis on the control of shifting cultivation. The government has introduced certain measures aimed at i) restricting jhumming like allowing natural forest to grow in jhum lands, ii) initiating resource surveys, iii) increasing the area under terrace cultivation, iv) promoting programmes for intensive valley development and development of horticulture, v) plantation farming in jhum land and vi) the development of sericulture and a few forest-based industries (Khongsai, 2014).

#### **(b) Mizoram**

Shifting cultivation in Mizoram is an integral part of the socio-cultural life of Mizos. With increase in population the jhumming cycle has shortened considerably and the productivity of land has fallen with devastating impact on the environment (Darlong, 2000). The Govt. of Mizoram in 1984 launched a programme called New Land Use Policy with an objective to put an end to the practice of jhumming by providing alternative land based permanent occupation and stable income to the families practicing jhumming (jhumias) in rural areas thereby raising their standard of living. Assistance is provided for various trades or occupation for a period of three years. The programme is operated on yearly basis (Garbyal, 1999).

Under its New Land Use Policy, Mizoram is laying emphasis on ending the age-old jhum shifting cultivation and has allocated Rs.410 crores in budget to enable about 30,000 more tribal families to shift to stable farming. Already 90,139 farmer's families have benefited under the State Government's flagship scheme and 29,861 more families

would be benefited during this financial year. The Planning Commission has appreciated the Mizoram government for launching such a unique scheme. The NLUP's success could be a model for other Northeastern States. The Mizoram government initiated its New Land Use Policy in January 2010 to put an end to the age-old shifting or slash-and-burn method of cultivation, and help the tribal farmers to shift to stable cultivation of various cash crops.

In jhum, bamboo forests are cut, burnt, cultivated, and then rested and regenerated for several years until the next round of cultivation, making bamboos vanish and return on the slopes in a cyclic ecological dance of field and fallow. While Cheraw is cherished by all, jhum is actively discouraged by the State and the agri-horticulture bureaucracy. Although jhum is a regenerative system of organic farming, Mizoram, the first Indian State to enact legislation to promote organic farming, is now pushing hard to eradicate jhum under its New Land Use Policy. Labeling jhum as unproductive and destructive of forest cover, policy makers and industry now promote settled cultivation and plantations, such as pineapple and oil palm, claiming they are better land use than jhum. Oil palm, rubber and horticultural plantations are monocultures that cause permanent deforestation, a fact that the India State of Forest Report 2011 notes to explain declines in Mizoram's forest cover (The Hindu, 2014).

While the area of jhum cultivation in Mizoram decreased by 36 per cent that of wet rice cultivation increased by 28.4 per cent during 2010. While the area of shifting cultivation in 2010-2011 has decreased from 44,947 hectares to 28,562, the area of wet rice cultivation has increased from 9,446 hectares to 12,130 hectares. At present, Mizoram produces only 25 per cent of the total rice consumption. Mizoram produces only 44,950 metric tonnes of rice, against the total consumption of 1,80,000 metric tones (The Shillong Times, 2011).

### **(c) Nagaland**

The north-eastern state of Nagaland is located at the confluence of the Indo-China and Indo-Myanmar region, and is endowed with rich diversity of species, flora and

fauna. Shifting cultivation is the main form of agriculture, most suitable for the state's climate conditions and steep terrain. In recent years, however, the duration of jhum cycles have shortened. This has meant that there is little time for restoring soil fertility and yields are declining over time. Families that were once self-sufficient in food grains are now not able to produce enough even for a few months of the year.

Nagaland faces a major challenge in adapting land use and production systems to meet rising populations and changing lifestyles, while also maintaining its ecological sustainability. In partnership with the Government of Nagaland, the UNDP project focuses on reducing land degradation resulting from shifting cultivation practices. About 61% of the total households of the state are practice shifting cultivation in about 1.00 lakh hectare of land annually thereby exposing about 5.65% of the total geographical area of the state to soil erosion hazards. The report stated that jhumming is one of the key drivers of degradation of forest ecosystem in Nagaland, and also often the most suitable form of agriculture for the agro-climatic condition and steep terrain cultivation like Nagaland.

In Nagaland, jhum constitutes as much as 76 percent of the cropped area, as per United Nations Development Programme. At least 100 different indigenous tribes of north east India depend on jhum for their subsistence. Diverse views abound on the ecological and economic impacts of large-scale deforestation of acres of forests for farming. In Nagaland, jhum farmers normally grew multiple crops as decided by the community. The pattern of jhum practiced in the state consists of the burning of trees, felling, drying and burning of the jhum field followed by sowing, inter-cultural operation, harvest, and fallowin. The UNDP programme in partnership with the government of Nagaland, aims to address land degradation in shifting cultivation locations.

#### **(d) Meghalaya**

Shifting cultivation has traditionally been practised in Meghalaya for generations. This has created a mosaic of forested and jhummed areas, resulting in disrupted connectivity of forests, fragmenting populations of wild animals and increasing inci-

dents of human-animal conflicts. The problem is most acute in the Garo Hills; three quarters of the state's total number of households involved in shifting cultivation, belong to the Garo hills. As a result of jhum cultivation which involves slashing and burning of forests, rich wild habitats have been fragmented, affecting all kinds of wildlife. Jhum is a type of mixed cropping system practiced by Khasis, Garos and alike.

Some reports indicated a marked decrease in the number of families practising jhum cultivation in Meghalaya, but it was difficult to assess its success due to lack of reliable data. The implementation of the schemes to control jhum cultivation should not be a water-tight compartment, but has an integrated approach. Barring the decrease in the jhuming cycle from 20-30 years to 3-6 years, this method of cultivation is arguably the one that is most suited in the hills of Meghalaya and perhaps in the whole of north eastern region. The present allocation of funds of Rs. 10,000 per hectare for treatable areas was not sufficient for the required treatment because of the terrain and rainfall conditions in Meghalaya.

#### **(e) Tripura**

The Tripura government has targeted to achieve paddy cultivation in more than 17,000 hectares of hill land under improvised Jhuming method in 2011-12. The traditional method of Jhum had been banned in the state few years ago and the government had introduced various rehabilitation packages for the hardcore Jhumias. Despite sincere effort and initiative for alternative sustainable livelihood opportunities, still about 25,000 primitive tribal people are practicing Jhum but we are able to motivate them to give up the traditional method, which reduced the environmental degradation as well as increased the productivity (The Shillong Times, 2011).

Shifting cultivation has been identified as one of the main human impacts influencing biodiversity in Tripura. Over the last few years a new class of shifting cultivators has emerged that has adopted non-traditional forms of jhuming, which have been responsible for the loss of biological diversity in the state (Gupta, 2000).

**Table 5 : Main Jhum Crops in Tripura**

<b>Local Name</b>	<b>English Name</b>	<b>Scientific Name</b>
Dhan	Rice	<i>Oryza sativa</i>
Mokkya	Corn, Maize	<i>Zea mays</i>
Job Dhan	Barley	<i>Hordium vulgare</i>
Ghochya/Til	Sesame	<i>Sesamum indicum</i>
Kon Soal	Fox tail millet	<i>Setaria italica</i>
Joar	Sorghum/Broom corn	<i>Sorghum vulgare</i>
Sora Kozu	Aroides, Arum	<i>Colocasia esculenta</i>
OolKozu	Corn/Taro	<i>Amorphophallus campanulatus</i>
Matya-Alu	Yam	<i>Capsicum annum</i>
JummoBagoon	Brinjal, Aubergine	<i>Solanum melongena</i>
Jum/Kem Sumi	Bean	<i>Vigna sinensis</i>
Sal Kumuro	Wax gourd, a variety of bottle gourd	<i>Benincasahispida</i>
Karanga Sumi	Winged bean	<i>Psophocarpus tetragonolobus</i>
Shimei Alu	Cassava	<i>Manihot esculenta</i>
Sabereng	A basil like herb, a leafy spice crop	<i>Ocimum americanum</i>
Baghor Pada	Cilantro? A coriander like leafy spice crop	<i>Eryngium foetidum</i>

Amila	Roselle, a leafy vegetable Hibiscus sabdariffa with sour taste	Hibiscus sabdariffa
Arhar/Dumoor Sumi	Cowpea	Cajanuscajan
Holot	Turmeric	Curcuma longa
Ada	Ginder	Zingiberofficinale

The people of Tripura were mainly dependent on agriculture for their livelihood and the aborigines of the princely state were primarily depended on the shifting cultivation, commonly known as Jhum cultivation. It is a very primitive, uneconomic and exhaustive form of cultivation. Plough cultivation was unknown to the tribal's living in the interior of the state. Only the Bengali and Manipuri cultivators along with some tribal communities living in the plain lands and in the border land of Hill Tipperah were acquainted with the plough cultivations before partition. As Ganguly(1969) had mentioned that, in the year 1955, there are 25,000 Jhumia families in Tripura and the total area of land under shifting cultivation was 16,00,000 acres, i.e. about 60 percent of the total area of the territory.

On the basis of the report of Census of India 1961, the total number of tribal populations in Tripura in the year 1961 was 3, 60,070, the number of tribal people depending on Jhum cultivation were 1,75,000, i.e. half of the tribal population were engaged in Jhum cultivation. Following the partition of India large number of Bengali displaced persons immigrated into Tripura for settlement. Most of the immigrants were rehabilitated in rural areas where tribal's practicing shifting cultivation was also being settled in permanent colonies. This created its own problems of adjustment, as there was pressure on land (De, 2012).

The Reang tribe in Tripura, which practised shifting cultivation and still does to an extent, faces serious problems with the state government implementing measures to turn them into settled cultivators. Government programmes have widened social dis-

parities among the Reangs and brought in alternatives that cannot sustain them round the year. It argues that shifting cultivation, which aims at self-sufficiency, is still remunerative compared to other forms of cultivation if traditional forest and land rights are restored to the tribal people (Sengupta, 2013).

Mostly the Reang tribe of Tripura practiced jhum cropping at large. In Tripura over 10,039 hectares of land are under Jhum cultivation. In 1955, it was estimated that there were 25,000 jhumias families in Tripura and the total land under jhum cultivation was 16,00,000 acres. After 1949, when Bengalis from Bangladesh migrated to plain lands of Tripura, the jhumias used to sell their jhum cultivation vegetables and rice to them at a very low price and this led to the exploitation of the poor tribes.

**Table 6 :** Number of Households and Persons Dependent on Jhum, Tripura, 1968 to 2007

Year	Source of the Estimate	No. of Households	No. of Persons
1968	J. B. Ganguly	25,000	-
1978	Benchmark Survey	46,854	2.59 lakh
1987	Benchmark Survey	55,049	2.88 lakh
1999	Department of Tribal Welfare	51,265	-
2007	Forest Department	27,278	1.36 lakh

**Source :** Government of Tripura.

According to Tripura Human Development Report, 2007, we know that, traditionally, most of the tribal population practised shifting or jhum cultivation and were termed jhumias. The term jhumia is a generic term used for tribal people dependent on shifting cultivation as the primary source of livelihood. J.B. Ganguly's book on the showed that in 1961 there were about 25,000 families who were dependent on jhum for their livelihood. By 1978, this number had increased to 46,854 families, of which about



23,292 families were primarily dependent on jhum for their livelihood. In 1999, according to the Department of Tribal Welfare, 51,265 families were dependent on jhum, and the large majority of them were fully dependent on jhum. The big concentration of jhumia families was in Dhalai and South District. The total count shows a clear decline in the number of jhumia families.

**(f) Arunachal Pradesh**

Arunachal Pradesh has made a significant progress in gradually doing away with the age-old practice of jhum cultivation or shifting cultivation, which degrades the environment. In line with the Centre's stress on conventional methods of cultivation, the state with a 72 per cent forest cover had been able to reduce the total area under jhum cultivation from 1,10,000 hectares to 84,000 hectares in the last 10 years. About 8.4 lakh metric tonnes of biomass gets lost due to burning of trees resulting in a huge emission of carbon monoxide, carbon dioxide, nitrous oxides and other gases. The emission has been reduced by taking up rice and maize cultivation in terraces.

The harmful effects of jhum cultivation included rapid soil erosion due to deforestation of hill tops and slopes and high runoff velocity and siltation of reservoirs, rivulets and valleys. The harmful effects resulted in the rapid decrease of jhum productivity due to removal of top soil by runoff water and very little time to recuperate soil fertility due to reduced jhum cycle. Sixteen districts encompassing the eight Northeastern states, including West Kameng and East Siang districts in Arunachal Pradesh, are among the recently-identified 100 most climate-sensitive districts of the country.

Slashing or felling down of trees, herbs and shrubs for jhum cultivation reduces oxygen generation and burning of them pumps harmful carbon-monoxide, nitrous oxides and many other gases into the air. The state government's attachment of top priority to agriculture, horticulture and allied sectors, would add to the national food productivity and help achieve 6.5 per cent annual growth by the end of 12<sup>th</sup> Five Year Plan set by the Agriculture Ministry (The Times of India, 2013).

The practice of the shifting cultivation is a major occupation for the people of Arunachal Pradesh. Some people have shifted from village to urban areas due to varied reason but majority of people do reside in the remote rural villages of the state. The only means of livelihood is to practice this kind of agriculture. Jhumming is very closely associated with the culture and tradition. The Jhumias have been depending on their Jhum and as they have cultivated many economical plants which may include vegetables, medicinal plants, spices, taroos and yams, grain etc. They practice rearing of pigs, cows, goats etc. The fodder and feeds of these animals also comes from the field thereby decreasing pressure on pastoral land. Hence it is linked to their economy (Murtem et. al, 2008).

Watershed Development Project in Shifting Cultivation Areas was taken up in seven States of North Eastern Region with 100 percent SCA as per directions of National Development Council in 1994-95. Recently, under National Afforestation Programme, problem of jhum cultivation was given special focus. Mid-term appraisal of Eleventh Five Year Plan mentions that as per report of Ministry of Rural Development, only 6.5 per cent of households have been reportedly engaged in shifting cultivation in the country. The percentage of area under jhum cultivation is 9.5 in North-Eastern region, while it is 0.5 per cent for central tribal belt (Jhum cultivation, 2011).

### **Merits of Shifting Cultivation**

According to the jumias, there are many advantages of jumfarming. Jumis an indigenous knowledge-based production system that helps to maintain the traditional culture and heritage of the indigenous peoples. Jumiasget diverse seasonal crops from jumfields and it secures their rice, vegetable and other food needs for at least a few months of the year. Jumis a zero-tillage cultivation system with minimum soil disturbance and nutrient loss. Jumis rain-fed, so there is no need of watering or irrigation in a jum field. There is a higher agro-biodiversity in jumthan in lowland agricultural systems. Jumiashave their own seed preservation system for future cultivation. There is a great demand of seasonal and annual cash crops from jum, like ginger, turmeric, chili, cucumber (jummarfa), kozu/kochu (arum/aroides), etc. in the local market.

Shifting cultivation is the source of income for rural people in hilly areas. When crops are cultivated, after a certain amount of time, the nutrients become depleted from the soil. Shifting cultivation means setting aside a different, more nutrient-rich plot of land in which to grow vegetables. In the past, farmers have switched between different plots of land, which has allowed for the soil in certain plots to regain nutrients.

Some proponents claim that an advantage of shifting cultivation lies in the fact that it does not use fertilizers or chemicals to force crops to grow in nutrient-depleted soil. It helps to keep a good amount of diverse nutrients in the soil. One crop might take all of the nitrates out of the soil so after a year or two have no nitrates in that area and the plant will not grow well. This is when would either leave that area alone for a few years or plant a crop that puts nitrates back into the soil. Crop rotation is keys in large-scale, long term operations.

Market demand for fruits and availability of saplings in the market have motivated the jumias to opt for fruit orchards (particularly pineapple, mango, papaya and litchi) in the homesteads. Income and expenditure of some of the jumia households have increased because they are including market-driven cash crop cultivation like turmeric, chilli, ginger, aroides, and fruit trees like banana in their jum plots. In spite of the many benefits from jum, the jumias in the study areas also see some disadvantages.

Shifting cultivation is a form of land use which enhances biodiversity. Severe declines in plant diversity have been observed in most areas when shifting cultivation is replaced by permanent land use systems. Particularly worrying is the decline in agrobiodiversity. Shifting cultivators have preserved agrobiodiversity through local rules, practices and the informal networks for exchange of seeds and knowledge, thus ensuring food security of their communities. Along with the replacement of shifting cultivation comes the collapse of these networks, which results in a substantial loss of crop genetic resources. The availability of high genetic diversity in agricultural plants has, however, been identified as a key element in adaptation strategies to climate change.

## **Demerits of Shifting Cultivation**

Shifting cultivation is an agricultural system in which plots of land are cultivated temporarily, and then abandoned. This system often involves clearing of a piece of land followed by several years of wood harvesting or farming, until the soil loses fertility (Henriques, 2007). 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 manifold. Besides causing air pollution due to burning, shifting cultivation is responsible for loss of soil nutrients and useful soil fauna and microbes. Burning of slash lowers soil acidity, organic matter and total nitrogen. Most shifting cultivation practices are subsistence level farming system having very low output/ input ratio compared to other farming systems/methods. Excessive agricultural activity of shifting cultivation not only decreases the forest area, but also changes the primary forest into secondary woodland of shrub. On the phase of soil property, it accelerated the soil and gully erosion, and acidification (Das, Choudhury, & Roy, 2012).

The cultivation of Jhum leads to loss of natural forest ecosystems creating huge impact on environment. The extraction and the felling of large tracts of forest cover on the onset of Jhum distribute the environment in many ways. Loss in forest cover results on climatic variation like-uneven rainfall, precipitation, wind, humidity etc. The loss in biodiversity affects the environmental climatic conditions of a region affecting the abode of various faunas. Deforestation that results from the cause of shifting cultivation interference with the rain as vegetation plays a vital role in the rain cycle. The mass destruction of forest cover with forest canopy gaps lead to deforestation and this limit in rain formation due to low limited evapo-transpiration.

The defect of jhuming lies in the fact that the land can produce crops only once in several years (5 to 19 years) depending on the jhum cycle. But under settled fanning, the same field can be brought under multiple cropping with scientific management under irrigation, which can produce two or more crops. Thus, productivity per bigha under jhum cultivation is significantly lower than the settled cultivation. The level of income from jhuming appears to be very poor compared to prevailing wage rates. The grow-

ing population has brought about a vicious circle of more area being jhum leading to shortening of fallow period and consequent deterioration of soil fertility, which requires bringing more plots under jhuming.

## **Conclusion**

Shifting cultivation is in transition across the world. The characteristics of the shifting cultivation are changing over time. Reducing fallow period, or in some cases with no fallow, and changing vegetation management practices are major alterations in shifting cultivation. The statistically valid information on biodiversity value of the shifting cultivation lands and impacts of changing practices on biodiversity is inadequate to establish clear relationships. Further research is recommended on effects of changing shifting cultivation practices on biodiversity. Shifting cultivation is common cultivation in north-eastern states. In India the total area under jhum cultivation is 0.94 m ha whereas North East India itself accounts for 80% of the jhum area (0.76 m ha).

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. Intensive land management through agroforestry is a promising alternative that can sustainably manage the remaining forest resources. If adopted, such systems potentially provide good economic returns, and may significantly reduce rural poverty.

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