
Shifting agriculture: spatio-temporal patterns and processes in north-eastern India

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Introduction

North-eastern hill region of India is predominantly inhabited by tribal communities practising shifting agriculture on sloping lands (Task Force - Ministry of Agriculture, 1983; Task Force - Ministry of Environment and Forests, 2005). This region has been recognized as a 'global biodiversity hotspot'. Achieving the objective of sustainable socio-economic development of the region together with conservation of biodiversity and ecosystem services is a challenging task. Several development schemes fully funded by the government have been implemented over the last five decades for socio-economic upliftment of the communities practising shifting agriculture (commonly referred to as Jhum). These schemes are designed on a premise that shifting agriculture is the underlying cause of environmental degradation leading to economic impoverishment of local people. This premise led to incentives for settled agriculture and perennial cash crops, with a stipulation that the incentives would encourage abandonment of traditional shifting agriculture. Government schemes did provide some economic benefits to the local people but, by and large, failed to achieve the objective of checking shifting agriculture. These experiences led to efforts enabling people to improve rather than abandon shifting agriculture (IDRC-ICFRE, 1997; NEPED-IIRR, 1999; ICIMOD, 2004; World Bank, 2006; NERCORMP, 2006). This article presents an analysis of spatio-temporal patterns and processes associated with shifting agriculture in the north-eastern region of India.

Extent of shifting agriculture in the north-eastern India

A wide range of variation is evident from data available on the area under shifting agriculture and number of families practising this land use. Dhebar Commission (GOI, 1961) estimated that 2.6 million persons were engaged in shifting cultivation covering an area of 9209 km² in the country. National Commission on Agriculture (1976) estimated that 492000 tribal families practised shifting cultivation over an area of 4530 km² every year (i.e., cropped area), while the total area influenced by this land use (i.e., cropped + fallow area) in the north-east India was 26940 km². An Expert Committee appointed by the Government of India (GOI, 1997) estimated that, out of total geographical area of 25.5 million ha of north-eastern region of India, about 3 million ha was under settled agriculture and about 2.7 million ha under shifting agriculture practised by 0.45 million families. Recently, Satpathy *et al.* (2003) estimated the total area under shifting agriculture in the north-eastern India as 19820 km², covering 87 % of the total shifting cultivation area in the country. The National Remote Sensing Agency (NRSA, 2003) estimated that an area of 17436 km² area was under shifting agriculture in the north-eastern India. A Task Force constituted by the Government of India (Task Force - Ministry of Agriculture, 1983) estimated the total area under shifting agriculture in the north-eastern India as 3871 km², which accounted for about 40% area of this land use in the country. The available data indicates a significant increase in area under shifting agriculture in the north-eastern region but a decline in other regions of the country. Comparison of the satellite remote sensing based area estimates in recent years with the estimates arrived at by different methodologies before the advent of satellite data does show a decrease in area under shifting agriculture, though such comparisons have inherent limitations. A large difference in area estimates for the year 2003 reported by two agencies viz., the Indian Council of Agricultural Research (Satpathy *et al.*, 2003) and the National Remote Sensing Agency (NRSA) brings an element of uncertainty and ambiguity in the available area statistics (Table 1). Despite the limitations of available data, it is clearly evident that, in the north-eastern region comprising seven States of the country (Sikkim, which is included in the north-eastern region very recently and where shifting agriculture is altogether absent, has not been taken into account), relative area under shifting agriculture is highest in the State of Nagaland (38.2% of total geographical area) and lowest (2.5%) in Arunachal Pradesh. The data on number of families practising shifting

agriculture is meagre. There are 443336 families involved in shifting agriculture in the north-eastern India as against a total of 607536 in the whole country (Task Force-Ministry of Agriculture, 1983). Shifting agriculture is thus largely confined to the north-eastern region of the country.

Table 1. Variation in data on area under shifting agriculture reported by different agencies

States	Area under shifting agriculture (km ²)			Number of families practising shifting agriculture
	Task Force-Ministry of Agriculture (1983)	Satapathy <i>et al.</i> (2003)	NRSA (2003)	Task Force - Ministry of Agriculture (1983)
States in the north-eastern region				
Arunachal Pradesh	700	2610	1613	54000
Assam	696	3100	3931	58000
Manipur	900	3600	4817	70000
Meghalaya	530	2650	744	52290
Mizoram	630	450	4018	50000
Nagaland	192	6330	1918	116046
Tripura	223	1080	396	43000
Other States of India				
Orissa	5298	1840	1177	141000
Andhra Pradesh	500	1030	7	23200
Bihar+ Jharkhand	162	0	0	12200
Others	125	0	20	2500
Total	9956	22690	18641	622236

The wasteland maps based on interpretation of satellite data show that about one-third of the total area under shifting cultivation is under current Jhum, i.e., cropped (Table 2). In the states of Arunachal Pradesh, Meghalaya, Nagaland and Tripura, area under current Jhum is larger than

that under abandoned Jhum fallows, showing signs of sedentarization or land use intensification.

Table 2. Abandoned Jhum (fallow fields), current Jhum (cropped area) and total area under Jhum in north-eastern India

State	Abandoned Jhum area (km ²)	Current Jhum (km ²)	Total area (km ²)
Arunachal Pradesh	496	1116	1613
Assam	3495	436	3931
Manipur	3697	1120	4817
Meghalaya	117	627	744
Mizoram	2870	1147	4018
Nagaland	801	1117	1918
Tripura	110	285	395

Source of information: Wasteland Maps on 1: 50000 scale based on IRS-LISS III Data, Wastelands Atlas of India, National Remote Sensing Agency, Hyderabad, 2003

Typology of shifting agriculture

Shifting agriculture system varies tremendously in terms of intensity of fire, soil fertility management practices, legal status of land, crop composition and the goal of this land use envisaged by the farmers. Four types of shifting agricultural systems are evident in the north-eastern region of India (Table 3).

Traditional shifting agriculture

This type of shifting agriculture is found in areas where the rate of population increase has been low and per capita land availability is quite high. There is a high level of involvement of traditional village institutions in regulating land use within the village territories. This type of shifting cultivation system is generally sustainable from environmental conditions but may not fulfill all needs and aspirations of farmers getting more and more influenced by market, technological innovations and the mainstream modern society. Fallow periods are so long and regrowth during secondary succession so luxuriant that it is sometimes difficult to distinguish patches of natural forests from fallow fields. This type of traditional shifting

Table 3. A comparative account of four types of shifting agriculture currently practised in the north-eastern region of India

Features	Traditional shifting agriculture	Distorted shifting agriculture	Innovated shifting agriculture	Modified shifting agriculture	
Ecological/agronomic	Fallow period	1-3 years	> 8 years	5-8 years	
	Cropping period	1 year	2-5 years	2 years	
	Biodiversity	Very high	Very low	High	High
	Soil erosion	Very low	Very high	Very low	Low
	Deforestation	Limited	Excessive	Limited	Limited
	Natural regeneration	High	Very low	Adequate	Adequate
	Availability of crop products	Year round	2-3 months	Year round	Moderate
	Fallow management	Good	Very poor	Good	Good
	Sustainability	Very high	Very poor	High	Moderate
	Productivity	Adequate	Low	High	High
Economic	Food selfsufficiency	Very high	Low	High	
	Market dependence	Very low	Very high	Medium	
	Cash income	Very low	Very low	Limited	High
				Low	Adequate
Social and institutional	Community cohesion	Moderate	High	High	
	Cultural activities	Very high	Low	High	
	Community involvement in shifting agriculture	High	Low	High	Satisfactory
	Involvement of traditional institutions	Very high	Low	High	High
				Adequate	

agriculture can be seen in the buffer zone of Nokrek Biosphere Reserve, Garo Hills, Meghalaya and in Ngangching and Lazmi villages of Nagaland (Box 1, 2).

Box 1. Traditional Shifting Agriculture: Case 1.

Ngangching Village, Mon District, Nagaland

Inhabited by Konyak people, Ngangching village is located 42 km south of Mon town, the headquarters of Mon district, Nagaland. About 30% of village area is under primary forests and the remaining 70% under shifting agriculture and other land uses. Some important features of shifting agricultural system are listed below:

- Current Jhum fields are enriched with *Macaranga denticulata* by broadcasting its seeds and protecting its seedlings/saplings.
- Trees of *Trema orientalis*, *Sapium baccatum*, *Grewia* spp., *Quercus* spp., *Alnus nepalensis* and *Schima wallichii* are cut at a height of about 3 m to promote their profuse coppicing following fire.
- Natural regeneration of *Cedrela serrata*, *Duabanga grandiflora*, *Melia* spp. and *Spondias axillaris* with domestic timber uses are selectively protected.
- Banana and large cardamom are planted underneath *Macaranga* trees to maximise the yields.
- Gardens of *Livistona jenkinsiana* (Toko) are maintained to obtain thatching material.
- Steep escarpments and ravines are set aside for *in situ* biodiversity conservation and wild edibles.
- Firelines (2 to 3 m wide) are established and the whole village is involved to reduce the risks of spread of fire from shifting agriculture plots to other areas.
- Area under shifting agriculture is divided into 8 plots, each cropped for a period of 2 years after burn followed by 6 years of fallowing.

Box 2. Traditional Shifting Agriculture: Case 2.**Lazami Village, Zunheboto District, Nagaland**

Lazami is the biggest village of Sema tribe in the District of Zunheboto, Nagaland, located at an elevation of 1150 to 1250 m amsl. The village has 700 households with a total population of about 5000. Some of the features relevant from the point of sustainability of shifting agriculture are listed below:

- Luxuriant growth of thatch grass (*Imperata cylindrica*) is considered as an indicator of high soil fertility. Length of cropping period varies depending on farmers assessment of soil fertility of the plot.
- In situations where cropping is done for longer periods, some slash is composted and spread over the site.
- Weeding is done before weeds set seed. Visible seeds and flowers of weeds are manually collected and disposed off.
- Farmers classify weeds and those reproducing by means of both seeds and vegetative propagules are considered to be the most obnoxious ones.
- Contour bunding using locally available poles, stumps and boulder across the slopes at an interval of 3 to 5 m is practised to check soil loss.
- Yam, ginger and maize are planted along contours, tuber crops just above and leguminous crops immediately below the contour bund to reduce soil loss.
- Logs and poles are left in the site after cropping is over, a practice contributing to the enhancement of soil organic matter content.

Distorted shifting agriculture

This system is commonly observed in areas where villagers are forced to reduce the fallow period to 1-3 years due to scarcity of land available for Jhum. Such short fallow periods do not permit adequate regeneration of soil fertility through natural succession, resulting in site degradation over a period of time. In some places, e.g., Tuirini and Tlawng catchments in Mizoram, people have not shortened fallow period but have started practising Jhum on steep slopes due to scarcity of better quality of land.

The distorted shifting agriculture is unfortunately becoming more and more prevalent. In Mizoram (areas with < 1000 m altitude), the distorted system has led to conversion of much of the subtropical evergreen and semi-evergreen forests into scrub and bamboo brakes.

Innovated shifting agriculture

This type of system brings out traditional farmers' ability to adopt new methods of cultivation adapted to the changing circumstances and goals of agriculture and livelihood priorities. In some cases, farmers have made the system more productive and market - friendly by cultivating nitrogen fixing cash crops, e.g., beans in Nagaland and pea in Pamlakarai, Meghalaya (Box 3, Tiwari, 2004).

Modified shifting agriculture

Over the last few years, two externally funded development projects have been implemented in the region: Nagaland Environment Protection and Economic Development (NEPED) project in state of Nagaland and North Eastern Region Community Resource Management project (NERCORMP) in Meghalaya, Manipur and hill districts of Assam. Improvement of Jhum is a major objective of these projects. While NEPED has tried to improve local livelihoods through promotion of tree husbandry and cash crops, the NERCORMP has viewed institution building and microfinance facilities as catalytic actions for sustainable livelihoods in the region. These projects have demonstrated that productivity of shifting agriculture can be enhanced over a short period of time. However, long term sustainability of the recommended actions can be tested if the flow of benefits continues after termination of support being provided through the project to the people. NEPED approach has been recommended for replication elsewhere in the region (GOI, 1997). In both NEPED and NERCORMP villages, shifting agriculture has been modified to enhance income of the people. Jhumia (shifting cultivators) rehabilitation schemes implemented by the central and state governments have also tended to bring in such modifications in the target villages. However, in the absence of any systematic quantitative assessment of impacts of development projects, it is not possible to draw any conclusion with regard to their socio-economic sustainability. In the present analysis (Table 3), the modified shifting agriculture refers to the donor driven mega projects only.

Box 3. Farmers' Innovation: Case 1.

Pomlakrai-Mawbyinna Village, Khasi Hills District, Meghalaya

Pomlakrai is a village located at about 13 km south-west of Shillong at an altitude of 1880 m above mean sea level. It comprises seven sub-villages covering an area of about 12 km². Some of the important features of shifting agriculture in this village [details in Tiwari (2004)] are listed below:

- Biomass, which is burned, consists of lower branches of trees, aboveground herbaceous and shrub biomass and some crop residues.
- Burning process is slowed down by covering crop residues by soil, a process which is likely to reduce loss of nutrients.
- The site is prepared into ridges and furrows. Crops are grown on ridges, with furrows serving as channels for run-off water so as to reduce soil erosion.
- Fallows and crop fields are interspersed such that soil and nutrient losses from the latter are largely captured and retained by the former.
- Partial shifting within the cultivated land enhances land use efficiency.
- Some slash is allowed to decompose naturally so that nutrients locked up in plant biomass are released at slow pace matching with the crop demands.
- Cultivation of nitrogen fixing crops such as sweet pea (*Pisum* sp.) enriches soil nitrogen content.

The changes in shifting agriculture over time can be categorized as:

- (i) The changes where man appears a passive onlooker to the retrogressive development of shifting agriculture system and allows the natural resource base to degrade. Such a situation ultimately leads to transformation of area under shifting cultivation into uncultivable wastelands.
- (ii) The farming community is constantly thinking how to keep the system productive. Further, people continue to adapt to the changing needs of the society. They use their traditional knowledge to conserve natural

resources and also adopt modern technologies and marketing for improving productivity and income.

- (iii) The community evaluates and adapts the technological and management prescriptions of development/donor agencies and enhances land productivity without depleting the natural resource base. In all such changes, farmers tend to integrate traditional subsistence economy with market economy.

Drivers of change in shifting agriculture

Growing population has put increasing pressure on community forest lands. Severe degradation or conversion of agricultural land to permanent non-agricultural land use reduces the net area of land available for shifting cultivation, forcing farmers to reduce fallow period leading to incomplete recovery of ecosystem functions lost due to cropping and making shifting agriculture less and less productive with the passage of time. The principal drivers of such a change are: (i) increasing population pressure, (ii) need of cash and (iii) government schemes of raising forest and plantation crops in Jhum lands. Commodification of agricultural and forest products took place and in some places market became a driver for transition in shifting agriculture and popularization of monoculture of commercial species such as coffee, rubber, tea, cashew nut, pineapple and broomgrass. The current transition in shifting agriculture, to certain extent, can be summarized as a shift from community based agriculture to market driven agriculture (Tiwari and Darlong, 2001). Over the years the land has become a valuable commodity and therefore people are increasingly being interested in owning land. In many villages in Meghalaya and Nagaland a trend of privatization of land has set in, which is also reducing the area of land available for shifting agriculture (Choudhury, 2004). These changes also lead to scarcity of forest products and loss of ecosystem services. Some of the less frequent changes in shifting agriculture system include conversion of fallow lands into grazing lands and outmigration of the youth to urban centers, leaving burden of shifting agriculture on old men and women (examples of this can be seen in East and West Khasi Hills of Meghalaya). Rural societies are thus getting more and more dependent on cash remittances from urban employment, while urban centers undergo the consequences of environmental degradation as a result of unsustainable growth of human population. Large scale outmigration (for example Mokokchungkit village of Nagaland) leads to permanent abandonment of shifting cultivation. In general, distorted shifting agriculture system has expanded and the traditional one has shrunk (Tiwari, 2001b).

Impact of shifting agriculture on forest resources

Table 4 shows that 12.6% of all forest area in the north-east was subject to shifting agriculture during 1987-97 period. Shifting agriculture is practised in dense forest landscapes in the state of Arunachal Pradesh and in open forests in the States of Manipur, Nagaland and Meghalaya (Table 5).

Table 4. Area under forest and shifting cultivation (Jhum) during 1987-97 in north-east India

State	Total Forest Area (km ²)	Area under Jhum (km ²)	% of forest area under Jhum
Arunachal Pradesh	51500	2300	4.5
Assam	27000	1300	4.8
Manipur	17400	3600	20.7
Meghalaya	9500	1800	18.9
Mizoram	15900	3800	23.9
Nagaland	8600	3900	45.3
Tripura	7000	600	8.6
Total north-east	136900	17300	12.6

Source: Forest Survey of India, 1999.

Table 5. Forest cover affected due to shifting cultivation in the north-eastern India

State	Dense Forest (km ²)	Open Forest (km ²)	Total (km ²)
Arunachal Pradesh	663	262	925
Assam	272	337	609
Manipur	125	730	885
Meghalaya	141	543	684
Mizoram	351	336	687
Nagaland	321	1011	1332
Tripura	221	163	384
Total north-east	2094	3382	5476

Source: State of Forest Report, 2003; National Forestry Commission, 2006

Administrative classes of forests affected by shifting agriculture

Shifting agriculture is largely practised in Unclassed State Forests (USF), which are under the dual control of the Revenue and Forest Departments. The revenue authority and local traditional institutions are empowered under law to allow any use of the land. These forests have been claimed variously as private, clan and communal property and have been traditionally under the control of the village community. No survey or demarcation has been done and there is no well defined land revenue regulation. The statistics of USF in seven states of the region is presented in Table 6. It is seen that maximum USF is covered in the state of Arunachal Pradesh followed by Manipur, Nagaland, Meghalaya and Mizoram. For all practical purposes, USF are community land available for shifting cultivation. Because USF is legally classified as forests, forest managers consider Jhum as 'agriculture on forest land' and they often believe that it is their obligation to rehabilitate the Jhum lands by converting it into a forest through tree plantation (GOI, 1997; Malhotra *et al.*, 2004). In some places, shifting cultivation is also practised in Reserve Forests particularly in the vicinity of human habitations (IDRC-ICFRE, 1997).

Conclusions

Since colonial period most foresters, bureaucrats and researchers have steadily believed that shifting agriculture is a bad practice for forest and soil conservation. Laws and rules have been enacted by both central and state governments for checking this land use (Upadhyay, 2004). In the north-eastern India, shifting cultivation continued to expand until recent times. Only since last few years, some signs of reduction in area under this land use have been noticed (NFC, 2006). This shows that shifting agriculture does have some inherent qualities that favour its perpetuation in an otherwise unfavourable legal and policy environment. The subject has received ample attention of researchers and policy planners. Yet, there is conspicuous lack of reliable temporal data on area under shifting cultivation as well as number of families practising shifting cultivation. Emphasis has been on the research on ecological, agronomic and cultural dimensions of shifting cultivation and better alternatives for this land use (Borthakur, 1992). It is now being increasingly felt that emphasis should be laid on controlling distortions or retrogressive developments rather than on controlling the shifting agriculture system itself.

Table 6. Administrative classes of forests where shifting agriculture is practised and their area

State	Administrative classes of forests where shifting cultivation is mostly practised	Ownership	Control	Area (km ²)	Percent of geographical area of the state
Arunachal Pradesh	Unclassed State Forests	State Forest Department	Village community/traditional institutions	32039	23
Assam	Unclassed State Forests of District Councils	District Council	Village community	5713	7
Mizoram	Unclassed forests	State Forest Department/Village Council	Village Council under intimation to govt.	5240	25
Manipur	Unclassed State Forest	State Forest	Village community	11288	51
Meghalaya	Unclassed forests	Traditional Durbars, District Councils	Traditional institutions	7146	32
Nagaland	Unclassed forests	Village Councils	Village Council	7813	47
Tripura	Unclassed State Forests	State Forest Department	Village community	2195	21

There is a need of proper integration of agriculture and forestry sectors. National programs and schemes are often formulated keeping in view the situations in the country as a whole. There is a need to tune the development programmes with the location specific circumstances. Afforestation of Jhum land through government schemes reduces net area available for shifting agriculture and leads to shorter Jhum cycle, a characteristic of distorted shifting agriculture system. Market is influencing shifting agriculture and many changes in this land use are driven by market forces. It is next to impossible to keep the traditional subsistence communities insulated from market forces. Therefore, there is a need to adapt traditional shifting agriculture system to the new opportunities and constraints related to market. Introduction of cardamom, kolar bean, ginger and turmeric are examples of this adjustment. The transition in shifting agriculture needs to be directed and guided for making it more productive, socially acceptable and ecologically sustainable.

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