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Shifting cultivation in North East India: Social dimension, cross cultural reflection and strategies for improvement

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ABSTRACT

The shifting cultivation is an indigenous land use system widely prevalent and practiced in North East India. Around the globe, the tropical countries practise this form of land use called commonly as shifting cultivation or swidden or slash and burn agriculture. Being one of the dominant land use systems, shifting cultivation calls for investigation by the interested researchers and academicians. Hence, the purpose of the present endeavor is to analyze the basic social dimensions of shifting cultivation through interventions analysis of secondary information and strategies for improvement. The review lays focus on shifting cultivation in India and blending the accumulated experiences with those of other countries. The review takes into account social characteristics of the shifting cultivation, the underlying causes of the shifting cultivation, the Government of India initiatives and impacts to control the shifting cultivation, sustainability, livelihood and food security and the shifting trends in shifting cultivation and the strategies for livelihood improvement. The analysis reveals that the shifting cultivators have an intricate relationship with the land and have a strong affinity and respect towards the land as it is a way of life. The trends in shifting cultivation though depict some patterns of change but the data are highly varied. From the literature, it is observed that there is a transition taking place in the various countries in varied form from subsistence based system to dual economy. The *jhum* land use is debatable as the practice is criticized as an unscientific form of land use, which causes land degradation and ecosystem fragility. As a result, the region is experiencing colossal loss of vegetation cover and top fertile soils through erosion from steep slopes. Therefore, a significant, multidimensional strategy is required to transform the large scale agricultural degraded land from a financial and environmental liability to valuable assets. However, the systematic and detailed study needs to be conducted in the North Eastern Region on the social dimension of shifting cultivation and strategies for its improvement.

Key words: Jhum characteristics, Jhum programmes, North East India, Shifting trends, Strategies for *jhum* improvement

Jhum (Shifting) cultivation is a indigenous and primitive practice of cultivation in the states of North East of India occupying more than 84% (0.76 m ha) of land out of 0.94 m ha of India which includes both current *jhum* (53%) and abandoned *jhum* (47%) (NRSC 2011) and about 0.44 million tribal families are dependent on this for their livelihood (Yadav 2013). This practice resulted in burning phytomass (including forest floors) in this region which is more than 8.5 million tonnes annually (Choudhury *et al*. 2015). Therefore, the region is experiencing colossal loss of vegetation cover and top fertile soils through severe erosion from steep slopes. Nearly 30% area of the region is categorized as severely eroded with a potential erosion rate of 40-80 t/ha/year (Mandal and Sharda 2013). This has disturbed the soil fertility and sustainability, due to loss of top soil from surface runoff in sloping lands.

This shifting cultivators are categorized as indigenous communities, government organized colonists and spontaneous settlers or ranchers (Fujisaka and Escobar 1997). The shifting cultivation or slash and burn cultivation or swidden cultivation is widely practiced in the tropical countries. The nomenclature of shifting cultivation varies from place to place. There is no universal definition to define shifting cultivation, as this cultivation is practiced by number of people and they are as diverse as they are practised. However, it is defined as "swidden cultivation which is a form of land use system that employs a natural or improved fallow phase which is longer than the cultivation phase of annual crops sufficiently long to be dominated by woody

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vegetation and are cleared by means of fire" (Mertz *et al.* 2009). It involves shifting of fields from one place to another over the years and is practised as a resource management strategy (Mertz *et al.* 2008). This system reflects indigenous knowledge accumulated through centuries of trial and error (Cairns and Garrity 1999). In 1957, the Food and Agricultural Organization had stated shifting cultivation as the most serious land use problem in the tropical world and many countries formulated policies and laws to eradicate shifting cultivation system (IWGIA 2014). However, in spite of the best efforts, shifting cultivation is still continuing. Although, large volume of literature has been created since time immemorial, many aspects of the system are still poorly understood (Mertz *et al.* 2008). Hence, it has created interest to explore the various social dimensions of shifting cultivation. The current review lays focus on shifting cultivation in India with specific case studies and findings from other countries experiences. The revelations were under the social characteristics of the shifting cultivation, the traditional institutions and its role in *jhum* society, the underlying causes of the shifting cultivation, strategies taken by the Government of India to control shifting cultivation in India, the shifting trends in shifting cultivation and the strategies for livelihood improvement of *jhumias*. The social dimension of shifting cultivation and its cross cultural reflection in North East India is not well reported and documented systematically. However, we have analyzed the systematic and detailed study in the North Eastern Region on the social dimension of shifting cultivation as well as the *jhum* improvement strategies.

Social characteristics of jhum system

Based upon ethnic values and culture, both private and common property land tenure regime is found in existence in the shifting cultivation system. In Orissa, locally called as podu, there exists both private and common property regime (Dash 2006). In case of Meghalaya, while the private land ownership pattern does exist among the Khasi and Karbi tribes, the Garo tribes, on the other hand, resort to community land ownership pattern (Deb *et al.* 2013). Further, *jhum* based ethno-agrarian economy is self sufficient and habitually such *jhumias* either depend minimally or not at all on outside for mitigation of their livelihood needs (Gupta 1994).

The use of human labour is the key input in the shifting cultivation system and the practice of mutual exchange of labour amongst these shifting cultivator communities is also not uncommon. In practices like harvesting, the groups of families join hands together to harvest the crop of each plot one by one. This practice of community labouring reduces drudgery and increases work productivity. During this harvesting time, it is said that farmers exchange their innovations and look at each other's innovations as they work. Further, it is customary to arrange food and drinks by the family of the plot which is being harvested. The community recognizes these harvest periods as festive events which makes their work enjoyable. The case of village named Nawalparasi, Nepal, shows that shifting cultivators work in an innovative way in their community in which the part of the village land is set aside and is cultivated by the members of whole community jointly. The benefit they harvest from this area is used to fund for teachers' salaries in community school (Kherkhoff and Sharma 2006). Further, the close knit and kinship ties are not only necessary for labour sharing but also important for technology diffusion among the members (NAEB 2008).

The division of labour exists between men and women. It varies from place to place. The Manipur Jhumias characteristics portray that the women predominate in seed selection and planting, weeding and other operations, the activities like cutting of the trees in jungle, clearing, burning are generally done by men. Both men and women participate in harvesting of produce and so harvested produces are carried to the villages by head loading (Anonymous 2015).

The research shows that the *jhum* economy once was considered to be an egalitarian one, nevertheless, there was social hierarchy noticed as folkways in many such societies (Gupta 1994). The village headman exercises power and authority over their fellow Jhumias. This is exhibited while distributing *jhum* lands among the fellow social members in his village. Even during the regime of maharajas in the past, he could partake a certain amount of money collected for those rulers. He used to allot larger area of *jhum* land for himself by virtue of having more labour. Further, by virtue of his position, he could act as an agent of traders and money lenders in the Jhumia society (Gupta 1994).

Traditional institutions and its role in jhum society

Traditional institution plays an important role in the Jhum society. In sociological terms, the institutions "comprise shared norms, values, traditions, beliefs, religion, rules, regulations, laws, civil society organizations, and government agencies (North 1990). The traditional institutions were nothing but the village councils which have been responsible for managing land resources at community level. Each and every clan was represented in this village council. However, the composition of the traditional institution varies between the tribes. In Nagaland state, the communities in Mokokchung district practice collective decision making on land use for different purposes like demarcation of area for burning, digging of fire lines and controlled burning which were responsible for continuation of both sustainable and equitable use of land and resources (IWGIA 2014). Similarly in Kachin state of Myanmar, the community cooperation took place in fire management and fire control. In Chittagong hill tract of Bangladesh, the community decision making was involved in natural resources management.

Social security was also one of the main functions of local institutions of shifting cultivators. They provide farmers with the social capital which they require for their livelihood. The hangvu in Manipur, a customary village authority were like in other shifting cultivation communities. The hangvu is comprised of chieftain and a council of clan elders

(Kherkhoff and Sharma 2006).The indigenous knowledge occupies an important place among the communities of shifting cultivators. The cultural norms, values, beliefs, and rituals also form an inseparable part of this knowledge. The indigenous knowledge covers a host of activities which includes land management, biodiversity conservation, water management, health care and medicines (Chin 2006). This indigenous knowledge has been developed through careful observation and experimentation by the community members through generations and are transmitted and passed orally or through experiential learning.

The land allocation is an unique characteristics of this society. The land allocation meant that the land is distributed to every family member of the village to eke out the livelihood by cultivating the allocated *jhum* plot. The allocation of plot is based on the family size. The size of the cultivation plot possessed by the family is based on the food requirement and the available labour in the family. The larger the family, more hands will be there to extend their help in the shifting cultivation plot. The land allotment exhibits slight variation among the North Eastern Region. For example in a village named Phuldangshai in Tripura adjoining Mizoram, village council decides the hillock to be selected for jhuming. The areas selected for jhuming in the village are classified into big, small and medium size ones. Similarly, families who are interested in jhuming are also divided on the basis of adult members. Within each category, lotteries are put and the land is allotted accordingly (Gupta 1994).

Distribution of land was based on the traditional institutions existing in the village. In case of Tripura's tribals, when the *jhum* activities were about to start, the group of headman from close by villages decides a meeting for the Ker worship. The institution of Ker worship exists in the Tripura tribals in which the group of villagers exercise their joint rights over a specific area they would *jhum* in a particular year (Gupta 1994). After the Ker worship, the individuals were free to choose any hillock he like. This was based on the number of family members he had. The labour support taken from other family for his work in his *jhum* plot has to be returned in terms of work days as much as was taken by him from others. In many villages of North Eastern India, the lands were divided into different *jhum* blocks (Kherkhoff and Sharma 2006). The *jhum* blocks were based on the shifting cultivation cycle. For example, if the shifting cultivation cycle were of 10 years, there will be ten *jhum* blocks and author further stressed that sometimes these *jhum* blocks have been named by the communities. The plot selection was slightly different in other countries. The selections of the sites in the phangzhing type of shifting cultivation in Bhutan were done by women as they manage the fields and crops (Kherkhoff and Sharma 2006). Further, there are certain norms and values followed in this *jhum* system. The shifting cultivators regard some patches of primary forest for religious and ecological purposes. Also, the shifting cultivators' village territory were not encroached by the outsiders. They respect and the violation of the rules and regulations posed by the society would harm the others with punishment (Rahman *et al.* 2011).

Social causes of shifting cultivation system

There were very few researchers who looked upon the causes of shifting cultivation system. Rahman *et al.* (2011) elaborated the underlying causes of the shifting cultivation. They came out with the revelation that older and non educated farmers due to their tradition have the tendency to practice shifting cultivation. The variables such as large family size and lack of opportunities of off farm earnings significantly increased the farmers' possibility to opt for shifting cultivation. The more investment and access to available credit increase the probability of permanent agriculture. The younger farmers with small household size decrease the probability to practice shifting cultivation. The farmers practised shifting cultivation as it gave relatively stable net cash flow each year. Further his logistic regression analysis revealed that tradition and custom play a decisive role for the continuance of shifting cultivation.

The study conducted by Gupta (1994) on the Jhumias of Tripura revealed that 50.47 per cent of the Jhumia households continue jhuming as a way of life but attributed that the economic compulsions force them to continue. Despite keenness of the central and state governments in promoting various shifting cultivation programmes, 73.77 per cent of the respondents reported that the government assistance given to them for giving up the practice was inadequate. Further, 60.46 per cent of the Jhumias expressed the need to find a supplementary source of income if the practice of jhuming had to be given up. It was also observed that as back as in 1982 itself, there were no core Jhumias i.e. Jhumias who entirely depend on *jhum* cultivation for livelihood. Since the Jhumias work as wage labourer and remain dependent on low income occupations to eke out their livelihood, their annual income were reported to be low.

Initiatives taken by the government to reduce the shifting cultivation in India

There are various initiatives taken for shifting cultivation. The hidden aspect behind many governmental programmes taken up under shifting cultivation is to eradicate shifting cultivation system (Mertz *et al.* 1999) and to move to settled cultivation system (Gupta 1994). In the 1950s and 1960s, ameliorative programme was introduced in which alternative land use system were adopted by introducing plantation crops like cashew nut, rubber, black pepper, and coffee in the Assam hill district, Garo hill district of Meghalaya and Mizoram. Subsequently, the Pilot project for control of shifting cultivation was launched by the Government of India during the fifth five year plan (1975-80). This was the first ever specific programme for controlling shifting cultivation in which each family was assisted with a ha of irrigated or unirrigated terraced land and one ha as developed plantation and targeted settlement of 1700 families practising shifting cultivation within a period of 3 years (Maithani 2005). Subsequently, river basin

scheme for control of shifting cultivation was initiated with eight pilot schemes by the North Eastern Council during the fifth five year plan period with a common objective of controlling shifting cultivation but the component varied (soil conservation, promoting terraced land for rice cultivation and promotion of horticultural crops) from state to state.

On the basis of experiences from the schemes implemented by the central and state government, the seventh five year plan formulated certain guidelines for controlling shifting cultivation (Ray and Kamukenthang 1997). As per the guidelines when the existing land under shifting cultivation were agriculturally productive and already well developed, *in-situ* settlement of shifting cultivators will be taken up. Further, the *ex-situ* settlement of shifting cultivators was to be carried out if it was not productive. This was taken up within the forest areas and denuded patches in and around the adjoining villages. It advocated the component of forestry, animal husbandry, village and small industries units besides providing much needed community and social services. The task force on shifting cultivation programmes implemented by North Eastern Council and the state government reported that in the first phase there was no concentrated effort and secondly in several cases the involvement of the target group was totally absent (Maithani 2005).

After this task force report, model schemes were introduced with 100 per cent financial assistance, taking the important elements from the earlier projects. It concentrated on both young and older generations. For older generations the technologies like terracing, cash crop plantations, supply of agricultural inputs, livestock were introduced. The vocational training for the development of non-farm skills was introduced for the youths to wean them away from *jhum*. Emphasis was given on infrastructure creation for community development. A group of 25 Jhumia families or so in a village or hamlet constituted the basic unit of development. The midterm review of the model scheme in 1989-90 suggested adopting holistic approach rather than group or family units promoted under the scheme (Maithani 2005). Subsequently, the Watershed Development Project for Shifting Cultivation Area (WDPSCA) was introduced from 1995 to 2012 with 100 per cent financial assistance from the central government with a holistic development and emphasized the soil and water conservation measures in the shifting cultivation area. Further, the National Mission on Greening India 2010, implemented by Ministry of Environment and Forest has proposed different activities for rehabilitation of shifting cultivation areas. The mission lays emphasis on fast growing species used by the community (Deb *et al.* 2013). Nowadays in case of Manipur, no separate project is being implemented in shifting cultivation areas. But, WDPSCA has been subsumed in Rashtriya Krishi Vikas Yojana and is being implemented as a part of the Project. Further, through North Eastern Council, NERCORMP (North East Region Community Resource Management Project) is working with the shifting cultivation farmers through formation of natural resource management group and other livelihood improvements of the shifting cultivation farmers since 2000 in various states of North East India.

Sustainability, livelihood and food security of the Jhumias

The sustainability level of *jhum* has been operationalized by the author as the extent to which the tribal people practice *jhum* that are less specialized farming, requiring mixed crop livestock farming, with minimum/ no dependency on outside inputs that provide basic need of the farm family (Dutta *et al*. 2014a). The study of Tripura farmers revealed that the 42.14 per cent of the farmers perceived sustainability level of the *jhum* as medium followed by 36.43 per cent as low and 21.43 per cent as high. It was found that to improve sustainability; the farmers need to be supported by other enterprises like dairy, poultry, piggery, sheep and goat rearing. This will enable farmers to improve their socio-economic condition and further this diversification will naturally promote sustainable *jhum* by way of providing organic manure through recycling of farm wastes.

The livelihood status of the tribal farmers is operationalized as the status of the tribal farmers with reference to capabilities, assets, activities and coping strategies to overcome stress for *jhum* cultivation to ensure livelihood security (Dutta *et al.* 2014b). Analysis of livelihood status of the Tripura shifting cultivation farmers revealed that in case of natural assets, 72 per cent of the farmers were satisfied that a livestock unit provides guaranteed additional income to the farmers. Further, 84 per cent of the farmers were highly satisfied with the ability to call on friends or neighbours at the time of need and the 88.58 per cent is highly satisfied with reference to social assets. In case of human assets, 100 per cent of the shifting cultivators were highly satisfied with the quality of the labour available at the household level. In case of financial assets, 100 per cent of the shifting cultivators were highly satisfied that they had sufficient access to common property resources. However, the overall livelihood status revealed that 39.3 per cent of tribal people practising *jhum* had low livelihood status, followed by 36.3 per cent had medium livelihood status and 24.3 per cent had high livelihood status. Area under *jhum* and number of family members involved in the *jhum* had positive significant relationship with the livelihood status (Dutta *et al.* 2014b).

The conservation of germplasm among the shifting cultivators was found to exhibit a relation with the farmers' livelihood and food security. In Tuensang of Nagaland, shifting cultivators maintain good breeds of crops and live stocks in their field to conserve germplasm. They used to grow wide variety of food crops that are nutritious, tasty and had the custom to maintain crops throughout the year for food security. They took due care to conserve seeds so that seeds are never lost and it was exchanged from farmer to farmer and village to village. Genetic diversity was maintained among the shifting cultivators through intricate seed exchange and conservation measures. Further, the bamboo and cane were the main products which gave

livelihood importance to the shifting cultivators. The mithun raised in Khonomos forest of Nagaland was also an important source of livelihood (Kherkhoff and Sharma 2006). The matured mithun of 3 year old would cost ₹ 40 000 to 45 000 at market price of 2016. Further, mithun becomes a symbol of status and is slaughtered during wedding occasions. Hence, raising mithun has become an important source of income with less labour.

Shifting trend and social impact in shifting cultivation

The transition in approach was noted in recent years by emphasizing that nomenclature of shifting cultivation/ slash and burn by its name connoted negative approach instead this could be named as rotational agro-forestry/ agro-forestry with a burn cycle or a form of forest gardening (Kherkhoff and Sharma 2006). With an objective to improve the shifting cultivation in the eastern Himalayas (Bangladesh, Bhutan, India, Nepal, Myanmar), a study was taken up with the ICIMOD initiative funded by International Fund for Agricultural Development. It came out with the recommendations in the workshop on "shifting cultivation regional policy dialogue workshop for the eastern Himalayas" held in October 2004 at Shillong, India and subsequently it was named as Shillong declaration which tried to look shifting cultivation in a positive perspective. Further, shifting cultivation has been portrayed as cause of deforestation. The Food and Agricultural Organization defines deforestation as "transfer of forest land into non forest uses" and shifting cultivation makes temporary use of forest land unlike permanent agriculture system, human settlements, dam construction (Fox 2000).

The transition in shifting cultivation was also observed by few researchers in various countries. Fox *et al.* (2009) observed that there were transitions from rural to urban livelihoods in South East Asia. The reasons for transitions were shortage of land, employment opportunity for youth in urban centers or in the coast and inability of the farmers to depend only on shifting cultivation for livelihood. Similarly, Cramb *et al.* (2009) also pointed out that shifting cultivation was disappearing because of population decline. Moreover, he observed that many young people temporarily or permanently leave their villages to seek jobs in cities. This in turn reduces the labour force required for shifting cultivation. Also, the variable education contributed for the abandonment of shifting cultivation.

The Table 1 illustrates that in the state of Nagaland of India, the current *jhum* is increasing and in case of Tripura it shows the decreasing trend. The per cent change is higher in the state of Manipur, Tripura compared to 2005-06. It also reveals that, the states like Manipur and Tripura may have contributed for diversification in terms of non-farm, off- farm and farm activities which may be responsible for reduction of current *jhum* in Manipur and Tripura.

The total area under *jhum* in Manipur was reported to be 85220 ha in 2005-06 and subsequently decline was also reported to 47163 ha in 2008-09 (GoM 2015). The total area was 137970 ha for the period 2014-15. The data reported exhibits huge variation. Such variation has been reported not only in India but in other countries also. Country by country analysis shows that both area under swidden and the number of people dependent on swidden are largely unknown and the data from each country are highly variable (NRSC 2011).

The shifting cultivators cultivating crops only for subsistence is rare and diversify to other crops and other off farm opportunities due to risk in cultivating upland rice, population pressure, reduced fallow period (Mertz *et al.* 2005). The case studies were conducted in Bangladesh, Cambodia, India, Indonesia, Laos, Nepal and Thailand to know the changes in livelihood and food security among indigenous shifting cultivation communities in South and Southeast Asia by the FAO under the project 'Regional Support to Indigenous Peoples for Livelihood and Food Security'. The findings of the study revealed that, shifting cultivation not only gave economic security but also a cultural identity with rituals and festivals revolving around it. Further, it was also reported that livelihood in indigenous communities became more diversified partly because of necessity and partly because of choice. The factors like scarcity of land, market integration, education, and mass media played an important role for the livelihood preferences especially among youth (Patel *et al.* 2013).

Table 1 *Jhum* lands in NEH Region of India

States	Current *jhum* (sq. km)			Abandoned *jhum* (sq.km)		
	2005-6	2008-9	Change	2005-6	2008-9	Change
Andhra Pradesh	1025.07	961.04	-64.02	506.39	1078.52	572.13
Assam	160.15	258.86	98.71	79.41	136.33	56.92
Manipur	752.10	270.31	-481.79	100.10	201.32	101.22
Meghalaya	291.87	272.52	-19.35	157.12	268.11	110.99
Mizoram	1028.53	612.71	-415.82	1589.03	1049.37	-539.66
Nagaland	1239.09	1514.95	275.86	1588.65	842.47	-746.18
Tripura	89.28	33.20	-56.08	164.83	68.99	-95.84
North Eastern Region	4586.09	3923.59	-662.49	4185.53	3645.11	-540.42

Source: Wastelands atlas of India, 2011

Strategies to improve jhum, conserve natural resources and livelihood of the Jhumias

Diversification of land use practices for both subsistence and commercial need has been reported in shifting cultivation areas. The cases observed were combination of agro-forestry with shifting cultivation (fruit and cashew orchards in Cambodia, rubber gardens in Indonesia), incorporation of high value crops in shifting cultivation fields (herbs, ginger, turmeric- India, Bangladesh), establishment of permanent fields for cash crops like tobacco, corn, pine apple, vegetables (Thailand, India, Bangladesh) and improved fallow management through domestication of wild plants and trees that were in high demand and change of crops to market demand were noticed among the Nagaland shifting cultivators community (IWGIA 2014). Further, the research portrayed that "shifting cultivation is to be accepted as a rational land use system" and that author calls for green revolution in shifting cultivation area to bring intensive and sustainable production (Mertz *et al.* 2008). The farmers should be educated to enrich the biodiversity of fallows and to increase the soil productivity to avoid the problems of shortened fallow periods and new policies to be designed to protect the land of shifting cultivators (Fox 2000), as in India shifting cultivation has been recognized under wasteland category (NRSC 2011).

The major constraints in shifting cultivation are remoteness, jurisdiction (lack of convergence of stakeholders), land tenure system (example ownership is with Husa Pu of the Kukis in Manipur, who is a proprietary landlord having sole decision making power through the traditional clan-based institution of Khwasung Upa) and transitory land use. Inspite of above constraints, the following strategies may be implemented to improve jhum cultivation.

Institutional initiative

The following institutional transformation is required for improvement of *jhum.*

- The researchers, state governments and other stakeholders involved in *jhum* should strongly create awareness on "*Jhum* improvement" from the present understanding of "shifting cultivation as destructive" form of *jhum*.
- The shifting cultivated land may be transformed from liabilities to assets, because tribal family's lives resolve around the *jhum*.
- Frequent interface meeting of the line departments-research institutions-NGOs-Stakeholders to take stock of the situation and discuss various options/development programmes on *jhum*.
- The schemes which have existed for shifting cultivation had a hidden agenda of *jhum* eradication than livelihood improvement of *jhum*. Hence, a suitable scheme in a mission mode should be implemented for the livelihood improvement of Jhumias and their *jhum* based on the location specific needs and willingness of the community members rather than specifically *jhum* improvement. Since *jhum* is indispensable, synergy among the departments/research institutes/universities for convergence of available programmes (RKVY, MNREGS, NWDPRA, HTM MM-2) in a holistic manner should be taken up for improvement of the existing systems.
- Strengthening the existing government policy and action on *jhum* regulation and forest policy involving local people/village development council without any prejudice.
- There is absence of uniform land use or *jhum* policy. The need for proper planning of land use and conservation of resources is a very important issue in shifting cultivation.
- The customary laws of the community govern the ownership of land and individual rights with constitutional sanction. Reforms with regard to allocation of ownership of land are needed through introduction of new government policy. While doing so, sentiments of tribal community should be given priority.
- There is an urgent need for evolution of proper strategic plans and policies based on reliable and sound data based upon land records to find compatible land uses for *jhum* land management.
- Cadastral surveys have been conducted to ascertain the exact extent of lands under *jhum* cultivation. The data on *jhum* lands available in the public domain from various sources appears to be contradictory. Use of geospatial tools with ground truth survey is urgently needed to find out the exact extent of *jhum* lands in the North East.
- Recent data on number of families involved in *jhum* is not available. Data available in public domain from various sources is contradictory. Family survey is needed to gather relevant information and data on the existing situation of families involved in *jhum* cultivation.
- Participatory land use planning and fallow management is considered essential for the long term ecological sustainability of *jhum* lands, especially in areas where soil erosion has led to decline in crop yield threatening local food security.
- *Jhum* continues to be addressed by adhoc schemes and programmes with serious limitation because of both financial coverage and technical capacity. Schemes/programmes should focus integrated vision about the ecological viability of the options and alternatives and their co-relations with the food security and cultural ethos.
- Initially, when the shifting cycle as much as long was 20 to 30 years, the process worked well (Singh and Bag 2002). However, with increase in human population and increasing pressure on land, shifting cycle reduced progressively (4-5 years) causing problems of land degradation and threat to ecology of the region (Kleinman *et al.* 1996, Ramakrishnan 2003). Hence, suitable model involving multidisciplinary scientists in a participatory mode should be carried out involving community members for the livelihood improvement of Jhumias. This will help people who are willing for

transition from *jhum* to other livelihood options which will in turn reduce the pressure on *jhum* land as well as for Jhumias who want to pursue *jhum* as a livelihood.

- Those Jhumias who are willing for transition from *jhum* to other livelihood options should be trained with the various technologies by different stakeholders. The technologies released for *jhum* cultivation have to be tested through on-farm trials by Krishi Vigyan Kendras in India for the location specific suitability and modification of the technology.
- Moreover, access to better market opportunities and accompanied infrastructure such as cold storage facility should be planned to promote entrepreneurship as an alternative to subsistence farming.

Technological transformation

The current *jhum* adversely affects soil fertility of *jhum* fields due to soil erosion, loss of organic matter and leaching of plant nutrients. Studies on steep slopes (44–53 %) have indicated soil loss to the tune of 40.9 t/ha, and corresponding nutrient losses per ha are 702.9 kg of organic carbon, 63.5 kg of P and 5.9 kg of K (Ram and Singh 1993). Soil loss can be suitably minimized through adoption of soil conservation measures such as contour trenches, contour bunds, vegetative bunds, grass water ways etc. Introduction of leguminous cover crops in current Jhum field will minimize soil loss, improve soil health, suppress weeds, provide food to human and feed to animal besides adding cash incomes (Sahu *et al.* 2005, Bhadana *et al.* 2013, Baishya *et al.* 2016, Ansari *et al.* 2017). Bio-terracing of *jhum* fields with fast growing hedgerow species like *Tephrosia candida, Crotalaria tetragona, Crotalaria juncea, Indigofera tinctoria, Flemingia macrophylla* and *Cajanus cajan* has scope for minimizing soil loss and improving the productivity of the soil of current *jhum* fields. However, cultivating various hedgerow species even in *jhum* field could be better option for them as these species have short gestation period. Barrier crops alone reduced soil loss by 94% and run-off by 78% (Saha *et al*. 2012). When twigs and tender stem of hedge plants are used for mulch, it conserved 83% of the soil and 42% of rainfall. The soil loss was reduced by 22% with the incorporation of hedgerow species in the *jhum* fields compared to traditional *jhum* site (38.14 t/ha/yr) (Saha *et al*. 2012). Among the hedgerow species, *C. tetragona* enriched the soil fertility more efficiently as it accumulated higher amount of total N, P and K (79.74, 11.03 and 37.46 kg/ha) through its leaf incorporation. The recycling of bases in litter of hedgerow could potentially counteract the acidification (Laxminarayana *et al.* 2005). Despite having heavy monsoon rainfall in North East region, there is acute shortage of water in winter months. Construction of low cost micro water harvesting structures with minimum seepage and evaporative losses (Jalkund 30 000 to 50 000 l capacity) depending on availability of suitable space in sloppy land will be a viable option for life saving irrigation of crops. Harnessing perennial spring water in *jhum* areas, through diversion channels may hold promise to overcome the water scarcity problem in *jhum* fields. *In-situ* conservation of soil moisture through organic mulch may be one of the ideal options. Forest biomass of adjoining *jhum* field may provide source of availability of organic mulch. Vegetative barrier with hedge row species in *jhum* field may provide alternative source of biomass for organic mulch. Adoption of Alder based *jhum* system, wherever possible, should be encouraged because it is an outstanding model of sustainable land use system for hilly ecosystem and has been evolved through numerous years of testing. Alder based *jhum* fields are managed typically in four year cycles, with two years of cropping between the alder trees fallowed by two more years while the soil is rested and the coppices allowed to grow.

Soil fertility exhaustion is the main reason for the rotation of the land in *jhum* lands. Adoption of cover cropping, introduction of legume in cropping system, carbon management through manure/compost application, green manuring etc is required to improve the soil fertility. The SALT approach (Sloping Agriculture Land Technology) when suitably adapted to the local conditions has the potential to offer the hill tribes with an alternative method of agriculture, which while being climate smart, will also provide the farmers with a means of sustainable livelihoods. Soil and water conservation through adoption of site specific land use systems, viz. horticultural based land use system, horti-silviculture based land use system, agri-horti-silvi-pastoral land use system, agro-forestry based land use system etc. Agro-forestry has been a long-standing custom in the region, where cereals, rhizomes, pineapple, coffee, tea, spices and vegetable crops are grown along with fruits and other trees such as pine, pear, plum, arecanut, mandarin, guava, coconut, jackfruit, banana and large cardamom with alder trees. Creation of micro water harvesting structures in steep hill slope of *jhum* fields is difficult for rain water harvesting. Adoption of rice cum fish integrated farming system developed by Apatani tribe of Arunachal Pradesh in abandoned *jhum* lands with terracing should be encouraged. Integrating aquaculture with agriculture assures higher productivity and year round employment opportunities for farmers. Introduction of secondary agriculture activities like mushroom cultivation, bee keeping, food processing etc. may introduce especially for landless Jhumias.

Role of the government in the concerned states would need to work in collaboration with Jhumias and the organization involved in Jhum improvement programmes (viz. NGOs, ICAR institutes, SAUs, CAU, Forest Department, village level committees, NERCORMP etc.) to mitigate potential deleterious effect to the ecology rather than prevent shifting cultivation per se.

- To constitute a committee for formulating plan for the management, protection and conservation of land, forest and biodiversity within the village.
- Formulation of a uniform state land use policy.
- Strengthening policy interventions to improve subsidiary income generating avenues of *jhum* farmers.
- Institutionalization of the concept of Participatory

Land Use (PLUP) using the legal provisions within the village empowerment laws that also recognize customs and customary institutions.

- Watershed development project/schemes in shifting cultivation areas.
- Clear identification of *jhum* improvement schemes with bottom up approach.
- Access to better market opportunities and accompanied infrastructure such as cold storage facility should be planned to promote entrepreneurship as an alternative to subsistence farming.
- Initiative to organize intensive capacity building programmes for all stakeholders to enable smooth implementation of participatory land use planning.
- Constitution of a technical committee involving all line departments at the district level to provide requisite inputs to the farmers through village level committee on land use.
- To achieve long term *jhum* Improvement and subsequent rehabilitation of Jhumias, ICAR has emphasized to take initiatives on participatory and convergence approach, location specific and farmers' centric approach, new land use policy for all NE states, incentives and financial support from Government of India, special subsidy to Jhumias of NE Region of India.

Conclusion

The various studies, reports revealed that shifting cultivators' community is embedded with unique, rich socio-cultural characteristics. It is also observed that there is a transition taking place in the various countries in varied form from subsistence based system to dual economy in the shifting cultivation dependent communities. The trends in shifting cultivation though depict some patterns of change but it is very difficult to predict the exact change as the data are highly varied from government records, wasteland atlas and various researchers' data. There is a need to have a reliable data for the researchers to work on different aspects on *jhum*. Hence, in the population census which is decadal and for the north eastern hill region a question of "are you depending on *jhum* for your livelihood" will help to identify accurately and may give the accurate picture which would be helpful for the policy makers, academicians and other interested stakeholders who would work for shifting cultivators' community. Further, apart from the above strategies mentioned in the discussion, the existing rural development programmes, forthcoming programmes should take into consideration the richness of the cultural and social aspects of Jhumias before implementation of any programmes for livelihood improvement of Jhumias by different stakeholders.

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