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Shifting cultivation, climate change and environment poverty nexus: an anthropological study among tribal communities of odisha, India

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Abstract
Shifting cultivation, variously known as rotational bush-fallow agriculture, swidden cultivation or slash-and-burn cultivation is an ancient form of agriculture practiced in hilly terrains, mostly by the tribal communities of India. Recently, two major issues are debated for this agricultural practice; firstly, its impact upon the environment contributing to climate change and secondly, adaptation to climate change of the practitioners of shifting cultivation. The present paper examines the nature of shifting cultivation and its role in climate change in Koraput region of Odisha, which is known for its ecological wealth or genetic prosperity coexisting with poverty. Though there is less literature on emission of green gases from this anthropogenic source in this region, some studies have observed huge emission of CO^2 from the burning of biomass of shifting sites, causing deforestation, lowering soil fertility, degradation of quality and quantity of water flow, soil erosion and ecological disturbances. The hill slopes with reduced shifting cycles was found to be prevalent. In addition, there is reduction of "*rasa*" (nutrient content) in water due to hillside degradation. According to villagers, it is due to absence of fertilizer usage and consequently less nutrient flow from hillsides. Secondly, this paper critically examines the importance of shifting cultivation for tribal livelihood, which provides food security for 4-5 months (September-January) for the tribal communities. Since the nature of the agricultural practice is labour intensive and not technology intensive, it can be argued that it is significant for conceptualizing sustainable development. This paper also advocated for the role of spatial approach- adaptation to climate change and implications of environmental and poverty programs in bringing the environment-poverty nexus closer to the climate change agenda.

Keywords: climate change, shifting cultivation, sustainable livelihood, adibasis

Introduction

Shifting cultivation is a primitive system of agriculture, the first step in transition from food gathering and hunting to food production is nearly 9000 years old practice believed to have started during Neolithic period. This is extensively practiced by the indigenous communities throughout the tropical and subtropical region of Asia, Africa, South America and Australia. Shifting cultivation has been interpreted as an economically inefficient and ecologically destructive form of agriculture (Concklin, 1954) [6].

In India, the environmental and agricultural policy practitioners have tried to give an alternative livelihood to the practitioners of this so called "unethical", "anti-environmental", "anti-developmental", "anti-social" primitive form of agriculture. Recently, shifting cultivation is viewed as an inflexible static system, ill-suited for adapting to modernity, slows down agricultural production and causes ecological degradation (World Bank, 1992) [38]. The existing literature revolve around two major issues; firstly, to investigate the inextricable relationship between Population, productivity and deforestation. Shifting cultivation and poverty has a vice versa relationship. Under the most recent policies of the Ministry of Agriculture and Forestry, four targets were identified for a sustainable livelihood among the practitioners of shifting cultivation; ensuring food security, Commercialization of agricultural productions, stabilization for poverty reduction and sustainable forest management (Das, 2006) [7]. On the other hand, anthropological and sociological interpretations have seen this agricultural practice as a tradition and basic for the livelihood of a community. The practitioners have the better understanding of the environment than others and thus, nothing to do with environmental issues associated with it (Pelzer, 1945; Wettess, 1960; Concklin, 1954) [26, 6]. Therefore, the climate change agenda needs to examine the environment-poverty nexus as well as adaptation to climate change among the practitioners of shifting cultivators worldwide.

Aims and Objectives

The present study is an anthropological study among the Most Vulnerable Tribal Groups in Koraput district of Odisha to sort out three major objectives:

1. To examine the nature of shifting cultivation and its contribution to climate change,
2. To critically examine the importance of shifting cultivation for tribal livelihood, which provides food security for 4-5 months for the tribal communities and
3. To advocate for the role of spatial approach- adaptation to climate change and implications of environmental and poverty programs in bringing the environment-poverty nexus closer to the climate change agenda.

Material and Methods

The present study is an in-depth study having multiple approaches like anthropological, historical and ecological

Approach and methods to bring out the linkages contribution of shifting cultivation in environmental pollution, poverty and sustainable development among the MVTGs of Koraput district in Odisha. The study was undertaken within social and cultural context and an extensive fieldwork was conducted. To fulfill the objectives of the study, it used participant observation, observation, secondary literature and interview schedule for the collection of different aspects of shifting cultivation and livelihood.

Results and Discussion

Shifting Cultivation: Extent and Economic Context

As different from settled cultivation, shifting cultivation involves traditionally established conventionality and rituals. It is generally practiced in the following sequence: 1.selecting a forest patch and clearing the vegetation normally in December and January, 2. burning of the vegetation (without stumps and roots) in February and March, 3.sowing of seeds, by dibbling, generally of cereals, vegetables and oil seeds in April–May, 4. Continuing cultivation for few years and 5. Abandoning the cultivated site and shifting to other forest sites and returning to the former site, and once again practice shifting cultivation on it.

In India, about five million tribal families are practising this system on 4.37million hectare of land covering 11 states. The state of Odisha has the highest amount of land under shifting cultivation in India (Table 1 & 2).The estimated area under shifting cultivation ranges from 5298 to 37,000 sq. kilometres. The differentials are due to non-recognition to it as a valid land use pattern, declaring it as forest land and encroached land during different survey settlements since the colonial period. For instance, the Forest Enquiry Report, GoO, 1959 reported that 3,07,2000 hectares land is under shifting cultivation. However, during the Survey and Settlements, these lands were categorized as government land, with no recognition of tribal rights over it, either individual or collective. Again, the Indian Forest Act 1927 (Sec.10) declared these as reserve forests. Since no law recognizes the shifting cultivation land-use and the rights of tribal people over these lands, the tribal communities have been effectively alienated from these vast areas. As Roy Burman Committee Report mentions, "A Policy decision of the Government, as a result of which the preparation of Record of Rights turned into denials of rights which were enjoyed by the concerned population for generations" (Viegas, 1991) [37].

Table 1: Shifting cultivation in different states of India

State	Tribal Families (Million)	Total Area (Million hectare)
Andhra Pradesh	0.11	0.15
Arunachal Pradesh	0.43	0.21
Assam	0.31	0.31
Bihar	0.23	0.19
Madhya Pradesh	0.19	0.38
Manipur	0.36	0.26
Meghalaya	0.61	0.47
Mizoram	0.40	0.19
Nagaland	0.19	0.12
Orissa	2.00	1.60
Tripura	0.19	0.49
Total	5.02	4.37

Source: Shifting cultivation in India, ICAR, 2017

Table 2: Estimates of area under shifting cultivation in Orissa

Source of Information	Estimates of area under shifting cultivation in Orissa
FSI, 1999	5,29,800 hectares under active shifting cultivation in the yearof Survey
N.Pattnaik, 1993	37,00,000 hectares of shifting cultivation area
A Decade of Forestry, GoO, 1995	2649000 hectares of shifting cultivation
Forest Enquiry Report, GoO, 1959	3072000 hectares of shifting cultivation approximately

In Odisha, this form of agriculture has been a source of livelihood for several tribal communities like *Kondhas*, *Kutia Kondhs*, *Dongaria Kondhs*, *Lanjia Sauras*, *Parajas*, *Godabas*, *Koyas*, *Didayis*, *Bondas*, *Jhangs*, *Pauri Bhuyans*, *Perangas*, *Erengas*, and *Kolhas* covering 119 Blocks in Kalahandi, Koraput, Kandhamal and other southern and western districts. One study by OTELP (2007) [22] found that shifting cultivation provides food security for 4-5 months to the tribal families in four districts; Kandhamal, Kalahandi, Koraput and Gajapati of Odisha (Table-3).

Table 3: Area under Shifting Cultivation by Households (Ha)

District	Area under shifting cultivation per HH	Type of crops grown
Gajapati	0.52	Millets, pumpkin, pulses
Kalahandi	0.47	Millets and pulses
Kandhamal	0.60	Millets, pulses, turmeric, vegetables
Koraput	0.55	Millets, pulses, pumpkin

Shifting Cultivation and Environmental Sustainability

Shifting cultivation has an immense impact upon the environment in the form of emission of CO^2 due to burring of biomass, deforestation, reducing soil fertility, degradation of quality and quantity of water flow, increasing soil erosion and ecological disturbances. Though there is less literature on emission of green gases from this anthropogenic source in this region, some studies have observed huge emission of CO^2 from the burning of biomass of shifting sites contributing to climate change. The burning of secondary vegetation in shifting cultivation releases CO^2 and other trace gases to the atmosphere. If the shifting cultivation system is in equilibrium, carbon dioxide released by fire will be reincorporated into the secondary vegetation biomass re-growing in the fallow areas that make up the system and will not therefore contribute to variation in the atmospheric CO^2 concentration on longer time scales, while the other trace gas emissions will represent a net addition to the atmosphere (Fearnside, 2000; Lehsten *et al*., 2009) [12, 18]. Tripathi and Barik (2003) [35] observed negative impacts of shifting cultivation in the North-Eastern states in the form of environmental degradation, loss of soil nutrients and useful soil fauna and microbes. Besides causing air pollution due to burning, burning of slash lowers soil fertility, organic matter and total nitrogen but enhances phosphorus and captions.

The shifting cultivation cycle has been reduced from 20-30 years to 3-5 years, which has two major impacts; firstly, it caused fragmentation of habitat and disappearance of native species including invasion by exotic weeds and secondly, it reduced recovery of soil fertility, and the nutrient recycling by the ecosystem including creation of forest-canopy gap (Rajiv Ranjan

and Upadhyay, 1999) [27]. During field study, reduced shifting cycles was found to be prevalent in the hill slopes. This has led to degradation of hillside vegetation, increasing soil erosion and scarcity of forest products. According to villagers, the degradation of hillsides has affected both the quality and quantity of water flow. In absence of fertilizer usage, the lowland as well as medium land depends on the nutrient flow from hillsides and villagers pointed out that there is reduction of "*rasa*" (nutrient content) in water due to hillside degradation. The streams also carry more coarse silt, which affects the *Jhola* (land between hills and plain area) land through sand casting.

Shifting cultivation is also responsible for destruction of rich forest cover, degradation of land through soil erosion and decreasing the availability of floral waste. The presence of a good forest cover used to enrich the soil fertility and affecting the catchment areas of rivers and hill streams in a number of ways. It increases rainfall, ground water level, siltification and consequent burial of river channels due to soil erosion (Chin, 1985) [4]. For instance, the forest cover of Odisha shows that it has been drastically reduced during the last fifty years; from 65868.9 sq. km. in 1962 to 57184 sq.km. in 1997 (Forest Survey of India, State of Forest Report 1997, p.29). In the tribal dominated districts it reduced from 25760 sq. km. In 1993 to 25424 sq. km. in 1997 (State of Forest report, Govt. of Orissa, 1997). The loss of forests has drastic general and species specific effects upon flora and fauna. The invasive weeds have entered the deforested areas, which do not allow regeneration of forest crops. It has reduced the availability of forest tubers, bamboo and minor forest products. Few commercially important plant species like *khandakhai* (*Litseamonopetala)* and botanically important species like *Gnetumscandense* is almost extinct from the forest.

Shifting Cultivation, Poverty and Social Sustainability

Several studies have found that that shifting cultivation is not merely an agro-economic activity; it is an integral part of the socio-cultural processes. Conklin at.al. (1954) outlines the ecological dimensions of shifting cultivation in relation to environmental, cultural and temporal axis to justify the sustainable utilization of land use by the tribal communities. The practitioners do not seem to have any emotional attachment to the land as an asset or property needing care and attention. For them, land means livelihood and their culture is built upon it. In the deep forest and hilly areas, shifting cultivation is the only system of cultivation due to lack of sufficient plain land, access to credit and extension. Presently, shortening of cultivation cycle has been a major challenge.

In a study among the Sherpas in Eastern valley of Nepal, Dhakal et.al (1990) [8] found that shifting cultivation or *khoriya* or *Sherpa* is practiced in a slate of balance with the natural environment and productive, practical and adaptive to the physical environment (as observed by Spencer in 1966) [32], it fits to the practitioners' history and culture and economically sustainable because it is highly labour intensive and land extensive form of cultivation. They change the cultivation field in every 12 years based on movement animals and environmental considerations. For example; they are not allowed to clear *khoriya* plots during spring and summer, because wood they are cutting and slashing is against their religion. Thus, agricultural activities are controlled by space, time and religion. In India, though shifting cultivation is a primitive form of agricultural practice, still it is a source of livelihood of majority of tribal communities in India. In a study in North-East India, (Rathore, 2010) [29] found that it contributes to good outcomes as well as keeping the soil nutrient along with *alder* biomass enriched. Tripathi and Barik (2003) [35] observed that shifting cultivation has positive aspects like it helps conserve the rich cultural diversity of more than 2000 tribes those inhabit the north-east region; It being a labor intensive and low subsidy based farming system, provides an assured source of food security to the sustenance level farmers; it represents an effective form of land use by way of optimum utilization of space, where as many as 60 varieties of crops are cultivated at a time in the same plot and it also provides the low external input agriculture technologies. This agricultural practice has the potential for social sustainability as it is not labour intensive, but managed by a group of friends, relatives or community to form reciprocal labour group, and work in each other's field and by turn on the day work is done on a particular field, the owner of that field is required to serve mid-day meal to all. In a study among the indigenous communities in Meghalaya, jeeva et.al (2006) [17] found that traditional farming systems are not practical for mass food production, but account for a substantial amount of local food production. It is sustainable as it helps in improving soil fertility through decomposition of plant material left on soil. Farmers prefer the bamboo drip irrigation system because of its feasibility and no loss of water on the way. In the state of Odisha, 0.53 million ha is under active shifting cultivation on which 150 thousand households are dependent. It is legally prohibited inside RFs and PFs, but allowed in other unclassified forests with the permission of Revenue Department. However, the practice is quite prevalent even inside RFs and PFs despite initiation of punitive action by the Forest Department.

Shifting cultivation in-between environment and livelihood

Historically, shifting cultivation has been an issue in-between livelihood and forest conservation. Since the colonial period, the first impression of the policy makers is that the practitioners of shifting cultivation are major culprits of destruction of valuable hill forests and it is necessary to declare this practice as a criminal act to protect and conserve forests. During colonial administration, while advising the feudatory chiefs to take steps against the destruction of forests in their states, the Superintendent of Orissa Tributary Mahals in his letter dated 27-02-1872 mentioned *Toila* (shifting cultivation) as the number one chief cause of useless destruction of timber, and said "The profit derived from such cultivation is very small to the ryots and generally little or nothing to the Rajah or Zamindar. Rajas should not interfere in existing cultivation lands but no new land should be cleared where timber is available (quoted in Rath, B.2005, *Aspects of Garjat Forestry*, pp.51-52) [28]. However, it could not be done because the affected people could not just grasp this kind of restriction as their culture and livelihood was centered round shifting cultivation and they were not in a position to visualize life without it. The two major reasons of failure to stop shifting cultivation were that, firstly, in its ideal nature shifting cultivation is a technique for the utilization and development available/reclaimable land for cultivation under unfavourable geographical conditions. The Inspector General of Forests, GoI rightly said in 1953 that 'jhuming'(shifting cultivation) not as an evil practice but as an agricultural practice evolved as a reflex to the physiographical character of land. It is a mistake to assume

that Jhuming in itself is unscientific land use. Actually it is a practical approach to certain inherent difficulties in preparing a proper seed bed on steep slopes where any disturbance of hoeing or ploughing will result in washing away of the fertile top soil. The tribal people therefore take care not to plough or disturb the soil before sowing. The destruction of weeds and improvement of tilth necessary for a proper seed-bed are achieved with the help of fire. Seeds are dibbled ahead of monsoon so that these may not be washed away and this produces a light cover of protective vegetation, which reduces erosion of soil when heavy rains begin.xxx" (quoted in GoI, *Report of the Committee on Special Multipurpose Tribal Blocks., 1953*). Secondly, it is the 'civilised people' of the plains who have deprived the tribals of their resources and have forced them to search for an alternative place of sustenance in the hill-forests, thus leading to shifting cultivation. In 1872, Special Assistant Agent of undivided Koraput district admitted that "While civilisation pushes back xxxx the hill tribes into the yet unconquered jungle, they commence upon it by felling and burning virgin forest on the side of the hills' (quoted in Bell R.C., *Orissa District Gazetteer: Koraput*, p.104, 1945) [2]. Hence, as the Committee on Special Multipurpose Tribal Blocks observed in 1959, "The tribal is criticised for unauthorised felling of trees in forest areas for shifting cultivation, but he does so because of unsatisfied land hunger." (*Report of the Committee on Special Multipurpose Tribal Blocks*, p.44).

Poverty due to shifting cultivation and vice versa

The practice of shifting has direct consequences to insecurity of land rights, land alienation and poverty. The land they are cultivation is not in their legal possession, hence prone to alienation through forceful dispossession, tactful dispossession, flaws in the government policy on land settlement and unlawful reservation of their village lands as forests. Thus, insecure livelihood in tribal areas has had various trends in the manifestation of its impact on poverty; violent conflicts, social disruptions, lack of access to infrastructure, lack of access to basic environmental services, education and health (The Samaj, 2003; *Kalahandi District Gazetteer*, 1980; Chinara, 1990 and Elwin, 2002) [34, 5, 11].

The incidences of violent intra and inter-conflicts among tribal communities, tribals with the government and tribals with the outside settlers due to shifting cultivation are of 200 years history in Odisha. The Saoras of Jerangamutha in the Parlakhemundi hills had violent confrontation with British government in 1912 due to cut of reservation of the local forests (Elwin, 1945). Recently, there were bloody conflicts between the Kandhas and the Panas in the Phulbani district, the latter being accused by the former of exploiting them in a number of ways including alienating their lands. The tribals of Kashipur confronted with the administration when the govt tried to alienate their lands to a mining company and three protesters were killed in the incident. In Kaudiguda and Chaulamindi villages of Mathili block in Malkangiri district more than 400 tribals had the violent conflict (*The Samaj*, 16-11-2003) [34].

Historically, the practitioners of shifting cultivation have faced social disruptions due to ill survey and settlement principles of the governments. The survey and settlement principles adopted by the government do not recognize community ownership over land and encourage individual ownership, which has not been very beneficial for the hill-tribes so far their resource utilization is concerned. In Bonda hills of un-divided Koraput district, every *Salap* tree in the village belongs to some individual and being regarded as the most valuable private property, can be mortgaged but once made so, it can't be got back. Many conflicts and murders were caused due to uncertainty over the ownership of such trees or the theft of its juice (Elwin, 1950) [10]. Presence of the non-tribals is another factor of poverty among the shifting cultivators. For instance, the Patros a non-tribal community directly instigated the tribals to cut in the Reserve forests to make it shifting plots because they knew that unless the tribals did this they would not be able to pay their dues to them (Patros). Elwin (1947) found that British govt would never be able to stop axe cultivation among the Saoras of Udaigiri so long as they had the Patro (A Brief Survey of the Aboriginal Tribes of the Districts of Ganjam and Koraput, 1947).

Shifting Cultivation as Livelihood Option and Criminality

This primitive form of agricultural practice has direct consequences upon the criminal behavior of the Most Vulnerable Tribal Groups. The hardships associated with livelihood have created a kind of criminal behaviour in the tribal mindset which is reflected in the differentiation of tort and crime in the contemporary legal jurisprudence. The Bonda tribe in the Malkangiri (undivided Koraput) district is infamous for their high aggressiveness since decades. Elwin (1940) [9] found that they were twice as murderous as the highest recorded elsewhere if the fascist genocide was ignored. He found the annual homicide rate over 1000 per million, in the Bonda hills. He attributes this behaviour to economic rights and harvest-"The more serious crimes are the result of hot-tempered disputes or the desire to prevent economic loss. Someone takes a jack fruit and the argument about it ends in his head being broken. Cows wander into a field and when the ploughman injures them as he drives them out, he gets beaten up for his pains. Murders over the possession of land are of more interest to the economist than to the student of crime. The mortgaging of land is a constant source of dispute, for the Bonda's attachment to his fields is such that even when he knows that he has forfeited his right to it, he cannot bear to see someone else in possession, and often tries to take it back"(Elwin,1950) [10]. Among the Kondhs, Elwin (1947) found that "It was sheer hunger that drove these people to cut inside the Reserve".

Historically, education was seen as another form of hateful 'bethi' (forced labour) system imposed by the government by the adibasis practicing shifting cultivation. They preferred seeing their children assist them in their agricultural sites rather than wasting time at the school. The literacy particularly of the female children is still very poor in the Koraput region. For instance, in the Bondahills, enrolment of girls in the school is only 9.31 percent (BDA Report, 2003). Similarly, unemployment is very high and percentage of workers is low in the areas affected with shifting cultivation. For instance, among the Dongria Kondhs of Rayagada in un-divided Koraput district, only 0.15 percent of the total population depends on service as the primary occupation as against 96.97 percent on shifting cultivation (DKDA, 2003). Therefore, Verrier Elwin had suggested to link education with employment for the Bonda tribe of Koraput "The aboriginal looks on education simply and solely as a means to getting a job as a Chaprasi or forest guard and why should we not frankly accept

this, deplorable as itsounds?" (Elwin, 1940) [9]. There is hardly any doubt that a good service can work as a substitute for against *Podu* cultivation.

The forest ecology in which the shifting cultivators are residing is having both positive and negative impact upon their health status. For example, the country liquor like salap stands up well against malaria and lot of herbal *medicines* have cured them from different diseases since prehistoric age (Elwin, Report on the Tribals of Ganjam and Koraput Districts). Their food habit is often responsible for different diseases. In many pockets Eating of rotten meat is responsible for Anthrax disease. Shifting cultivation engages women folk in different phases of agricultural practice and household income. They collect minor forest produce, help in forest clearance and sell their produce in the local markets. They contribute more than fifty percent to the household income.

Nexus between Environment, Poverty Nexus and Sustainable Development

Sustainability in nature or society has **v**arious connotations; survival of the community at all scales and stages of growth, ecologically acceptable production in social sense, long term carrying capacity of regions, attainable through appropriate technology and or for controlling pollution hazard. It can be assessed through Norgaard's (1985) narrow and overspecialized approach of environmental economics, Daly's (1977) zero growth strategy, Naess' (1973) organic agriculture for self-sustaining societies and UNEP's (1972) recognition of growing global environmental crisis. Swaminathan (1991) [33] advocated that the basic principles of sustainability for promoting ecologically sound agriculture include- land, water, energy, nutrient supply, genetic diversity, pest management, post-harvest systems, systems approach and location specific research and development along with monitoring, equity in conservation and no less pivotal and vitally significant areas of climate change, biodiversity, disposal of hazardous and toxic wastes, location of pollution-generation industries and food and ecological security. Since shifting cultivation is labour intensive and not technology intensive, it can be argued that it is significant for conceptualizing sustainable development.

Since the colonial period, several special committees have found that though ecologically disastrous, shifting cultivation is a source of livelihood for poor tribals. The colonial approach to stop this practice in Koraput region was temporary. For instance, on the basis of Elwin's report, demarcation of hill forest was temporarily postponed and the forest officers preferred forest conservancy than tribal livelihood and were ready to take the risk of confronting with the tribals (Elwin, 1950) [10]. In 1930s, the district collector of Koraput suggested that "A better policy would be to set aside in each village certain limited area within which Podu cultivation will be permitted and to prohibit rigidly elsewhere" (Bell, 1945) [2] and in mid-1940s J. Nicholson, then Conservator of Forests, Orissa suggested to for the constitution of 3 aboriginal reserves with a hope that the execution of this scheme 'would help enormously towards the better preservation of forests in tracts populated by tribes addicted to shifting cultivation' (Annual Progress Report on Forest Administration, 1946-47). The post-independence committees have recommended for awareness, motivation, and self-help strategies to end shifting cultivation and to adopt alternatives sources of economy to bring ecological balance and to remove poverty. It was realized that without a solution to the basic problems of land scarcity and economic pressure, all other efforts to stop *Podu* cultivation would be but in vein (National Agriculture Commission 1976, Working Group on Tribal Development during Sixth Plan, 1980 and ICAR 1986).

Conclusion

The global climate change agenda has cited unethical resource use and management practices that rely on use of fire and thus emit carbon to the environment as one of the most powerful source of climate change. For that several indigenous communities practicing shifting cultivation around the world have been accused of major contributor to climate change. Contrary to this approach, the rights approach, including the United Nation's Declaration on the Rights of the Indigenous Peoples clearly states that indigenous peoples have the right to their land, territories and resources, and participate in decision making processes directly relevant to their lands and territories. Similarly the present historical-anthropological study among the shifting cultivator Most Vulnerable Tribal Groups of Koraput region in Odisha have found contradictory issues. Though there is less literature on emission of green gases from this anthropogenic source in this region, it can be said that burning of secondary vegetation is responsible for releases of CO^2 and other trace gases to the atmosphere. Due to reduction of cultivation cycle, it has caused fragmentation of habitat and disappearance of native species including invasion by exotic weeds and reduced recovery of soil fertility, and the nutrient recycling by the ecosystem including creation of forest-canopy gap. When social sustainability is concerned, this form of cultivation is not merely an agro-economic activity, it is an integral part of the socio-cultural processes. For them, land means livelihood and their culture is built upon it. In the deep forest and hilly areas, shifting cultivation is the only system of cultivation due to lack of sufficient plain land, access to credit and extension. There is vice versa relationship between poverty and shifting cultivation. There is also inextricable relationship between Population, productivity and deforestation. Under the most recent policies of the Ministry of Agriculture and Forestry, four targets were identified for a sustainable livelihood among the practitioners of shifting cultivation; ensuring food security, Commercialization of agricultural productions, stabilization for poverty reduction and sustainable forest management. Thus, there is the need of a spatial approach in which the issue of adaptation to climate change and implications of environmental and poverty programs to be discussed in bringing the environment-poverty nexus closer to the climate change agenda.

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