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A socio-ecological analysis of shifting cultivation in Nagaland: Challenges and opportunities

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Abstract

The northeastern (NE) region of India, including the state of Nagaland, is home to 37.2% of cultivated crop types and is the origin of 20 major agricultural and horticultural crops. The different types of soil of the region are rich in organic matter that is suitable for agriculture, and the climate is conducive to rich vegetation. However, low cropping intensity, undulating topography, and subsistence farming characterize the agricultural production system. Agricultural land productivity is much lower than the potential yield due to low or no fertilizer use and low irrigated areas. Shifting cultivation is the dominant food production system in the region, with strong customary laws ensuring equitable land distribution and usufruct sharing. A literature review was conducted to understand the trends of shifting cultivation, its sustainability, and challenges and opportunities in Nagaland. A group of researchers, primarily economists and environmentalists, advocate that shifting cultivation is a wasteful practice that must be replaced with settled cultivation. It has led to soil erosion, forest loss, and destruction of natural forests because of population pressure. It is considered one of the drivers of deforestation in tropical countries, with estimates of 60% of the tropical forest lost due to shifting cultivation. Alternatives are suggested through agricultural extension and land reform, but the sustainability of shifting cultivation cycles is questioned as the fallow period is reduced**.** The second group of researchers, who are from the disciplines of sociology and anthropology, value shifting cultivation as a traditional, legitimate practice on marginal lands to ensure the survival of people. The social cost of shifting cultivation is higher, while most farmers benefit from it.

Keywords: Shifting cultivation, Northeast India, Nagaland, Trend, Sustainability

Introduction

The NE region of India comprises eight states: Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim, and Tripura. They occupy approximately 8% of the total land area and 3.8% of the population of India (Census of India, 2011). It is home to approximately 37.2% (132 of 355) of the cultivated crop types in India. At the same time, it is considered the origin of 20 major agricultural and horticultural crops, signifying the rich biodiversity listing 160 domesticated and 355 wild cultivars of different crop types found in the region (Upadhyay & Sundriyal, 1998). The average area under forest to total land area is more than 75% in the NE region, except Sikkim and Assam. The proportion of forest cover in the NE area accounts for 21.9% of the overall forest cover in India (FSI, 2017).

However, recent studies have reported a declining trend in the diversity of cultivated crops, attributed mainly to the reduced fallow period in shifting cultivation. Maintaining agri-biodiversity is essential for agricultural and environmental sustainability and food security of the region. In the past decades,

this region has also witnessed climatic changes; studies have identified the area as highly vulnerable to climate change. The agriculture and allied sectors support the livelihood of 70% of the population of the region (Feroze et al., 2010). The area has a high rural population concentration of 50%−80%, predominantly dependent on agriculture and forests for livelihood (Choudhury & Sundriyal, 2003).

The soil profile of the NE region is rich in organic matter suitable for agriculture, and the climatic conditions are conducive to rich vegetation. However, low cropping intensity, undulating topography, and subsistence farming characterize the agricultural production system. The productivity of agricultural land is much lower than the potential yield due to several factors, such as low fertilizer consumption and low irrigated area (11% of the net sown area). Moreover, studies have shown that 96% of the agricultural implements are traditional in this region. The NE region produces only 3.1% of national food grain production and remains a net food grain importer for consumption purposes (Roy et al., 2015).

According to Choudhary and Sundriyal (2003), the dominant food production system in the NE region is shifting cultivation. Apart from the state of Sikkim, the entire NE region practices shifting cultivation in many ways. Initially, the vegetation in a patch of land is cleared by the felling of trees, followed by burning the patch with fire and making it suitable for cultivation. Both rice and maize are cultivated in patches, along with a few vegetables. The entire land area under shifting cultivation is upland and has a slope. There is no scope for artificial irrigation apart from the precipitation available in the area. Among all states of the NE region practicing shifting cultivation, Nagaland has the maximum number of households (approximately 116,000) following the system. However, the land availability in Nagaland is the lowest, with only 0.16 ha per household. Equitable land distribution is ensured despite this low per capita availability through strong customary laws, clan and subclan relationships, and land ownership. It is reported that there has been a reduction in the fallow period from 20−30 years to 3−4 years.

There has been an increase in agricultural production in most of the states in the NE region, which has been attained mainly due to increased agricultural inputs and the application of modern methods, i.e., “intensification.” In Nagaland, the factor for this is the high growth rate in grain production in the past few decades owing to large-scale “extensification” and reduced fallow periods in the shifting cultivation cycle (Rathore et al., 2010; Roy et al., 2015). There has been a significant reduction in the area under shifting cultivation among all states of the NE region except Nagaland (DoLR, 2019). Although in the past, there have been several policies and initiatives to replace shifting cultivation with other cultivation methods, such as agroforestry, e.g., monocropping of rubber, coffee, or tea plantations. Furthermore, the introduction of terraced cultivation, among others, has not been successful.

Methodology

The study primarily relied on secondary data from government sources, literature reviews, and previous research on the topic. This approach was chosen due to mobility constraints and the broad scope of the study, which aimed to collate and analyze existing knowledge on shifting cultivation in Nagaland. Nonetheless, it is undeniable that incorporating primary research or empirical data could offer more nuanced insights and validate the conclusions drawn. Future studies may benefit from direct field observations, surveys, or interviews with local practitioners of shifting cultivation to enhance the depth and applicability of the research findings.

Literature review

It is imperative to understand the drivers of shifting cultivation, its sustainability, and its challenges and opportunities in Nagaland. Such information/ knowledge would help plan and strategize agricultural production and food security of the state. With this in view, a detailed literature review and analysis were conducted to understand (i) the trend in shifting cultivation of the states in the NE region, (ii) the practice of shifting cultivation in Nagaland, and (iii) the arguments on the sustainability of shifting cultivation.

Table 1 *Area under* shifting cultivation *(active and fallow since 2003−2016)*

State	Area under Shifting cultivation (shifting cultivation) (current) (km²) 2003	Area under shifting cultivation (fallow) (km²) 2003	Area under shifting cultivation (active) (km²) 2006	Area under shifting cultivation (fallow) (km²) 2006	Area under shifting cultivation (current) (km²) 2009	Area under shifting cultivation (fallow) (km²) 2009	Area under shifting cultivation (active) (km²) 2016	Area under shifting cultivation (fallow) (km²) 2016
Arunachal Pradesh	1116.9	496.2	1025.1	506.4	821.7	947.5	509.1	1204.2
Assam	435.9	3495.1	160.2	79.4	82	83.2	52.6	82.1
Manipur	1119.5	3697.1	752.1	100.1	296.7	243.5	500	298.7
Meghalaya	627.2	116.6	291.9	157.1	281.7	275.4	237.9	422.7
Mizoram	1147	2870.5	1028.5	1589.03	602.9	1034.3	691.6	1011.4
Nagaland	**1116.6**	**801.3**	**1239.1**	**1588.7**	**1414.5**	**903.1**	**979.3**	**681.2**
Tripura	284.9	110.4	89.3	164.8	30.3	65.2	30.6	64.2

Source: (DoLR, 2019)

Table 2 *Change in* shifting cultivation *(active) area in % of NE region*

State	Change from 2003−06	2006−09	2009−16	2003−16
Arunachal Pradesh	-8.2	-19.8	-38.0	-54.4
Assam	-63.2	-48.8	-35.9	-87.9
Manipur	-32.8	-60.6	68.5	-55.3
Meghalaya	-53.5	-3.5	-15.5	-62.1
Mizoram	-10.3	-41.4	14.7	-39.7
Nagaland	**11.0**	**14.2**	**-30.8**	**-12.3**
Tripura	-68.7	-66.1	1.0	-89.3

Source: (DoLR, 2019)

Analysis of the overall trend

Overall declining pattern

Analyzing the data the "Wasteland Atlas of India" detailing about area under shifting cultivation, most states of the NE region indicate a reduction in the extent of land used for shifting cultivation between 2003−2016. This pattern may imply agricultural practices, economic progress, or ecological policy changes for the changes. Short term patterns show variability among different states of the NE region over 2003−2006, 2006−2009, and 2009−16. This shows that shifting cultivation is affected by various aspects, such as changes in policy and environmental protection with economic and social requirements. Drawing emphasis distinctive first spike (2003−09): Nagaland experienced a significant increase in the area devoted to shifting cultivation between 2003−2009, with an initial growth of 11% from 2003−2006, followed by a further growth of 14.2% from 2006−09. On the other hand, while other states have been experiencing a generalized decline,

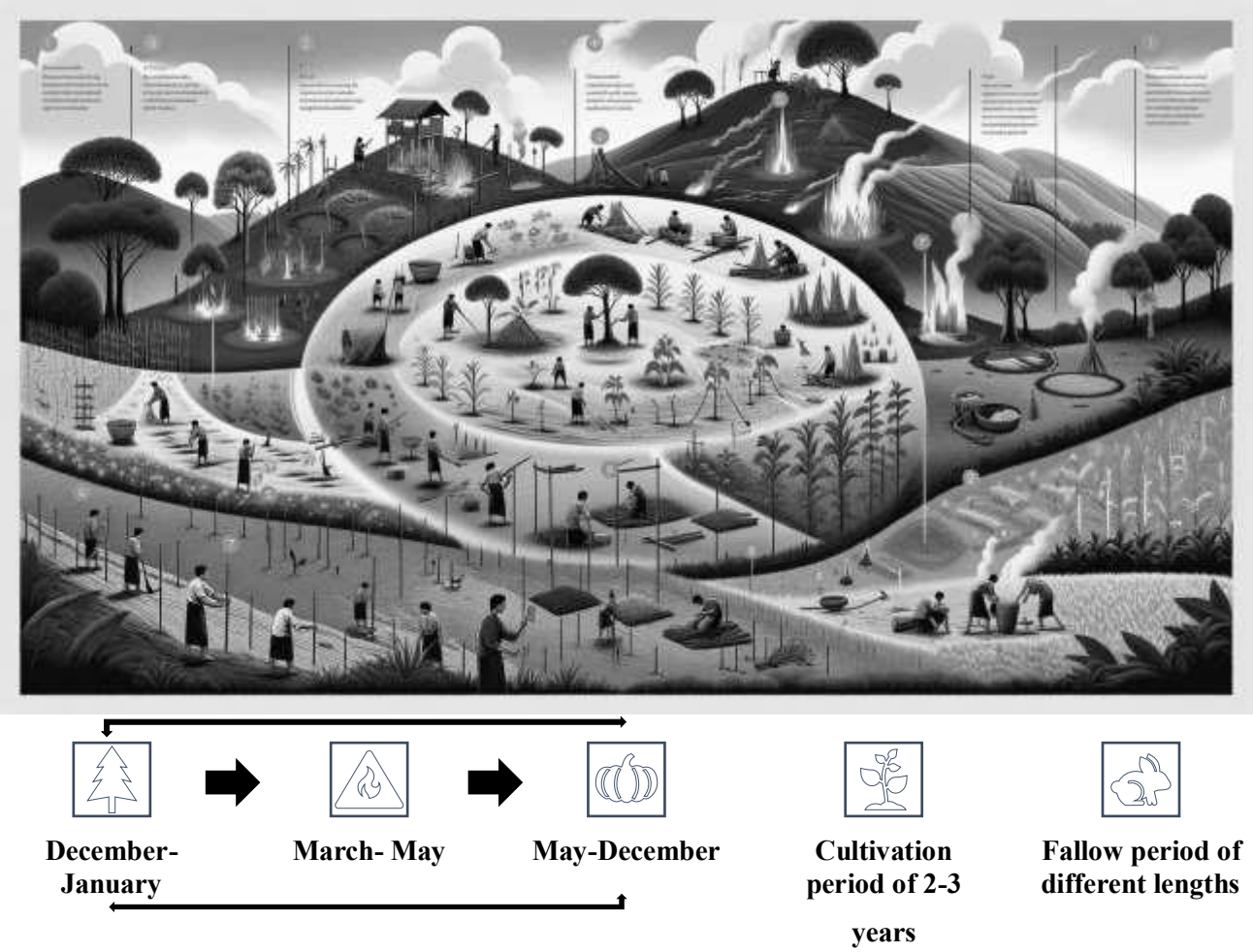
Nagaland exhibits a significant dependence or propensity towards shifting cultivation during this period. Nagaland witnessed approximately a 30.8% decrease in shifting cultivation land between 2009−2016. The reported decrease, although notable, follows an initial rise, suggesting a multifaceted interplay among socio-cultural dynamics. Nagaland showed a total reduction (-12.3%) in the shifting cultivation area among the NE states during 2003−2016. It implies that although there was a decrease in the later period, shifting cultivation continues to be a significantly more critical aspect of agricultural practices in Nagaland (DoLR, 2019).

Multiple variables contribute to this phenomenon

Shifting cultivation holds agricultural significance and functions as an integral component of the cultural legacy and way of life of various tribal societies in Nagaland. Shifting cultivation is a crucial means of subsistence for many people. The method is tailored to the unique ecological features of Nagaland, such as steep terrain, high rainfall, subhumid climate, and absence of external inputs, where conventional farming methods may be challenging to implement.

Shifting cultivation

Shifting cultivation is the practice of clearing the vegetation partially by flash burning, followed by a stint of cultivation for a short term and repeating the act in other patches (FAO, 1957). There is a difference between slash and burn cultivation (SBC) and shifting cultivation. In the SBC, there is no scope for forest regeneration and converting the land into permanent fields, whereas shifting cultivation is a cycle with a fallow period, which allows forest regrowth; however, labeling such terms is complex (Vliet et al., 2013).



Logging the trees | Ash poured over | operation
Prayer | Different harvest
Seed sowing | periods

Figure 1 Process of shifting cultivation in Nagaland

Source: (Jamir, 2015; Nakro, 2009; Ramakrishnan,1992; Ramakrishnan,2007; Vilet et al., 2013)

Sustainability of shifting cultivation

Shifting cultivation as an unsustainable farming practice

The Food and Agriculture Organisation of the United Nations (FAO) in 1957 made a universal appeal stating that shifting cultivation in humid tropical countries is the greatest obstacle not only to the immediate increase of agricultural production but also to the conservation of the production potential for the future, in the form of soil and forests. FAO states it is a form of shifting base when soil fertility is exhausted. The fallow left behind after a cycle of recuperation/ regeneration is beyond the purview of the human being. It is a wasteful practice with soil erosion and forest loss, can bear a certain population pressure, cannot generate any material wealth, urbanization is not possible, and the introduction of cash crops has led to greater destruction (FAO, 1957).

Baden Powell, in 1874, at a forest conference held in Allahabad (present-day Prayag Raj in India), stated: "The fact is that the system is so wasteful that somehow or the other it must be put a stop to, just like '*suttee*', (burning alive a widow with the dead body of the husband)" or any other great evil. It destroys significant and valuable capital to produce a miserable and temporary return. In order to stop it, it is only to anticipate, by a few years, the natural determination of the system, which will happen if the system continues long enough because there will be no more forest to cut down and burn. The way out is to reserve large areas and prohibit shifting cultivation. Efforts should be made to change people to permanent agriculture" (Malik, 2003).

Shifting cultivation was regarded as one of the drivers of deforestation in the tropics in the 1990s. It was blamed for 10% of the forest loss in Latin America, 30%− 35% of forest losses in the Amazon, and approximately 50% in Indonesia during this period, there was a concern over emissions into the atmosphere, and it was argued that the secondary forest growth during the fallow period does not compensate for the forest loss (Filho et al., 2013). All these antagonistic positions shaped the public policy in many tropical countries toward the removal of agricultural systems having a foundation in shifting cultivation (Filho et al., 2013; Ramakrishnan, 1992; Ramakrishnan, 2007; Narko, 2009; Tiwari & Pant, n.d). Managing protected areas and biodiversity conservation is considered incompatible (Namgyel et al., 2008; Filho et al., 2013).

Since the independence of India in 1947, the policy paradigm of shifting cultivation has been divided into two factions, one terming it as a wasteful practice that needs to be replaced with settled cultivation and the other advocating as a traditional, legitimate practice on marginal lands ensuring the survival of people. There have been intrusive market forces (Malik, 2003).

Tinker et al. (1996) and Schuck et al. (2002) found that this cultivation method produces less food, generates more greenhouse gas emissions such as carbon dioxide (CO_2), and results in deforestation. Rodenburg et al. (2003) opined that fire causes volatilization and particulate movement off the patch and removes the vegetative cover, resulting in topsoil and litter loss and movement of nutrients related to gravity flow.

Extra nutrients in plant biomass must be added to maintain yields, contributing to deforestation. It is estimated that 60% of the tropical forest is lost due to shifting cultivation (Lianzela, 1997; Tiwari & Pant, n.d.; Vilet et al., 2013)

Schuck et al. (2002) argued that the social cost is higher for such technology, with fewer benefits for the farmers. Farmers without land or title must bear the cost of freshly degraded land. Furthermore, farmers can use alternatives through agricultural extension and land reform (secured land tenure). Farmers are more likely to adopt new technologies than slash and burn if the above are done right. They also suggest that the method benefits the landless as it involves lower entry-level costs.

Shifting cultivation is less productive than settled cultivation (1 t/ha compared to 2 t/ha for paddy). The sustainability of such shifting cultivation cycles is questioned as the fallow period is reduced. It is considered a wasteful practice leading to soil erosion, mainly an issue with increased population density. However, what an adequate population density is has not been answered. The destruction due to burning is much higher than the actual cultivated area. Significant flora is lost because of burning, and the native species give way to cultivated ones for food (Lianzela, 1997; Filho et al., 2013; Tiwari & Pant, n.d.).

Shifting cultivation as a sustainable farming practice

Another group of researchers had a positive approach and argued for the positive environmental impacts of shifting cultivation during the same period (Filho et al., 2013). Wilkinson (2011) pointed out the essential factors of "interactions" in the "System Thinking Approach" and argues that human interactions (here shifting cultivation) have been a factor in the evolution of forests on time scales and, therefore, can be termed as cultural forests. Namgyel et al. (2008) argued that shifting cultivation has been a millennial practice in Bhutan, and the biodiversity (flora and fauna) is adapted to cyclical disturbances. Curbing the practice would hinder the process of protecting biodiversity, supported by other tropical forests worldwide (Filho et al., 2013).

The International Center for Integrated Mountain Development (ICIMOD) has documented regional case studies, farm innovations, and the reasons behind shifting cultivation. The policymakers do not subscribe to the benefits accrued regarding gainful employability, socio-cultural identity, and food security; instead, the communities push to earn income by stopping shifting cultivation. There is a perceived benefit in retaining forest cover, conserving fauna, and agri-biodiversity through innovative crop rotation, in-situ soil, and water conservation (Kerkhoff, 2006).

Customary institutions are essential for shifting cultivators to manage their farming system as a community. These institutions comprise shared norms, values, traditions, beliefs, customs, rules, regulations, and laws. The innovations described above exist in pockets but might be documented, scientifically validated, packaged, and exchanged with other farmers to help improve the practices in a much larger area. Building innovations done by farmers requires a different, more appreciative, and participatory approach to research and development than is currently in practice. Sustaining the success of these innovations depends on a favorable policy environment (Kerkhoff, 2006)

Chase and Singh (2014) compared the soil properties of natural forests, shifting cultivation fields, and wet terraced paddy fields in Khonoma village of Kohima district. Interestingly, the findings have pointed out that there is a significant accumulation of soil organic carbon (SOC) and soil organic manure (SOM) in shifting cultivation fields due to the cyclical operation, and there is no statistically significant difference between the natural forest and shifting cultivation fields. Incorporating alder and fast-growing native plants helping the soil regenerate and rehabilitate the degraded land are the reasons behind this. However, there is a significant loss of SOC and SOM with settled wet rice paddy cultivation (Chase & Singh, 2014).

Some researchers believe the high precipitation of the area does not expose the topsoil for a long time; therefore, soil erosion is low. The case is of a unique ecosystem where the steep slope and

other means of cultivation and mechanization are futile. It is a way of life based on the scientific knowledge of physiography. However, the other section believes that it degrades the ecosystem by soil, water, and forest loss. This practice leads to drought and floods in changing climatic conditions, ultimately leading to food insecurity, poverty, and low nutritional status. Where there is low population density, a longer cycle of shifting cultivation does not significantly impact environmental loss. However, it significantly impacts higher population density with a shorter cycle (Tiwari & Pant, n.d.).

Poor farmers perceive shifting cultivation as one of the low-cost farming technologies. The system is perceived as beneficial and positively affects the field by adding nutrients such as calcium, magnesium, phosphorus, and potash. The soil structure improves, and there is a reduction in weeds and pest and disease attacks. Other reasons for the continuation of shifting cultivation are population pressure, communal land tenure, top-down government policies devoid of ground realities, and polyculture; the economic cost is not an incentive for shifting cultivation as the primary aim is on subsistence agriculture (Abdulai & Binder, 2006; Adesina et al., 2000).

Ninnan (1992) points out that there is a polarization of views between anthropologists and sociologists on the one hand and economists and ecologists on the other. The point of contention has been the customary tradition of a symbiotic relationship between tribal culture and environmental and economic costs. There also remains a difference of opinion between community ownership of land and private ownership in settled cultivation. In the research conducted in Garo Hills, Meghalaya, for a year, it was found that shifting cultivation provides considerably higher returns than settled agriculture, which is associated with higher input costs. Moreover, the uneconomic size of holdings, non-suitability of modern technologies, and agricultural equipment in physiography put settled agriculture second fiddle to shifting cultivation.

Conclusion

The work on the detrimental effects of shifting cultivation has been dramatically overestimated. There has been reliance on “spatial analogs (adjacent sites with different cultivation practices)” and disregard for the conscious choice of the site of farmers along with the perception of soil quality and agriculture. Another factor equates to the ecological processes of two sites, which can differ in terms of “soil quality, topography, land-use history, climate, and biota. Contrary to popular belief and assumptions, shifting cultivation is a highly efficient ecological and economic practice, provided the fallow period is sufficiently long (Grogan et al., 2012).

The findings of this study, while providing significant insights into the practice of shifting cultivation in Nagaland, may have limited applicability to other regions due to the unique geographical, cultural, and environmental factors inherent to Nagaland. Comparative studies in other regions with similar environmental and cultural settings are recommended to evaluate the broader applicability of the findings and understand the diverse manifestations of shifting cultivation practices.

Future research

The research on shifting cultivation in Nagaland has highlighted significant environmental, socioeconomic, and cultural implications, underscoring the need for a multifaceted approach in future studies. Building upon the insights gained, the following research should incorporate comprehensive field studies, employing methodologies like participatory rural appraisal to gather first-hand data from local farmers. This should include detailed assessments of the socio-economic impacts of shifting cultivation practices on local communities, evaluating both the benefits and

drawbacks. Emphasis should also be placed on exploring sustainable agricultural practices that can be integrated with traditional methods to enhance productivity without compromising ecological balance. Additionally, interdisciplinary research involving environmental science, economics, and social anthropology could offer holistic solutions that respect the cultural significance of shifting cultivation while addressing its environmental impact. The involvement of local communities in devising and implementing these solutions is crucial to ensure their effectiveness and sustainability. By bridging the gap between traditional practices and modern agricultural techniques, future research can contribute significantly to developing sustainable and culturally sensitive agricultural policies in Nagaland.

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