

Balancing traditional jhum cultivation with modern agroforestry in eastern Himalaya – A biodiversity hot spot

In Arunachal Pradesh, the thinly populated and biodiversity-rich hot spot in the Indian eastern Himalayas, shifting cultivation (popularly known as 'jhum kheti') has been projected as an environmental problem contributing significantly to the loss of lush green forests in the state (currently holding 62% forest cover¹). Nonetheless, this practice of food production has evolved in close conjunction with tradition and socio-cultural values that the people perceive towards livelihood sustenance in the mountains. This practice has however been refined through experience and requirements. Although this age-old practice has been projected as harmful, no good alternatives (such as agroforestry or horticultural intervention) were found to suit the local conditions. The traditional lifestyle, culture and resistance to government policies by the local inhabitants have led to non-adoption of any suggested alternatives to jhum cultivation. Further, in Arunachal Pradesh, with no land-use policy and no clear identity of land ownership², suggesting any alternatives would just remain academic. This is because the land-capturing capability depends on the social status of a person. Therefore, it is imperative that only a few persons with huge land holdings can adopt alternatives to shifting cultivation while continuing their traditional practices also. A person with a small land holding may have to take a risk in this scenario, and eventually the alternatives are not conducive. We have attempted to compare jhum cultivation and one of the suggested alternatives, i.e. agroforestry (Table 1), based on a few socio-ecobiological principles.

Northeast India has been identified by the Indian Council of Agricultural Research as a centre for rice germplasm, while the Forest Survey of India reports that the region harbours a wide range of species with greater endemism. About 35 crops are cultivated in a jhum cultivation system³. It is also vital that most of them are traditional cultivars that the local people have been conserving from time immemorial. However, with the modernization of the village lifestyle, people are migrating to small townships. Also

education and training facilitating off-farm employment have led to the reduction of active human power in the rural areas for farming. Eventually, some of younger generations are completely deprived of the knowledge about 'jhumming' as such. So, it may be presumed that

shifting cultivation would cease automatically along with the demise of the older generation.

With the alarming rate of species extinction of about two species per day⁴, it has been emphasized that species inventory and prioritizing species for conser-

Table 1. Comparison of jhum cultivation and agroforestry

Factor	Jhum cultivation	Agroforestry
Ecological factor		
Fragility	High	Low
Homeostasis	Internal	External control
Biodiversity	High	Low (restricted)
Leaf area	Less	More**
Carbon sequestration	Low	High**
Regeneration	Natural	Artificial/managed
Dispersal	From surrounding natural vegetation	Man-made
Potential nutrient loss	High	Low
Pathogen/disease attack	Less risk	More risk
Connectance (biotic interdependence)	Low	High
Energy source	Low	High
Nutrient source	High*	High*
Irrigation	Rainfed	Moderate
Soil fertility management	Poorly managed	Well-managed
Tillage	No tillage	Minimum tillage
Carrying capacity of land	Low	High
Ecological status	Complex	Complex
Economic factor		
Labour	Intensive	Systematic
Inorganic fertilizer	Not used	Used sometimes
Monetary input-output	Low	High
Production/yield	Low	High
Land required	Large (extensive cultivation)	Relatively less (Semi-intensive cultivation)
Socio-cultural factor		
Approach to cultivation	Slashing and burning followed by cropping	Trees grown with crops
Cropping pattern	One rotation	More than one rotation
Harvesting pattern	Multiple harvest	Multiple harvest
Integration of animal component	Poorly integrated	Well-integrated
Cultural value	Traditional value	Intervention
Local adaptability	More	Less
Sustainability	Diversity conserved	Production sustained

*In jhum cultivation, the initial slashing and burning becomes a huge one-time source of soil nutrients, while in agroforestry systems the litter and fine roots of the tree component continually add plant nutrients into the soil. The latter could be further improved by selecting biological N₂-fixing tree species to promote natural nutrient cycling.

**Due to presence of woody perennials.

vation are inevitable for human existence in this planet. Also, geneticists believe that wild relatives of cultivated species and the traditional crops have a wide variety of genetic diversity⁵, some of them still remaining to be screened. Bawa and Dayanandan⁵ also stated that deforestation and fragmentation pose more serious challenges to biodiversity and wild genetic resources than climatic change. Thus, whether we need to go for improved production or conserve existing crop diversity in shifting cultivation remains a dilemma. The increasing attention to traditional ecological knowledge and practices⁶ embedded in any land use by the people living in the mountains is especially crucial in the hilly state of Arunachal Pradesh, where the soil is geologically young, highly leached and prone to frequent landslides and erosion in the hills and floods in the foothills⁷. The political development and strengthening of the government have led to the transfer of powers and authority from traditional leaders to government or political officials, who constitute a new elite. Yet, imposition of shifting cultivation regulation Act 1947 or the ban on timber-logging has not helped in improvement or rehabilitation of the jhum lands⁸. A few farmers have, however, gone for terracing the jhum fields on the slopes and some have adopted horticultural plantations. But again, lack of infrastructure for marketing has led to devastation of the excess produce. Our own field observations and personal interviews with the village heads who adopted horticultural rehabilitations of jhum lands through *Citrus* plantations reveal that most of their produce (ca. 80%) rot due to lack of storage and/or marketing facilities.

Further, in the context of sustainability, which is a bondage between conservation and production, it is important that location-specific, highly economic improvements need to be amended into the ongoing shifting cultivation practice to bestow sedentary farming in the long run⁹. Under this contention, jhum cultivation seems to better conserve the diversity of crops compared to the mod-

ern agroforestry where production has been projected to be better. While the former remains a labour-intensive but monetarily economic practice of food production, systematic labour and money inputs are required for managing the latter system. Also the agroforestry system does not get quick and continued support in tribal settings. From a forestry viewpoint, natural regeneration is promoted in the jhum fields after abandonment, while carbon sequestration can be higher in the tree component of the agroforestry system.

With the growing human population, greater ethnic diversity, loss of forest cover, decreasing shifting cultivation, changing rural lifestyle, expanding townships, ban on timber-logging and increasing dependence on rice and vegetables; Arunachal Pradesh would run into trouble in terms of food security¹⁰, as most existing production systems are less productive (e.g. 10.14 quintals/ha of rice production), but the shifting cultivation harbours greater crop/genetic diversity. Thus, the challenge lies in providing a minimum of traditional practices of jhum and modern agroforestry.

Therefore, it is important that the state constitutes its land-use policy and implements the same strategically for better land management and also to support the growing livelihood requirements of the residents. Further, farmer's innovations need to be recognized and scientific ideas need to be built upon them for improvement of shifting cultivation¹¹. For instance, recognition and incentives should be provided to traditional farmers ameliorating agroforestry. This may help in balancing between biodiversity conservation and economic growth. In this regard, a farmer-led extension programme would prove viable to rehabilitate the jhum lands without hurting the traditional will and sentiments of the local people. For example, in Nagaland, local people have adopted growing of alder trees in jhum lands that has contributed to the soil nutrient enrichment and crop production⁹. However, in Arunachal Pradesh, this strategy has not been adopted due to lack of land tenure sys-

tem. Such a farmer-led approach may also help in conservation of crop diversity as well as enrichment of crop production, instead of an external intervention that may not be successfully absorbed by the people.

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