International Journal of Biodiversity and Conservation Vol. 3(5), pp. 147-154, May 2011
Available online http://www.academicjournals.org/ijbc
ISSN 2141-243X ©2011 Academic Journals

Review

An overview of shifting cultivation with reference to Nepal

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Accepted 10 March, 2011

Shifting cultivation is a form of land use among resource poor communities with a rotation of cultivation and fallow in the same unit of land. Millions of indigenous people are dependent on shifting cultivation practice, with majority households for subsistence living. This practice is in transition these days with rising population of shifting cultivators and demand for more food. This paper provides a review on shifting cultivation practice in the world with reference to Nepal, with an insight on emerging land use transition, its impacts and future priorities.

Key words: Shifting cultivation, biodiversity, fallow, climate change, Chepangs, Nepal.

INTRODUCTION

Shifting cultivation is defined in different circumstances, with relatively the same meaning (AIPP/IWGIA/IKAP, 2009; Spencer, 1966; Schmidt-Vogt, 1999; Mertz et al., 2009a, b; Conklin, 1957; Ruthenberg, 1971; Lanly, 1983; Kerkhoff and Sharma, 2006). Shifting cultivation is a form of land use among resource poor communities with a rotation of cultivation and fallow in the same unit of land. It involves the clearing of certain patches of forests by slashing and/or burning (in many cases), followed by short span of crop cultivation and long span of fallow period. It involves the cyclical shifting of cultivation sites. In general, the shifting cultivation plots are cultivated for shorter periods than they are fallowed. In later years, more dynamic approach has been followed to define and characterize shifting cultivation. McGrath (1987) defined shifting cultivation as “a strategy of resource management in which fields arc shifted in order to exploit the energy and nutrient capital of the vegetation-soil complex of the future site. Kerkhoff and Sharma (2006) referred to shifting cultivation as an adaptive forest management practice predicated on sound scientific principles that productively uses hill and mountain lands, conserves forest, soil, and water resources, and is ecologically preferable to alternative agricultural and forestry activities. Shifting cultivation in Nepal, locally called as Khoriya and Bhasme, is a land use practice in which indigenous communities clear and cultivate secondary forests in plots of different sizes, leave these plots to regenerate naturally through fallows of medium to long duration, as defined by Fujisaka et al. (1996).

Watters (1971) summarizes the principal characteristics of shifting cultivation in the tropics as the shift between fields rather than between crops on the same field, short (1 to 3 year) cropping periods alternating with longer fallow periods (4 to 60 years), cutting and burning of the fallow vegetation at the beginning of each cropping period, and the almost exclusive use of human energy in land management operations. Shifting cultivation creates unique landscapes composed of a dynamic patchwork of crop fields, fallows of various ages, secondary forest derived from fallows, and remnants of the original vegetation. Crop fields and old secondary forests are clearly defined communities (Finegan, 1992). Shifting cultivation practice in Nepal in many cases is characterized by 2 to 4 years of cultivation and 4 to 9 years of fallow. There seems to be a marked tendency of prolonging cultivation and shortening the fallow as the population pressure is increasing with a corresponding decrease in the cultivatable land. In some cases shifting cultivated lands are also being gradually converted to settled farms and regular cropping in some areas (Bajracharya et al., 1993).

It is estimated that as many as 400 million shifting cultivators or forest-dependent people were spread across tropical Asia at one time (Spencer, 1966; Ma, 1999; Kerkhoff and Sharma, 2006). The information of total distribution of shifting cultivation areas in Nepal is not available, existing studies show that this practice is prevalent in 20 districts of Nepal (Regmi et al., 2005). Shifting cultivation has ethnic and cultural affiliation with indigenous peoples of Nepal. The main shifting cultivators are the indigenous peoples: Chepang, Magar, Sherpa, Rai, Limbu, Tamang and Gurung (not in order of importance), with poor economic status. In Nepal, Aryal and Kerkhoff (2008) analyzed the shifting cultivation and indigenous peoples in relation to ILO Convention. The key issues found to be related to the right to practice shifting cultivation were: Rights to land, natural resources and minerals; displacement; access to (government) services and facilities, health care, education and vocational training (including agricultural and forestry extension); access to employment, employers' and workers' organizations, and traditional economies; consultation and participation in decision-making; customs, traditions and customary law; the need for special measures and undoing past harm; and governments' responsibilities.

Shifting cultivation, commonly known by its derogatory name "slash and burn agriculture," has been deemed destructive, wasteful, wild since the colonial era (Dove, 1983), outdated and destructive by development institutions (Brady, 1996; Thrupp et al., 1997; O'Brien, 2002). In the name of forest conservation and deve-lopment, colonial and post-colonial governments in Asia have since more than a century devised policies and laws seeking to eradicate shifting cultivation. The reasons usually given for such restrictive state policies are that shifting cultivation is technologically primitive, inefficient and wasteful, prevents development and thus keeps people in poverty; and destructive to forests and soils (AIPP/IWGIA/IKAP, 2009). Though the systematic studies on the impact of current policies on shifting cultivation practice have not been available in Nepal, the unsupportive policy and policy ignorance dimensions have been well indicated by many authors (Regmi et al., 2005; Kerkhoff and Sharma, 2006; Aryal and Kerkhoff, 2008). Nepal has not formulated any specific policy on shifting cultivation. Shifting cultivation 'terminology or word' is not recognized by Government of Nepal in any land use policies and it has raised conscious conflicts among indigenous shifting cultivators and government authorities in resource management and benefit sharing. Current agriculture, forestry and natural resources policies have not recognized shifting cultivation as a land use practice, hence policy ignorance is prevalent dimension to hinder shifting cultivation practice in Nepal. Government forest authorities have set up, in most cases the leasehold forestry, and in some cases the community forestry programmes to wean shifting cultivators away from shifting cultivation and compel them take up alternative livelihoods. Majority of shifting cultivators do not own shifting cultivation lands legally, as these areas are still with government ownership. They are only using these lands with no ownership. This situation has raised regular conflicts between shifting cultivators and government on land use development. Aryal and Kerkhoff (2008) highlighted the unsupportive policy environment as the main reason for increased poverty and land degradation in shifting cultivation areas, rather than inappropriate land use by the farmers themselves.

However, the productivity and sustainability of integral, long-fallow shifting cultivation is well documented (Conklin, 1957; Nye and Greenland, 1960; Spencer, 1966; Kunstadter et al., 1978; Cairn, 2007). Slash-and-burn agriculture is often effective for the farmer economy in terms of security and productivity (Dufumier, 1996; Fujisaka et al., 1996; Ducourtieux, 2005). They are nonetheless not sustainable if demographic growth leads to accelerating crop rotations (Brady, 1996; Thrupp et al., 1997). Although the social, economic, and environmental conditions considered here are unique, there is growing evidence documenting the role and importance of shifting cultivation and other historical anthropogenic disturbances to the development and maintenance of biological diversity and "pristine" forests throughout the tropics (Willis et al., 2004). This paper aims to review the changing status of shifting cultivation practice, with its brief overview in Nepal based on available current information.

IMPORTANCE OF FALLOWING IN SHIFTING CULTIVATION

Weed suppression and build up of ecosystem fertility are the two major reasons for fallowing. The fallowing phase is essential to help restore soil fertility lost during the preceding cropping phase (Liang et al., 2009). Many studies have demonstrated that weeds become more problematic when the fallow is short (de Rouw, 1995; Dingkuhn et al., 1999; Johnson et al., 1991). When the fallow period goes below 3 to 4 years, soil fertility is not renewed, and erosion and weed competition increase dramatically (Ramakrishnan, 1992; Van Keer, 2003). Yield levels in shifting cultivation are influenced by a wide range of biophysical, socioeconomic, and cultural factors and it is difficult to isolate fallow length as a single determining factor. Yield decline in shifting cultivation systems when fields are cropped successively in two, three or more years is well documented (Jordan, 1989; Kleinman et al.,

1995; Nye and Greenland, 1960). The causes of yield decline with continuous cultivation are attributed to weed infestation and soil nutrient deficiencies and depend very much on the specific area studied. Solid evidence for this theory is scarce and that this 'common knowledge' may contribute to forming negative views of shifting cultivation in government circles (Mertz, 2002).

Mertz (2002) questioned a theory that a correlation between shortened fallow periods and yield decline in shifting cultivation exists in his review paper. Although most of the empirical studies support the theory, the data sets are often ambiguous and important parameters are insufficiently taken into account. Several studies found no relationship between fallow length and yield, but these also lack information to verify the validity of the data. He concluded that empirical studies focussing on this problem are needed to fully understand this relationship and develop feasible scenarios for the numerous attempts at modelling shifting cultivation development. Moreover, the use of gloomy 'breakdown' scenarios as justification for improving shifting cultivation should be avoided.

SHIFTING CULTIVATION AND BIODIVERSITY

Both the cropping phase and the forest fallowing phase host a rich biodiversity, including crop diversity (Liang et al., 2009). However, shifting cultivation and other utilitarian activities are widely believed to be incompatible with conservation of biological diversity (Kramer et al., 1997; Struhsaker, 1998; Terborgh, 1999). The effect of shifting cultivation on biological diversity depends on specific attributes of the disturbance created and the niche, dietary, habitat, and other requirements of individual species. More specifically, the type, size, intensity, duration, frequency, and return interval of shifting cultivation affects and in turn are affected by flora and fauna (Wangchuk, 2005; Kerkhoff and Sharma, 2006).

Wildlife survival amid shifting cultivation ultimately depends on a variety of conditions, including hunting intensity, forest cover, cultural norms, and property rights (Cuaron, 2000; Escamilla et al., 2000; Naughton-Treves and Salafsky, 2003). Relationships between biological diversity and historical anthropogenic disturbances, particularly shifting cultivation, collection of forest products, and extensive livestock grazing, warrant empirical investigation and that one should not simply assume a negative relationship a priori (Namgyel et al., 2008). Whether shifting cultivation is beneficial or not to conservation depends on the specific conservation objective (Kerkhoff and Erni, 2005).

There is an important lack of systematic studies on biodiversity value of shifting cultivation in Nepal. Available reports (Aryal et al., 2010; Aryal and Kerkhoff, 2008; Regmi et al., 2005; Kerkhoff and Erni, 2005; Kerkhoff and Sharma 2006) have shown the importance of shifting cultivation ecosystem for biodiversity, in many cases agrobiodiversity, by using participatory tools but not verified with scientific research and empirical data. The authors mentioned that biodiversity is higher in shifting cultivation than in other agricultural systems, and current practices can be adapted to meet certain specific conservation objectives. Scientific studies are essential to statistically verify these versions with data.

Severe declines in plant diversity have been observed in most areas when shifting cultivation is replaced by permanent land use systems. Particularly worrying is the decline in agrobiodiversity (AIPP/IWGIA/IKAP, 2009). Moreover, the traditional culture and crop genetic resources associated with shifting cultivation would be also lost.

The biodiversity in changing shifting cultivation ecosystems in Southeast Asia has been reviewed by Rerkasem et al. (2009). High levels of both spontaneous biodiversity and agricultural biodiversity are associated with traditional shifting cultivation in Southeast Asia. This diversity is, in part, the product of constant innovations by farm households and communities striving to meet economic, ritual and social needs in a highly diverse and changing environment. Rich agro-biodiversity from shifting cultivation lands is sometimes lost completely when they are transformed to monocultures. Understanding of the dynamic processes of the management of agrobiodiversity, including diversity in fallows under shifting cultivation practice, as Southeast Asian landscapes are transformed is clearly inadequate.

Shifting cultivation and climate change

Shifting cultivation is widely believed as a practice promoting deforestation and carbon emission. Cumulative losses from shifting cultivation in the tropics can affect the local to regional to global balance of carbon and nutrient cycles. Eaton and Lawrence (2009) found the repeated shifting cultivation further depressed carbon stocks in live aboveground biomass and coarse woody debris and carbon fluxes in litter. Additional cycles of shifting cultivation may limit future recovery of ecosystem carbon through a decrease in organic matter inputs to the soil. Conversion of shifting cultivation to continuous annual cropping systems brings about substantial losses of time-averaged aboveground carbon stocks, reductions of SOC stocks and generally leads to declining soil quality. Above-ground carbon stock in long fallow shifting cultivation with cycles of 8 years and more was found to be between 74 and 80 t/ha. When shifting cultivators are forced to shorten their cycle to 4 years fallow, the carbon

stock is reduced to 8 to 9 t/ha. Under continuous annual cropping, the carbon stock is only 1 to 4 t/ha. When comparing with industrial tree plantations such as oil palm monocultures, the carbon sequestration capacity of agroforestry systems, including traditional long fallow shifting cultivation is generally higher, however, the short fallow periods have limited such capacity (AIPP/IWGIA/IKAP, 2009). There is important lack of information on the effect of varying fallow period on the carbon stock throughout the soil profile.

CHANGING SHIFTING CULTIVATION SCENARIO OVER TIME

Lands available for shifting cultivation are shrinking (Rasmussen and Jensen, 1999). A natural process of agricultural intensification under population pressure with increased frequency of landuse is by many other authors described as the process of shifting cultivation breaking down or becoming unsustainable (Gilruth et al., 1995; Greenland, 1975; Juo and Manu, 1996; Kleinman et al., 1995; Szott et al., 1999). Traditional shifting cultivation in the tropics integrates a relatively short cropping phase and a relatively long forest fallowing phase as a rotational system in space and time (Unruh, 1990; Yin, 2001; Kerkhoff and Sharma, 2006).

Under the assumption of constant land productivity, food self-sufficiency and land scarcity, population growth would require extension of the cropping phase and shortening of forest fallow phase. This extension would eventually transform the shifting cultivation into the continuous cropping without fallow or sedentary cultivation (Liang et al., 2009). Balla et al. (2000) revealed that farming in shifting cultivation lands are quite unsustainable and are unable to support livelihood systems within the farming communities in two watersheds of Chitwan and Tanahun districts of Nepal. The shorter fallow periods are believed to cause environ-mental damage in the form of soil mining and accelerated erosion which, in combination with national interests in protecting forest resources for other purposes, in many cases has led to a strong resentment by governments towards shifting cultivation practices (Dove, 1996; Fujisaka, 1991). However, the traditional shifting cultivation is under external and internal pressures to change and the circumstances needed for sustainable shifting cultivation systems with long forest fallow phase no longer exist in most regions (Cairns and Garrity, 1999).

All of the transformed agriculture systems are generally more intensive than traditional shifting cultivation, both spatially and temporally. Most commonly cited examples of severe land degradation resulting from shifting cultivation are associated with intensified systems, including opium cultivation, having insufficient fallow periods and uncharacteristically long growing periods (Ziegler et al., 2009). In the long run, disturbed tropical dry forests may respond to shifting cultivation with relatively abrupt and irreversible shifts to states with poor vegetation cover and limited P availability, with consequent loss of ecosystem function and service (Lawrence et al., 2007).

MAKING SHIFTING CULTIVATION SUSTAINABLE

Integral shifting cultivation developed over millennia to site-specific environmental and social conditions and reflects a rich and nuanced understanding of local vegetation, soils and climate (Conklin, 1957; Kunstadter et al., 1978). Under population pressure, the transition from the long-fallow shifting cultivation to short-fallow shifting cultivation with associated land degradation has been claimed to be unavoidable. There is a challenge to identify an alternative land use system that could continue to make use of the logic of traditional shifting cultivation on the sloping lands (Liang et al., 2009). The rotational agroforestry system may be promoted as a viable option for development of the shifting cultivation system in the mountainous areas where the introduction of sedentary agriculture is much constrained (Liang et al., 2009). Agroforestry has a potential to be a sustainable alternative to shifting cultivation (Lal, 1989). Some civil society organizations have promoted the modification of shifting cultivation land using contour hedgerows in Gorkha and Tanahun districts and fruit integration such as pineapple and banana in Makwanpur district of Nepal (own observation). Farmers have experienced such hedgerows beneficial in reducing soil erosion, and improving crop and soil productivity in sloping and shifting cultivation lands.

Realizing the negative consequences of the shortening of the fallowing phase, sedentary agriculture (continuous cropping in the same fields and without fallowing) is often recommended by scientists and promoted through governmental policies as an alternative to replace and discourage shortened shifting cultivation (Brady, 1996; Cairns and Garrity, 1999; Fox, 2000; Borggaard et al., 2003). Sedentary cultivation is not the only alternative to shifting cultivation. Under certain conditions, the rotational agroforestry system integrates crop production with short-term benefits and forest management with long-term benefits to provide multiple and profitable products and avoids shortening of the fallow phase and the land degradation scenario (Liang et al., 2009). The sedentary system, however, lacks the multiple benefits arising from the forest fallow, including soil regeneration as well as forest products (Liang et al., 2009).

Improved fallows have been proposed as a manage-ment alternative to shifting cultivation in the tropics (Nye and Stephens, 1962); in fact, however, shifting cultivators, by encouraging the presence of certain species in fallows, have traditionally used this practice to restore site fertility, suppress weeds, and increase economic yields (Beer, 1983; Budowski, 1987; Padoch and De Jong, 1987; Raintree and Warner, 1986; Unruh, 1990). Considerably higher yields, biologi-cal N_2 fixation, and P solubilization would probably occur if part of the effort for improving crops and legumes for intensive agriculture systems had gone to improving the fallow and crop species used in these traditional systems, which have proved sustainable over wide areas for millennia (Kass and Somarriba, 1999). Still in some studies, the artificial fallows did not do better than the natural forest fallows with regard to nutrient immobilization of the fallowing phase or crop yields of the subsequent cropping phase (Sanchez, 1976). Introducing cash crops is not a miraculous solution for stabilising shifting cultivation. Their promotion requires prior in-depth thought about the socio-economic conditions and suitable research in the on-farm environment (Ducourtieux et al., 2006).

CHEPANGS AND SHIFTING CULTIVATION IN MID HILLS OF NEPAL: A CASE STUDY (Kafle et al., 2009)

A case study by Kafle et al. (2009) has been chosen from an ecohealth research to demonstrate the relationship among land use transition, climate change and human health issues among indigenous Chepang peoples involved in shifting cultivation practice in Gorkha and Tanahun districts in mid hills of Nepal.

Chepang people represent one of the resource poor semi-tribal groups of Nepal. The population of Chepang people in Nepal is 52.237 in 2003, which represents only 0.23% of total population of Nepal. The literacy rate of Chepang people is only 13.9% according to Central Bureau of Statistics of Nepal in 2003. Being hunter-gatherers until about 80 years ago (Chhetri et al., 1997), the Chepang are considered among the semi-nomadic and most primitive indigenous peoples of Nepal. Evidence suggests that they are highly forest-dependent (Chhetri et al., 1997; Manandhar, 1989; Bhattarai, 1995; Gautam et al., 2003; Pandit, 2001) as well as among the poorest and marginalized in Nepal (Bhattarai, 1995). They are poor with very few livelihood alternatives and opportunities. They have poor access to public services on health and sanitation, education, agriculture, and other technologies. They have limited agricultural lands in slopes, mostly the shifting cultivation plots. The large pressure of human on limited marginal and sloping lands contribute to food deficit. Average annual food sufficiency per Chepang family accounts only for 5 months. However, their sustenance depends on wild foods. Kafle et al. (2009) reported 21 wild foods and 25 cultivated crops used by the Chepangs. Of which, few are stress tolerant. But, availability of wild foods is declining due to habitat degradation and over extraction; and hence they are deprived from balanced diet. Accordingly, prevalence of malnutrition is higher among the children under 5 years of age. More importantly, it is higher in females. Nutrition status of females of 15 to 49 years of age, in terms of body mass index (BMI), is poorer than national average. Faecal coliform has been recorded in major water sources. There is practice of applying chemical fertilizers and pesticides in the farmlands, leading to chemical leakage in water bodies. Diarrhea is common problem among Chepang families, which has also caused higher child mortality under five years old. Majority of the households do not have latrines. They follow open defecation in nearby places that contaminates the sources of drinking water.

Shifting cultivation is one of the major farming practices among Chepang families. Agriculture is dominantly rain-fed. In recent years, the shifting cultivation practice is in transition due to shortened fallow period. The Chepang farmers living in project sites have 0.198 ha of shifting cultivation per household in average. They have no legal ownership of these shifting cultivation plots, which belong to the government. The fallow period in shifting cultivation lands has been reduced to about 2.5 years only in the past three decades and most Chepang farmers (> 50%) practice annual cropping instead of fallow in the shifting cultivation land. The farmers have realized the scanty rainfall and rising temperature since last 20 years, leading to drought and drying up of water sources especially in slopy lands. The erratic rainfall pattern and seasonal shift has enhanced landslide and loss of topsoil through floods. Such trend has adverse impact on crop productivity and loss of soil fertility. It also threatens their livelihood option.

These facts reflect the ongoing land use transition and worsening condition of human health in Chepang families in the context of changing climate. The pressure of the impacts of climate change among the resource poor Chepang families is large due to low adaptive capacity, both in terms of their health and resources. The ongoing land use transition, malnutrition, limited livelihood options, poor economy and worse health condition of Chepang families have reduced their adaptive capacity to the changing climate making them more vulnerable to climatic risks and hazards. Local Initiatives for Biodiversity, Research and Development, a civil society organization has been using ecohealth approach to address land use transition, human health and climate

change issues in the areas mentioned in this case study in partnership with ICIMOD.

CONCLUSION

Shifting cultivation is in transition across the world. The characteristics of the shifting cultivation are changing over time. Reducing fallow period, or in some cases with no fallow, and changing vegetation management practices are major alterations in shifting cultivation. The relationship between the crop yield and fallow period is not clear though it is widely perceived that shorter fallows contribute to yield reduction. It needs further research. There is important information gap on the effects of short fallow period on the soil organic matter content throughout the soil profile at different horizons or depths. The statistically valid information on biodiversity value of the shifting cultivation lands and impacts of changing practices on biodiversity is inadequate to establish clear relationships. Further research is recommended on effects of changing shifting cultivation practices on biodiversity. Over centuries, shifting cultivators have created and accumulated profound knowledge on cropping as well as forest management.

However, the current government policies are not supportive to shifting cultivation practices, hence fuelling up the conflicts among the shifting cultivators and forest management authorities, along with land tenure issues. Altering crop and fallow management practices are widely perceived and practised to improve the traditional shifting cultivation practices. The available studies on shifting cultivation in Nepal are inadequate in concluding current status, distribution, management practices and practical implications in relation to this practice. Government policies are not responsive to shifting cultivation practice and shifting cultivators in Nepal, however thousands of indigenous peoples are dependent on this practice for subsistence living. In the context of changing climate, land use transition on shifting cultivation practice in terms of altering fallow period and agricultural intensification can exacerbate the vulnerability of the resource poor farmers and mitigation (carbon sequestration) potential of soil in Nepal. There is urgent need of systematic studies on shifting cultivation in Nepal, and based on this, to provide result based recommendations to the government for its mainstreaming in national plans, policies and priorities.

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