

Review

Impact of community forest management practices in Nepal

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Community forests management in Nepal has been exemplified as one of the most successful programs for participatory resource management. The success of community forestry is described in terms of restoring degraded land and habitats, conserving biodiversity, increasing supply of forest products, empowering women and disadvantaged groups, generating rural incomes, and developing human resources. However, the contribution of existing community forest management practices to biodiversity conservation in the form of enhancing species diversity and ecosystem functioning is questionable. We reviewed the role of community forest management practices to biodiversity conservation based on published materials and our own observations. Practices such as seedling plantation; controlling wildlife hunting, forest fire and grazing; regulating forest encroachment; protecting soil erosion prone area and water resource area assist biodiversity conservation, paradoxically other practices such as species selection; removal of unwanted species during silvicultural activities; leaf litter collection; elite dominance in decision making; and traditional knowledge depletion have detrimental impact on biological diversity and ecosystem function of community managed forest.

Key words: Ecosystem function, knowledge gap, silvicultural practices, socioeconomy heterogeneity, species preference.

INTRODUCTION

Nepal is exemplified as a biodiversity rich country that represents a significant share of global biodiversity, although it comprises 0.09% of global land area (ICIMOD, 2007). It is situated on the central part of the world's top 20 hottest global biodiversity hotspots, the Himalayas. Six biomes and twelve out of 867 terrestrial eco-regions of the world are occurring in Nepal. Nepal's biodiversity, thus, becomes a globally significant and locally important as biodiversity is the important source of livelihoods and income generation. Biodiversity conser-

vation and sustainable utilization of biological resources have been mainstream agenda after rectification and enforcement of more about 20 international treaties and agreements related to biodiversity and environment conservation including Convention of Biological Diversity (GoN, 2009). Biodiversity conservation becomes a high priority in the forest sector policy of Nepal (HMG, 2000). Government of Nepal aims *in situ* conservation of biodiversity by establishing new protected areas along with geographical expansion of current protected areas (HMG, 2002; Heinen and Shrestha, 2006). Although 22.5% of the total areas of Nepal are under legal protection, the current protected areas system is not fully representative of the major ecosystem, forest, and vegetation types (Inskipp, 1989; Hunter and Yonzon, 1993; Heinen and Yonzon, 1994; Shrestha, 2009). The Mid-hills has the greatest number of ecosystems (52 out of 118)

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Abbreviations: CFUGs, Community forest users' groups; NTFPs, non timber forest products; DFO, district forest office.

and high species diversity but has poor representation in current protected areas system (HMG, 2002), contributing only 1.33% of the total protected areas (Shrestha, 2009). Nearly 32% of forests occur in the Mid-Hills (Acharya, 2003) and it also has the highest concentration of community forests in Nepal (Baginski et al., 2003; Adhikari et al., 2004). Therefore, the issue of biodiversity conservation in community forests in the Mid-hills is critical. If not managed properly, could result significant loss of biodiversity (HMG, 2002).

Community forestry program is considered as one of the most successful natural resource management programs in Nepal in terms of restoring degraded land and habitats, conserving biodiversity, increasing supply of forest products, empowering of women, poor and the disadvantaged groups, generating rural income, and developing human resources (Acharya, 2003; Springate-Baginski et al., 2003). Although community forestry program has focused more on protection and production of forestry related needs for its user rather than conserving existing biodiversity (Belbase, 1999), It is perceived that it has contributed to biodiversity conservation (Adhikari et al., 2004; Kijewachakul et al., 2004). Pokharel et al. (2005) claimed that community forests have improved overall forest conditions including biodiversity. Pandey (2007) found comparatively higher tree species diversity on community-managed forest stands than the national parks and government managed forests. However, more rigorous studies are necessary to understand whether the current management practices in community forests have been ameliorating or aggravating or bringing no change in the forest biodiversity. We scrutinize the impact of community forest management practices, stakeholder's state of knowledge on biodiversity, and socioeconomic heterogeneity on forest biodiversity in community forests of Nepal.

Community forestry in Nepal

The community forestry program was initiated on 1978 on the ground of rapid decline of forests area and biodiversity. It is a partnership between local communities and the government for protection, management, and sustainable utilization of forest products and ecosystem services to meet the daily need of local community. Master Plan for Forestry Sector (MoFSC, 1989) fully recognized the need of peoples' participation, and Forest Act (1993) provided detailed guidelines and policy framework for community forestry. The main components of the program are : formation of community forest users' groups (CFUGs), the preparation of operational plan, approval of the operation plan by district forest office (DFO), and hand over of the forest to the community (HMG, 2002). In this legal and strategic framework, the CFUGs have been, managing, protecting, and utilizing forests for more than three decades. Up to now, about

35% of the population of Nepal is involved in community forestry management program managing 25% of the total area of forests (Nurse and Malla, 2005). By the end of October 2008, a total area of 11.23 million ha of national forest has been handed to 14,431 CFUGs involving 1.66 million households (GoN, 2009).

Biodiversity conservation in community forestry

National Forestry Plan (1976) for the first time encouraged the involvement of local people in participatory natural resource management (Acharya, 2002) . With this new paradigm of involving communities in resource management, the community forestry program was formally initiated under the legislative framework of Panchayat Forest Rules (1978) and the Community Forestry Programme (1980) by giving right to local communities to manage forest. The Master Plan for the forestry Sector (1989), the Forest Act (1993), the Forest Regulations (1995), and the Forestry Sector Policy (2000) reaffirmed government's policy to implement and strengthen the community forestry program. Forest Act (1993) incorporated the issues of biodiversity conservation by providing different provisions relating to protected forests, community forests, and leasehold forests however, very little is mentioned to incorporate biodiversity conservation in community forests in Forest Act.

Several efforts had been made to incorporate biodiversity conservation into policy, planning, and strategy; however, the issues of biodiversity conservation were much focused and confined only in conserving species, habitats, and ecosystems located inside the protected areas prior to 2000. The National Biodiversity Strategy (2002) urged to integrate the conservation of biological diversity and the sustainable use of its components into sectoral and cross-sectoral plans, programs, and policies (HMG, 2002). It also identified the need, constraints, and gaps of conserving biodiversity outside the protected areas especially community forests of the Mid-hills.

More recently, the issues of biodiversity conservation and ecosystem services have been incorporated in Community Forestry Guidelines (2009) . It is yet not free from the traditional utilitarian concept; under the guidelines, CFUGs have to make inventory of only useful plants, not all the species reside in the forests. The usefulness again is based on the personal judgment and state of knowledge. Thus, it would not make a significant change on current management practices, practices which that have been turning diverse forest into monoculture.

Although the number and coverage of community forests have been increased, there exists limited information on biodiversity conservation in terms of species richness, taxonomic diversity, and crown coverage due to the lack of an in-depth study and research (GoN, 2009). Due to lack of baseline information, it becomes harder to

investigate the impacts of management interventions over the time. Much has been written and debated on the policy (e.g. Acharya, 2002; Springate-Baginski et al., 2003; Gautam, 2006; Ohja et al., 2009) and socio-economic aspect (e.g. Timsina, 2003; Nightingale, 2003; Adhikari et al., 2004; Iversen et al., 2006; Sapkota and Oden, 2008) of community forestry, but conservation of biodiversity and maintenance of ecosystem services in community forests have been given very little attention in policy forum and by forestry technicians. It is essential to think about maximum utilization of forest resource but at the same time we should concern about maintaining biological diversity and conserving the ecosystem services in the forest.

Impact of community forests management practices on biodiversity

With the shift to active forest management, several types of silvicultural operations such as cleaning and weeding, thinning, pruning, coppicing, selective felling, singling, collecting litter, grass, and dry twig, grazing, establishing and monitoring of trial plots, harvesting and removing dead and logged trees along with planting new species have been designed and undertaken by CFUGs (Dhital et al., 1998; Ojha and Bhattarai, 2001; Khadka and Schmidt-Vogt, 2008). Controlling wildlife hunting, forest fire and grazing, regulating forest encroachment, conservation soil erosion prone area and water resource area are other activities carried out in community forests (Dhital et al., 1998; Ojha and Bhattarai, 2001; Acharya, 2003). Those activities fulfill the subsistence and commercial needs of the CFUGs.

Maintaining compositional, structural and functional attributes of forest ecosystem is one of the important approaches of biodiversity conservation (Franklin et al., 2002). Silviculture affects these three attributes of forest ecosystem in different scale and intensity (Khanna, 1994) if not carried out with caution; it can threaten biodiversity (Putz and Blate, 2001). The controlling of wildlife hunting, grazing, forest fire and conservation of soil erosion prone areas have positive impact on forest biodiversity, whereas leaf litter collection, species selection, removal of unwanted species, of herb, shrubs and climbers, excessive thinning and pruning, removal and harvesting of dead and logged trees and forest clearing cause detrimental impact on the structure, composition, and function of the forest.

Species preference, selection and removal

Silvicultural activities, combining with the district DFO and NGOs staffs' knowledge, have been initiated by CFUGs according to forest condition and community needs (Dhital et al., 1998). The silvicultural activities are carried

out mostly on local knowledge and skills rather than scientific justifications (Ojha, 2001). Completely utilitarian orientation of community propels selection bias. CFUGs select species based on usefulness of the species whose value or importance they are well-informed. CFUGs remove the undesired species from the forest and keep the desired ones during silvicultural activities. Timber, fast growing and multipurpose species including medicinal plants are likely to be kept in the forest, whereas low quality timber and little known value species of herbs, shrubs, and climbers have been removed (Acharya, 2003; Baral and Katzensteiner, 2009). For example, in a *Shorea robusta* dominated forest in (Devasthan Community Forest of Dhading District); use of *S. robusta* was completely banned while the villagers were free to use *Schima wallichii* and *Castanopsis indica* (Shrestha, 2005). In some community forests of Nawalparasi District, the junior field staffs of DFO have suggested to remove herbaceous climbers, lianas, and epiphytes (including CITES listed orchids) during silvicultural activities (BB Shrestha, personal observation, May 2007). The species preference and selection obviously augment the population and productivity of desired species but, meantime population of so-called undesired or value unknown or "valueless" species would become vulnerable.

The literal meaning of the term "Jhadi katne", which is one important silvicultural practice carried out by communities in 4 - 5 years interval, is removal of shrub species. In most of the community forests, the forests are divided into blocks and those silvicultural practices are done block wise in a rotational basis. For example, Nawalpur Saraswoti forest and Chakradevi community forest of Makwanpur District, forests divided into five blocks and silvicultural practices were carried out each year in each block (Acharya et al., 2007). During this time, herbaceous species, shrubs, and low quality timber yielding species, which are locally called "Kukath", have been eliminated and high valued timber species, which are locally called "Kath", have been kept on the forest (Ojha and Bhattarai, 2001). Frequent removal of thorny bushes, climbers, and other weeds are very common during "Jhadi katne" (Khadka and Schmidt-Vogt, 2008). Continuous "Jhadi katne" might convert all shrub-land into high forest area and reduce the structural diversity of forest. Moreover, it reduces the abundance and diversity of shrubby species in the forest.

"Godmel", literal meaning of removing unwanted tree sampling and seedling is another popular activity carried out by community in 3 - 5 years interval. This can cause reduction of the population and species diversity of tree species and ultimately convert mixed forest into monoculture of desired species. Development of mixed *Shorea robusta* forest to mono-dominant *S. robusta* forest due to community management have been reported in some community forests of central Nepal (Kandel, 2007; Shrestha, 2005; Acharya et al., 2007). *S. robusta*

is the single species highly preferred even in the mixed *S. robusta* forest (Ojha and Bhattarai, 2001; Acharya, 2003). Similarly, only *Castanopsis tribuloides* and *Quercus glauca* are preferred and preserved and other species are removed in mixed *C. tribuloides* and *Q. glauca* forests (Baral and Katzensteiner, 2009). Density of *S. robusta* has been increasing in managed forest at the expenses of low quality timber yielding species and shrubs (Kandel, 2007; Acharya et al., 2007; Shrestha, 2005). Acharya (2003) noted that out of 28 tree species in Bharkhore community forest, Central Nepal only 18 species were preferred. Similarly, in Kali Gandaki community forest, out of 45 tree species only 15 species were preferred. Likewise, all 33 shrub species were categorized as non-preferred species by both of the CFUGs (Acharya, 2003).

In a recent survey of six community managed forests in Dhading District, it was found that *S. robusta* constituted only 30% of the total fuelwood harvested during thinning, while in the same forests the mean contribution of *S. robusta* to community index (importance value) was 65% (Toya Belbase and BB Shrestha, unpublished data). The prevalence of species preference is found not only during silvicultural practice, it is also pervasive during the process of making operation plan in the beginning of community forests. The practice of documenting a comprehensive list of species found in the community forests is lacking while making operation plan. The names of only the most noticeable species are listed in the operational plan (Khadka and Schmidt-Vogt, 2008) that makes monitoring the change harder otherwise impossible.

Species preference, selection of single species, and removal of other species from a mixed species forest stand can eventually lead to monoculture in the forest and this has detrimental effect on not only species richness but also forest stability and health. Species mixtures appear to have lower levels of pest damage and higher resistance to invaders and weeds (McGrady-Steed et al., 1997), whereas monoculture in forest increases the vulnerability of forest to pests and diseases (GoN, 2009). Monoculture also diminishes habitat quality and habitat degradation result exotic species invasion (Somanathan, 2007).

Neglected lower plants

Along with shrubs, Pteridophytes especially the ferns are other neglected groups and are removed as weeds. "Hade unuyu" (*Gleichenia gigantea*) is one of the most neglected species and it has been removed extensively from the forest (Lawrence, 2002). It appears that CFUGs are not aware of the important role of Pteridophytes in controlling soil erosion. The excessive removal of the Pteridophytes along with other ground vegetation can have detrimental effect on soil conservation, no matter how big trees are there in the forest (Jones, 1987). In such forest, surface erosion is high that could trigger landslide and ultimate loss of biodiversity.

Habitat alternation

Besides, selection and removal of living species, CFUGs also removed dead and logged trees (Dhital et al., 1998). Most of the CFUGs allow unrestricted collection of dead wood for use as fuel wood to the members. The dead trees, fallen logs, and litter form important microhabitats for invertebrates, mosses, fungi, and lichens, and their continued removal may lead to reduce diversity (HMG, 2002). Collection of dead logs for fire wood would be a major threat to polypore species (a group of strictly dead wood fungi) and diversity of other life forms associated with dead wood (Christensen et al., 2009). The diversity of rotifers and fungi, which are dependent to dead wood, can be conserved by leaving some dead trees on the forest floor in all phases of the rotation period. But such practices are rarely observed in community forests since the value of micro-habitats is unfamiliar to the CFUGs.

Leaf litter collection

Leaf litter collection is widely practiced activities of community forests (Dhital et al., 1998; Acharya, 2003). Leaf litter is utilized to make compost and is one of the major sources of soil nutrients in the Mid-hills of Nepal (Oli and Manandhar, 2002). The collection of leaf litter is relatively higher than the sustainable extraction level (Ojha and Bhattarai, 2001). Completely clean forest floor in community forests of Panchkhal area of Kavre District was seen (BB Shrestha, personal observation, September 2006). The collected leaf litter is used for animal bedding, compost making, and spread on the field to increase the nutrient content of soil (Branney, 1996). Leaf litter has been collected to prepare organic manure for agricultural crops for potato cultivation. Collection of leaf litter has detrimental impact on the nutrient cycling and detritus food chain of the forest ecosystem and ultimately weakens the ecosystem function of forest (Wardle et al., 1997). Excessive removal of fallen logs and litter not only reduce biodiversity but also impoverish the forest ecosystem in terms of nutrient pool. To what extent does the litter collection affect the functional aspects of the forest ecosystem is still ambiguous and need a detail research in the Nepalese context.

Impact of Knowledge lack, gap and deterioration on biodiversity

There is wide range of ambiguity and considerable gap among planners, policy makers, NGO staffs, CFUGs, and other stakeholders involved in the forestry sector of Nepal to understand and perceive the term biodiversity and its Nepalese translation "Jaiwik bibidhata" (Acharya et al., 2004). Most CFUGs lack awareness about biodiversity and its potential benefits and consequences of its loss (Acharya et al., 2004; Khadka and Schmidt-Vogt, 2008). Biodiversity conservation has been a secondary issue in

present forest management (Acharya, 2004) and insufficiently integrated in operational plan (Khadka and Schmidt-Vogt, 2008). Among 17 indicators selected by 487 members during a community forestry workshop, biodiversity conservation isn't an acceptable indicator to determine the success of community forestry (Pokharel and Suvedi, 2007). During stakeholders consultation workshop at district level in 2008, it was observed that the terminology such as 'biodiversity', 'climate change', 'access to genetic resources and benefit sharing' are generally unfamiliar to the local communities (GoN, 2009). Lack of knowledge among CFUGs coupled with ambiguity and knowledge gap among government and NGO staffs on understanding the term and its consequences make the incorporation of biodiversity conservation goal in operation plan of community forestry more complicated.

In this context, the role of junior field staffs of (DFO) becomes crucial as they are the main responsible government staff to provide technical support to CFUGs. Unfortunately, these field staffs themselves are not well trained to meet the objective of biodiversity conservation in community forests. In many areas, those junior forestry field staff encourage community to select and remove undesired species. That blemishes determining biodiversity indicators in operation plan and understanding the importance of biodiversity conservation by CFUGs at local level. Thus, despite a huge effort on conservation and management of forest ecosystem, the biodiversity conservation goal in real sense is hard to achieve. The knowledge gap among and between different stakeholders involving in community forestry sectors can be mentioned as a major threat to achieving the goal of biodiversity conservation (HMG, 2002). Biodiversity is the source of livelihoods for CFUGs consisting of the poor and disadvantage groups. Rural people with high forest dependency are the source of the knowledge on the utilization of plants and Non Timber Forest Products (NTFPs). Traditional knowledge on utilization of forest plants, animals, and their products is gradually depleting, and in some instances, completely lost (Acharya et al., 2004). People who used to rely on medicinal plants for the treatment of disease have adopted modern medicines; consequences of which is their traditional knowledge on medicinal plants has depleted. Traditional knowledge has been disappearing along with the death of local healer, herbal practitioner or the senior citizen who acquire knowledge on the utilization of plants and its products. Knowledge deterioration on usage of plants makes the plants valueless in successive generations. Those plants, which have no or unknown economic values are of little interest of CFUGs and such plants have been removed during silvicultural operation; this causes a serious threat to the value of unknown or valueless species. In Gokhureshwar community forest of Kavre District of central Nepal people used to remove "Eklibir" (*Lobelia pyramidalis*), a rare medicinal plant, as a

weed. When an expert described the medicinal value of that species, they realized the importance of that plant and began to conserve in their community forest (UB Shrestha, personal observation, April 2004).

Impact of socioeconomic heterogeneity on biodiversity

Nepalese cultural, ethnic and religious diversity is reflected in the composition and structure of CFUGs that comprise people of different economic class, gender, ethnicity, religion, and political affiliation. The relationship between the forests and livelihood of the members of the communities therefore vary tremendously on the basis of their needs and interests. For instance, Black smith might have interest on the hard wood species suitable for making coal. Women might prefer fodder trees and religious families prefer religious plants, local healers certainly vote to medicinal plants and community elites like greenery and so on (Ojha et al., 2003). In this sense, influence of community heterogeneity could play important role in maintaining forest heterogeneity and species diversity as different ethnic group, gender, and economic class has different interests and preferences (Pokhrel, 2001).

The diverse interests and needs of the community is helpful in maintaining diversity in forest as if all of the members of the CFUGs are equally privileged and participated in operational planning, decision making, and implementation process. But this ideal condition is rarely observed. Women and disadvantaged groups were often neglected in the decision making process and the local elites and resource rich people reaped most of the benefits (Richards et al., 1999; Neupane, 2003; Iversen et al., 2006). Underprivileged participation of poor, members of so-called lower cast, and women along with domination of few elites on decision-making in the user groups alter the situation; user groups ultimately promote the elite's preferences and rely on elite's needs. In Sishwar community forest, a species called "Vokta" (*Eulaliopsis binata*) was used by the poorest groups for rope-making. Since the rich households could afford plastic ropes, they eliminated this species as a weed, and the poor suffered (Neupane and Ojha, 2002). Another example comes from Pallopakha community forest in Central Nepal, where women were found to value "Tinju" (*Dyosporus melanxylon*), whereas men valued only "Sal" (*S. robusta*) and "Chilaune" (*Schima wallichii*) (Ojha et al., 2003). Thus, despite the socio-economic heterogeneity, the difference in political position and elite dominance influences the species preference and selection; species preferred by elites are retained in the forest and the species preferred by unprivileged groups are wiped out. This situation finally alters the composition and structure of the forests.

Conclusion

Despite of some positive steps towards the conservation,

there are some serious negative impacts of current community forests management if not corrected, will pose serious threat to biodiversity. It is evident that anthropogenic, environmental, socio-economic, political, and knowledge factors play crucial role in conservation, maintenance, and degradation of forest biodiversity in community forests of Nepal. These factors solely or jointly affect structural, compositional, and functional aspects of forest ecosystem at different levels in different scale and intensity. By scrutinizing community forests management practices, it can be concluded that community forest user groups and policy makers have been giving less attention to the attributes of biodiversity, ecosystem functions, and services. Short-term economic motive, elite sanction, and knowledge gap are the major constraints for achieving the goal of biodiversity conservation in community forests.

Communities are not only unaware about maintaining biodiversity, forest health, and ecosystem services of the forest but also misinformed to set the goal of sustainable forest management. They are inclined toward increasing monoculture of high economic valuable species and greenery of the forest rather than the natural forest, which could be habitat of all types of living organisms from smaller lichens and fungi to larger plants and animals. Scientific knowledge about taxonomy, conservation status, methods of propagation, and utilization of species is necessary and that should be combined with the local or indigenous knowledge to design sustainable forest management goal. Forests is not only the stocking of trees and sources of timber but also are is the store house of biodiversity and sources of many ecosystem services such as balancing environment, soil conservation, nutrient cycling, pest and disease control, drinking water, crop pollination, and climate regulation etc. Thus forest conservation should not be perceived only as increasing the number of economically important trees but should be perceived also as the conservation of ecosystem function and service of the forest. For the maintenance of ecosystem function, every species, whether important economically or not, should be conserved and maintained in nature.

Community forestry has become an indispensable part of the rural livelihood and an important component of forestry sector of Nepal. There is no doubt that community forests have laid the foundation for biodiversity conservation by reversing the trend of deforestation and increasing regeneration. However, it is essential to change the current management practices that affect the composition, structure, and function of forest negatively. Although little progress towards the policy amendment has been done, the practice has not been changed due to weak implementation institutions. Inclusion of biodiversity issues in community forestry plans and programs helps to maintain the resiliency of forest for a long run. We herewith call a policy imperative to incorporate biodiversity issues in community forestry in Nepal.

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