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Developing community forestry management strategies for multiple ecosystem services and benefits in the mid-hills, Nepal

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1. Introduction

Nepal is a mountainous country where forest is one of the large natural resources with 25.4% of total land area under forest cover (FAO, 2005). In Nepal a variety of strategies and practices have been initiated to safeguard and manage the forest resources and various rules, regulations, acts, policies and programs related to forest management have been formulated. Among them, Nepal has been a pioneer in promoting and increasing community forestry (CF) by handing over the national forests to local communities with formation of Community Forest User Groups (CFUGs). The CFUGs are authorized to use forest products and services in a sustainable manner. To date 1,652,654 ha of forest area is under CF management by 17,685 CFUGs. This comprises about 28% of the country's total forest area (DoF, 2012). Although, CF is regarded as one of the most successful forestry programs in terms of increasing forest cover on degraded land and increasing forest productivity and bio-diversity (Jackson and Ingles, 1994; Branney and Yadav, 1998; Shrestha, 1999; Acharya, 2003) the livelihood improvement issue still remains an issue. In the last three to four decades, much emphasis has been laid on social processes, public awareness and participation of various ethnic groups in forest management activities. Forest production potentials regarding to timber and non-timber products as well as a variety of ecosystem services, the specification of management goals as well as sound silvicultural forest management strategy to achieve such goals have not yet received so much attention in community forests.

The CFUGs are doing major silvicultural operations such as thinning from below, pruning and single tree selection based on their operational plans to fulfil basic needs for forest products. But users are not able to use the potentials of the resource and to optimize the utilization of forest resources. This "under-achievement" in efficient and sustainable use of resources in CF may be due to several reasons including inadequate technical know how regarding silvicultural operations, inappropriate planning procedures, lack of enforcement of policies, insufficient knowledge about the forest resource potential among users and insufficient technical support by authorized government agencies. In order to address these issues, this research was conducted in Taldanda CF in the mid-hill region of Nepal (Figure 1). The main aim of the research was to assess the currently practiced forest management activities and develop appropriate alternative forest management strategies to achieve multiple benefits and ecosystem services

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2. Material and Methods

The study was carried out in Taldanda community forest from September 2011 to April 2012 in Tanahun District, mid-hill region of Nepal as a case study where a combination of tools including stakeholder interactions, Focus Group Discussions (FGD), interviews and forest inventories were used. A total of 8 FGDs from different castes and social classes including the district forest office were conducted. Seventy four (74) sample plots were measured based on a common method of systematic sampling called quadratic square grid in all four forest management blocks to identify the socio-economic, bio-physical, and ecological conditions.

Figure 1: Map showing the location of the case study community forest in the mid-hills in Nepal.

A local set of criteria (5) and indicators (30) was developed and finalized in consultation with members of 8 focus groups where the number and type of indicators were identified, which varied from 4 to 8 within each of the five criteria (Table 2). A five point qualitative ordinal scale (very good, good, satisfactory, bad and very bad) was used to assess the performance of current forest management operations with respect to indicators (30) by 50 CFUG members. The most frequent category per indicator was taken as performance value (Table 2). Addressing the diverse interest of stakeholders, three alternative forest management strategies have been developed. In addition, two multi-criteria analysis (MCA) techniques such as scoring and pair-wise comparison have been used for the evaluation of forest management strategies. Scoring method was used to identify the importance of C&I. Scores were given to all criteria and indicators by using the scale [0-10], where 0 = not important at all and 10 = highly important. The pair-wise comparison technique based on the method developed by Saaty (1995) called analytical hierarchy process (AHP) was used to compare the current and three alternative forest management strategies for better decision making. AHP is a frequently used multi-criteria decision making (MCDM) tool in the field of natural resource management (Mendoza and Martins, 2006). MCDM processes have proved to be useful tool in organizing forest management problems (Ananda and Herath, 2005); supporting participatory decision-making in forest planning (Nordström et al., 2010); negotiation and mediation processes (Bojórquez-Tapia et al., 2005; Antunes et al., 2006) that could potentially increase the quality of decisions by matching interests and thereby allowing solutions which effect in a higher level of overall stakeholder satisfaction.

3. Results and Discussion

3.1 Current forest management operations and stakeholder's satisfaction

Taldanda CF is an uneven-aged Shorea robusta secondary forest with a total of 65 ha forest area. Currently, users are managing the forest by separating it into four management blocks and adopting major silvicultural operations to fulfill their basic needs for forest products based on 5 years forest management plans. Table 1 shows that similar forest management operations such as thinning from below, single tree selection and continuous grazing were found in all blocks of

Talanda CF. Users were adopting two harvesting methods, one is removing weak, dead, dying and bad quality trees that are affected by diseases called thinning from below and another type is focused on large and mature trees that the user group wanted to remove refer to as single tree selection.

Table 1: Currently used forest management operations by management blocks and operation year in Taldanda CF.

Block - I: upper zone (about 18 ha) 1. Continuous grazing 2. Non-timber forest products collection **Block - I: lower zone** (about 13 ha) 1. Thinning from below (2008 and 2012) 2. Single tree selection (2008 and 20012) 3. Continuous grazing 4. Non-timber forest products collection	**Block – II** (11 ha) 1. Thinning from below (2009) 2. Single tree selection (2008, 2009 and 20012) 3. Continuous grazing 4. Non-timber forest products collection
Block – III (10 ha) 1. Thinning from below (2010) 2. Single tree selection (2008, 2009, 2010, 2011 and 20012) 3. Continuous grazing 4. Non-timber forest products collection	**Block – IV** (13 ha) 1. Thinning from below (2011) 2. Single tree selection (2008, 2009, 2010, 2011 and 20012) 3. Continuous grazing 4. Non-timber forest products collection

According to the stakeholder information and CF records, in 2011 users extracted 851cft timber from single tree selection method. Fuel-wood of 420 bhari/ha (1 bhari=35kg), small timber 240 kg/ha and fodder 168 bhari/ha (1 bhari = 35kg) were extracted during the operation thinning from below. Total 3768 kg non-timber forest products from two category (i.e. leaves of Shorea robusta = 3656 kg/year and medicinal plants = 112 kg/year) were collected throughout the forest (65 ha) by 325 households in 2011. Cattle and goat grazing have been a continuous practice in this CF. A total of 321 goats and 7 cattle visited the forest for grazing in six month period per year.

Performance assessment revealed that thinning from below considered very good in only 3 indicators. Not any indicator qualified as very good in single tree selection and continuous grazing. So users are not fully satisfied with current forest operations. Yadav (2004) also highlighted that many CFUGs in Nepal practice protection orientated forest management where an appropriate silviculture system is lacking.

Table 2: Indicator value on current forest management operations in Taldanda CF. (VG=Very good, G=Good, S=Satisfactory, B=Bad, VB=Very bad, and NA= not applicable)

C	I	Description	Stakeholders responses		
			Thinning from below	Single tree selection	Continuous grazing
1	I1.1	Maintenance/ Enhancement/ Restoration of natural tree species composition	G	S	S
	I1.2	Promotion of endangered/ threatened plant species	S/B	B	NA
	I1.3	Tree species diversity	S	S	NA
	I1.4	Share of exotic species	NA	NA	NA
	I1.5	Maintenance/ Enhancement/ Restoration of habitat for endemic wildlife species	S	B	NA
	I1.6	Maintenance/ Enhancement of deadwood	VB	VB	NA
	I1.7	Maintenance/ Restoration of nutrient cycling	S	B	S
	I1.8	Promotion of forest regeneration	S	S	S
2	I2.1	Reduce the risk of forest fire and fire damage	G	NA	NA
	I2.2	Control of forest pests and diseases	G	G	NA
	I2.3	Grazing does not negatively impact forest regeneration	NA	NA	S
	I2.4	Minimize area with soil compaction through management activities	S	S	G
	I2.5	Improvement of degraded land	VG	NA	NA
3	I3.1	Production of timber	VB	S	NA
	I3.2	Production of fuel-wood	S	S	NA
	I3.3	Provision of fodder	S	B	NA
	I3.4	Provision of forest litter for compost	S	NA	
	I3.5	Control of erosion/ landslides	VG/G	G	VG
	I3.6	Contribution to the protection of water resources	G	G	NA
	I3.7	Provision of livestock grazing	NA	NA	S
	I3.8	Protection and enhancement of NTFPs	VB	B	NA
4	I4.1	Management activities are based on objectives	G	G	G
	I4.2	The forest area to be managed is clearly defined	VG/G	G	S
	I4.3	The management operations are clearly described	S	S	S/B
	I4.4	A rationale for the annual/periodic harvest/use rate is documented	S	I don't know	VB
	I4.5	The cost/benefit (input/output) ratio of a specific management practice has been estimated as favorable	G	G	G
5	I5.1	Provision of employment opportunities for local people	B	S	NA
	I5.2	Promotion of skilled labour	B	B	NA
	I5.3	Safety and occupational health of workers	VB	VB	NA
	I5.4	Social development activities	S	G	NA

3.2 Criteria preference of stakeholder groups

The local criteria such as ecological values (C1), forest protection (C2), forest products and services (C3), planning and controlling (C4) and social values (C5) were formulated and finalized in 8 focus group discussions. The relative importance of each of the criteria was calculated based on the scored value assigned by 8 different stakeholder groups (Figure 2) and indicated that most of the groups (DFO staff, educated people, upper caste, lower caste and committee members)

ranked planning and controlling (C4) as the most important criterion in terms of CF management. The Muslim community gave highest score to forest protection (C2) and women group gave slightly higher preferences to forest products and services (C3). Overall, the result showed that there were different opinions among various stakeholders in the community in managing their forests. This statement is also supported by Khadka (2006).

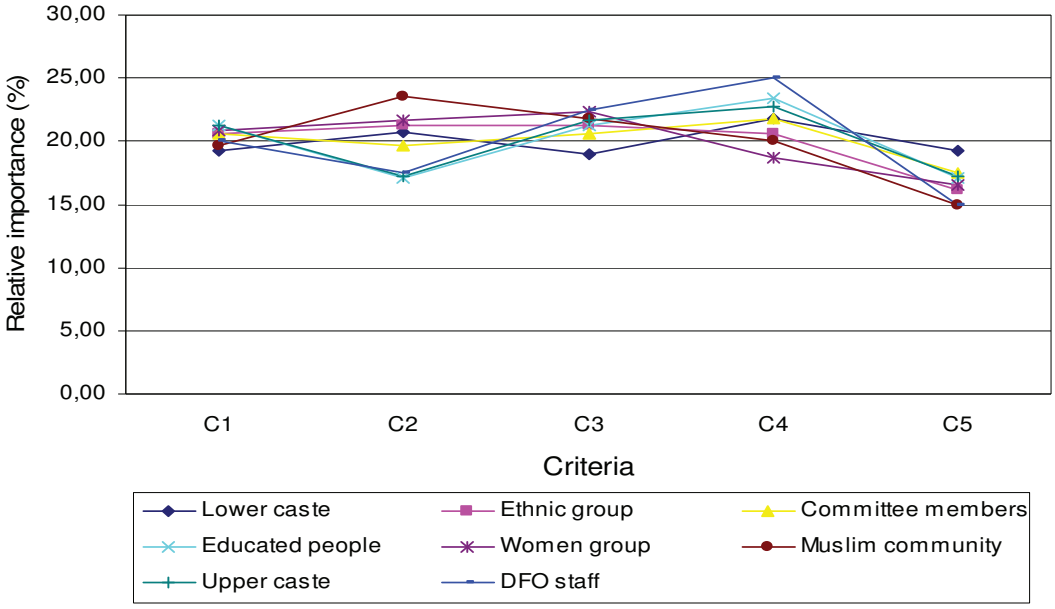

Figure - 2: Relative importance of 5 criteria ranked by different stakeholder groups, where C1 = Ecological values, C2 = Forest protection, C3 = Forest products and services, C4 = planning and controlling and C5 = Social values.

3.3 Development of alternative forest management strategies (FMS)

Three alternative forest management strategies (FMS) were developed in order to address the user's diverse interests and objectives as well as the weak performance of current forest management approaches. Alternative forest management strategy FMS-1 focused on the sustainable multi-purpose forest management, which is developed with the participation of local users based on their interest and objectives. CFUG could utilize timber and non-timber forest products (timber, small timber, fuel-wood, fodder, leaf, NTFP/medicinal plants) and forest services (livestock grazing) in sustainable way without forest degradation and income generation possible through marketing of NTFP. The major operational activities under alternative FMS-1 were planned as follows:

- single tree selection (1147cft/year annual allowable cut on 65ha).
- new crops are obtained by natural regeneration continuously.
- thinning from below (3 times) and pruning (once) between 10-29.9cm dbh classes
- block wise rotational grazing: 2 year (6 months/year) in one block, average 10 goats/ha and 1 cattle/ha was planned for grazing
- NTFP collection and marketing (total 5825 Kg/year from Shorea robusta leaves, nuts of Castonapsis indica and medicinal plants was estimated from 65 ha)
- wild-life habitat maintained systematically (10m2 bushy area in every 500m and 2-5 standing dead trees/ha and 5 lying wood/ha) and systematic fire-line (3m wide fire-line in every 100m distance in square grid system)
- bio-engineering technique to control the soil erosion

The alternative forest management strategy FMS-2 focused on commercial forest management. CFUG could produce and sell quality timber. The major operational activities for alternative FMS-2 were planned as follows:

- uniform shelter-wood approach planned in different (3) successive felling (in seeding cut seed bearer trees retained 75-80 trees/ha uniformly between 11m to 12m, in secondary cut retained 30-35 trees/ha between 17m-18m and remove all seed/shelter trees during final cut)
- regeneration period 10-20 years
- light thinning, pruning and cleaning of new crop
- no grazing and fencing for re-generation protection
- hunting prohibited and forest watch by fire watcher
- vegetative planting to control erosion

The alternative forest management strategy FMS-3 was based on the socio-economic benefit prospective. Users could produce timber and harvest basic forest products (fodder and fuel-wood). The major operational activities for alternative FMS-3 were planned as follows:

- two regeneration felling methods (patch cut and single tree selection) have been designated considering the forest slope. The upper zone of each forest management block has been planned with single tree selection method. A total 3 ha forest area from the lower zone of each block is forseen for the patch cut method.
- new crop obtained by plantation of fast growing tree species (Dalbergia sissoo) in patch cut area with spacing 2m*2m and continuously natural regeneration in single tree selection area
- weeding: every year, until 3 year after plantation
- thinning from below (2 times in plantation and 3 times in single tree selection) and pruning (every 10 and 20 year after plantation and once in single tree selection area)
- no grazing, hunting prohibited and forest road used as a fire-line and for timber transport
- soil erosion control by making bamboo crib-wall

3.4 Comparing forest management strategies

The AHP technique has been employed to select the best management strategy in comparing the performance of each FMS regarding locally acceptable 30 indicators. Based on the result, the overall preference for the four forest management strategies (current and three alternatives) from pair-wise comparison (Figure 3) indicate that all the stakeholder groups have given high preferences to alternative FMS-1 and FMS-3 as the second preference. Current forest management approach and FMS-2 were more or less similar and lowest preference in general.

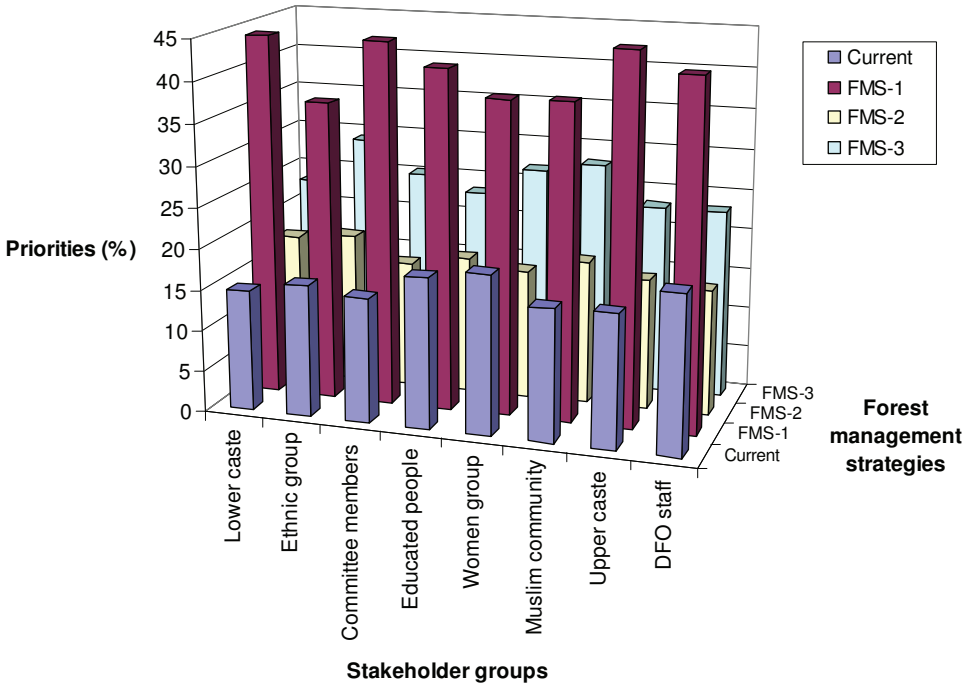

Figure 3: Overall preferences for all four forest management strategies.

4. Conclusions and Outlook

According to the responses received from the stakeholders current forest management operations do not fully match with users needs and objectives. Users are not much satisfied with current CF management system. Therefore, the concept of three alternative forest management strategies was developed addressing the diverse interest of stakeholders for better decision making. Based on the results from multi-criteria analysis, alternative forest management strategy-1 was found to be most preferred management strategy in order to address the user's diverse interest for achievement of multiple ecosystem services and benefits on a sustainable basis. Multi-criteria analysis (MCA) has been considered to be a very useful tool for organizing the diverse interest groups for better decision and support with participatory community forest management tool.

References

Acharya, K.P., 2003. Conserving biodiversity and improving livelihoods: The case of community forestry in Nepal. Paper presented at the international conference on rural livelihoods, forests and biodiversity 19-23 May 2003, Bonn, Germany.

Ananda, J., Herath, G., 2005. Evaluating public risk preferences in forest land-use choices using multi-attribute utility theory. Ecological Economics 55 (3): 408-419.

Antunes P., Santos R., Videira N., 2006. Participatory decision making for sustainable development: the use of mediated modeling techniques. Land Use Policy 23 (1): 44-52.

Branney, P. and Yadav, K.P., 1998. Changes in community forestry condition and management 1994-98: Analysis of information for the forest resource assessment study and socio-economic study of the Koshi Hills. Project report G/NUKCFP/32, NUKCFP, Kathmandu, Nepal.

Bojórquez-Tapia, L.A., Sánchez-Colon, S., Florez, A., 2005. Building consensus in environmental impact assessment through multi-criteria modeling and sensitivity analysis. Environmental Management 36 (3): 469-481.

Department of Forest, 2012. Community forest user groups' data based, Nepal.

Food and Agriculture Organization, 2005. Deforestation data for Nepal 1990-2005.

Jackson, W.J. and Ingles, A.W., 1994. Developing rural communities and conserving the biodiversity of Nepal's forests through community forestry. Paper presented at a seminar on community development and conservation of forest biodiversity through community forestry: Bangkok, Thailand, 26-28 October 1994.

Khadka C., 2006. Criteria and indicators for community based sustainable forest management: Case study from Nawalpur Saraswati (Basamadi) community forest user group, Makawanpur District, Nepal. A thesis submitted to University of Natural Resources and Applied Life Sciences in partial fulfilment of the requirements for the degree of masters in forest science.

Mendoza, G.A., Prabhu, R., 2003. Qualitative multi-criteria approaches to assessing indicators of sustainable forest resources management. Forest Ecology and Management 174, 329-343.

Mendoza, G.A., Martins, H., 2006. Multi-criteria decision analysis in natural resource management: A critical review of methods and new modelling paradigms. Forest Ecology and Management 230, 1–22.

Nordström, E.M., Eriksson, L.O., Öhman, K., 2010. Integrating multiple criteria decision analysis in participatory forest planning: experience from a case study in northern Sweden. Forest Policy and Economics 12 (8): 562-574.

Saaty, T., 1995. Decision making for leaders: The analytic hierarchy process in a complex world. RWS publications.

Shrestha N., 1999. Forest Control, Development and State Formation in Nepal, the degree of Doctor of Philosophy Interdisciplinary PhD Program Faculty of Graduate Studies at Dalhousie University Halifax, Nova Scotia, November 1999.

Yadav N.P., 2004. Forest Users Group in Nepal: Impact on Community Forest Management and Community Development. Submitted in accordance with the requirements for the degree of Doctor of Philosophy, The University of Leeds, School of Geography, U.K.