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REVIEW

Sustainability Assessment of Community Forestry Practices in Nepal: Literature Review and Recommendations to Improve Community Management

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Abstract Nepal's Community Forestry Program is a sustainable forest management and livelihood enhancement program reformed from earlier programs of the previous century. The government's initial policy was to provide the basic forest resources to local communities through their active participation in forest improvement and management. Nepal's policy and development program was based on sustainability concepts. Community forestry can be sustainable and produce socially, economically, and ecologically beneficial results. A number of both qualitative and quantitative options have been applied to measure the sustainable use of forests and other natural resources in community forests, but classifying the results is challenging. Policy-makers, experts, and the communities should be involved in developing and improving criteria and indicators for community forest management, reflecting the diversity of perspectives that must be accounted for and the increasing worldwide demand for sustainability and governance. The main findings were that sustainability can be measured with numerous tools, but there are several challenges. A literature review revealed that nationally and internationally defined criteria and indicators have not been extensively applied in Nepal due to lack of technical and other expertise.

Keywords Forest policy · Community forestry · Criteria and indicators · Sustainability

Introduction

Background

Forests provide numerous benefits if they are managed sustainably. Sustainable forest management is necessary to guarantee benefits for future generations, particularly in developing countries. Most of the population of Nepal depends on agriculture for its livelihood [1, 2]. The country's rural people depend on forests for fuelwood, fodder, timber for construction, medicinal products, and tree litter for compost and fertilizer. In the forest sector, extraction, processing, and commercialization of forest products are crucial livelihood industries [3]. Nepal has rich forest resources (timber, non-timber), but vast portions of the country's resources have not been used to support socio-economic development. Shifley et al. [4] noted that the most sustainable method for socio-economic development is one that makes the benefits available to as many people as possible, for as long as possible.

Increasing demand for forest resources by growing populations is placing considerable pressure on forests and threatening their sustainable management. Many initiatives and activities have been proposed to prevent over exploitation. Community forestry comprises one such initiative. This approach evolved from the recognition that conventional forest management could not meet the needs of people in developing countries when it did not

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encourage active participation in conservation by the people it serves [5]. Another key requirement that management must be sustainable in the long-term to guarantee the needed resources being utilized by the community.

To achieve this, it is necessary to define the guiding principles that will be used to evaluate the criteria. Several international initiatives [6–8]; (FSC https://ic.fsc.org/principles-and-criteria.34.htm) provide guidance. Based on these initiatives, several criteria and indicators have been proposed to evaluate sustainability; these tools can help to consolidate local and scientific knowledge of forest management. However, little work has been done to implement these indicators. For example, some countries, including Nepal, have adopted Forest Stewardship Council sustainability principles (FSC; https://ic.fsc.org/the-ten-principles.103.htm) as the basis for their forest management. Although community forestry can produce socially, economically and ecologically beneficial results, actual results have gone varied. It is therefore crucial to understand the background for these programs before it will be possible to understand the problems related to community forestry in Nepal.

Country Background

Nepal is situated in the Himalayas, within a transition zone that stretches more than 1000 km from the Gangetic plain to the Himalayas. Nepal is surrounded by India to the east, south, and west and by China (Tibet) in the north. It covers nearly 150,000 km^2, stretching roughly 885 km from east to west and has a mean width of 193 km from north to south [9].

The forest land covers about 5.83×10^6 ha, which amounts to 39.6 % of the total land area [10]. Of this percentage, 29.0 % represents dense forest and the remaining 10.6 % represents shrubs. More than 25 % of the population is below the poverty line [11], and 70 % depends on the forests for its survival. Forestry contributed 9.5 % of the 2008 gross domestic product (GDP) in the form of direct products and 27.5 % of GDP in the form of environmental services [12].

Nepal's topography is highly diverse, with elevations ranging from 60 to 8848 m a.s.l. at the top of Mount Everest. The country is divided into five major zones based on elevation (Supplemental Figure S1): the Himalaya (2500–8848 m) covers about 23 % of the country's total area, the high mountains (2000–2500 m) cover 20 %, the middle mountains (700–2000 m) cover 30 %, the Siwalik (300–700 m) covers 13 %, and the terai (flat plains between northern India and southern Nepal, which runs parallel to the lower ranges of the Himalaya and stretches from the river Yamuna to the river Brahmaputra, at elevations <300 m) covers 14 % [13]. Nepal is divided into 14 zones, 75 districts, and 3914 Village Development Committees (VDCs), and has been grouped into 5 development regions: Eastern (28 456 km^2), Central (27 410 km^2), Western (29 398 km^2), Mid-western (42 378 km^2), and Far-western (19 539 km^2).

Average annual precipitation decreases from approximately 1800 mm in the eastern Terai to between 760 and 890 mm in the west. Average winter temperature ranges from 19 °C in the southern Terai region to 13 °C in the inter-mountain basins, with summer temperature decreasing from 28 to 21 °C along the same path [14].

Nepal's population in mid-2011 was 26 494 504, and has increased by 3 343 081 since 2001. The Terai region is home to 50.3 % of the total population, versus 43.0 % for the middle hill region (middle mountains and Siwalik) and 6.7 % for the high mountains region. Among the five development regions, the central region has the highest population (36.4 % of the total) and the far-western region has the lowest (9.6 %) [15].

Economically, Nepal has been defined as a "least developed country". Its average annual rate of GDP growth between 2005 and 2009 was 4 % [16]. Likewise, UNDP [17] ranked Nepal 157th out of 185 countries in terms of its socio-economic development.

History of Community Forestry Management in Nepal

Please review the supplemental material for a full summary of the history of community forest management in Nepal and the associated literature citations. The following is a brief summary.

Nepalese forestry began with resource exploitation. Community forestry in Nepal began in the 1970s and evolved through a collaboration with the forest agency during the 1980s [18–24], which was focused on sustainable management of the resources. During the initial stages, the focus was on protection [25], but this approach did not stop forest degradation and several laws were implemented in an effort to solve the problem to no avail. The change from a common property regime to open access also caused a free-rider problem. Subsequent legislation was enacted to improve forest management and, promote economic activities in the forests. It was also intended to improve scientific management, and promote public and private cooperation. Though the government originally only emphasized plantation establishment and forest protection, this laid the ground work of the community forestry system through its support of self-reliance, flexible management and development of management plans [26]. The system also created a constitution and empowered impoverished people.

A growing emphasis on Community Forestry has been combined with sustainable management of Nepal's forest

resources. Community forestry transfers usage rights from a national level to a local level. This means that local "Community Forest User Groups" (CFUGs) have full rights to define how their forests will be managed while allowing the government to retain ownership of the forests. District Forest Offices help each CFUG prepare 5- to 10-year management plans and a constitution that describes responsibilities of the users which are the basis for evaluating changes in the forest during the planning period.

The Department of Forests has implemented this policy in most parts of Nepal, particularly in the middle mountains and Siwalik regions [27], and in the Terai (Supplemental Figures S1). By September 2011, 28 % of the total forest area was being managed by CFUGs for the benefit of 42 % of Nepal's households which have allowed the livelihoods of local communities to improve (http://dof.gov.np/dof_community_forest_division/community_forestry_dof).

Problems and Issues in Community Forest Management in Nepal

Community forestry is widely perceived as effectively addressing the environmental, socio-economic, and political problems raised by Nepal's rapid development, however, problems remain such. Population pressure on the forests for new agriculture and development as well as harvesting of small timber for construction, fuel wood, and fodder is leading to deforestation.

Baral and Subedi [28] noted that in Nepal, elite members of the community tend to control ("capture") committees and manipulate the situation in their favour; they take all positions in the executive committee and make decisions regarding harvesting, resource distribution, and use of funds. Women, the poor, and socially excluded members of the community are least involved in the overall process and provide little input into decisions about forest management. Under these circumstances, the driving force for management is often to earn money from the commercially viable forest rather than building common ground for community management. Baral and Subedi [28] reported that government legislation from 1990s stipulated community-based management, but the 1988 Master Plan did not provide for this.

Despite the large number of CFUGs, passive management remains a problem, with numerous underlying technical and social issues, including underutilization of the forest, too much emphasis on protection, and overstocked woodland with little regeneration. This leads to a scarcity of forest products, poorly planned silviculture, and inadequate knowledge of practical forest management. More active forest management would be possible if CFUGs worked with local forest user groups, forest officials, and non-government service providers [29].

In 2010, the government amended the Forest Act of 1993 to reduce user-group autonomy [30]. Many amendments appear to have been intended to discourage timber sales, thereby reducing community income and hampering local development (http://www.irinnews.org/report/96394/nepal-community-forest-value-untapped). Some district forest offices required CFUGs to open separate bank accounts to allocate revenues between forest management (40 %) and community development (60 %), but many CFUGs have fought against these targets.

Methods and Literature Review Results

The main objective of the present study was to review the status of sustainable community forestry in Nepal, with the goal of contributing to the livelihood of the communities, decision making related to community forestry management, and evaluate the community forests. This paper highlights the institutions, researchers, stakeholders, and the tools they have used that are related to sustainability. Details of the literature search are provided in the Supplemental Information; this section focuses on the overall approach and the results of previous studies. The required data was obtained from the research literature, government agencies, and other stakeholders.

Before it is possible to discuss sustainability, it is necessary to define the term and how it can be assessed. Forest management standards vary around the world, and each system takes a different approach. Nonetheless, all definitions seek ways to define how to use the forest today to ensure their benefits in the future. They also rely on identifying the principles [31] that define sustainability, and on criteria [32], indicators [32] and verifiers [33] that can be used to measure the goals. These parameters must be both scientifically rigorous and simple enough that CFUGs can adopt them in their management plans highlighted in the nine international and regional initiatives in the supplemental material.

Although each system has its merits, the present analysis focuses on the 2012 version of FSC's Principles and Criteria (https://ic.fsc.org/fsc-std-01-001-principles-and-criteria.441-10.htm), as this system has been widely implemented in Nepal and provides an enforceable future monitoring system. FSC is widely accepted by the public because it does not depend on any one special interest group and tries to balance the interests of all stakeholders [34].

The research has revealed a diverse range of needs that differ among regions and communities, suggesting the need for an approach that is flexible enough to account for these differences. In particular, the problem of capture of the benefits by the elite in each community [35]. This means that increased awareness is necessary to ensure that

the poor and the disenfranchised people's needs are met. It seems that it is easier to meet goals such as increasing forest cover [36] than to equitably allocate the benefits provided by this improvement to the poorest members of the community, or those who live farthest from the forest [37]. As management begins to affect the forests and dependent communities, it will be necessary to review the situation for each community to learn whether the situation has changed. Also, whether the current plan's objectives are being met, and whether subsequent plans must focus on different problems and opportunities based on the results of these assessments. To accomplish this the institutions that affect planning and operations, must be engaged so that institutional change can be promoted when this becomes necessary, such as the evolution of government from protection to facilitating the efforts of community group. This is important as to how tightly forest use is related to social and community institutions. A significant amount of legislation has already been enacted but some of it overlaps or contradicts other legislations. There are also gaps that are not covered by existing legislation and it will be necessary to harmonize and consolidate some aspects of the rules. If the principles of sustainable management can be clearly defined, the legislation be used to define the criteria and indicators that meet these objectives.

The research has also revealed the characteristics of those who are most likely to participate in forest protection and management. These include households that do not own much land or livestock [38]. Additionally women, low-caste individuals, and those with little education or a preference for traditional customs participate less in the decision-making process. This suggests that representation by these groups must be increased by explicitly including them in each CFUG. In addition, planners should educate these people so they have enough knowledge to effectively participate in their CFUG.

Research has suggested that a passive but adaptive management strategy focused on multiple uses of natural resources, combined with the production-oriented measures, would be a desirable option [39]. This approach would support assessments of management problems and development of ideas for long-term strategic planning of community forest management that account for Nepal's complex socio-economic and ecological conditions. All of these issues are included in the FSC criteria.

Sustainable forestry certification efforts have been conducted in several areas of Nepal. Most believe that these efforts will improve forest management and sustainability [40]. Certification efforts require an organized group such as the Federation of Community Forestry Users, Nepal (FECOFUN), to provide technical, financial, and social support while the community develops its own management capacity. They should also monitor the community's efforts to ensure that they comply with the principles and meet the objectives of the management plan. The success of this model suggests that it should be expanded, supported by funding from Nepal's government and international agencies such as the Asia Pacific Network for Sustainable Forest Management and Rehabilitation (http://www.apfnet.cn/).

Nepal has not yet widely implement rigorously science-based forest management, and CFUGs must therefore develop suitable substitutes that can be used. Currently Simple criteria like "annual allowable cut" method, biodiversity protection through the prohibition of hunting, fire control, grazing restrictions, and limits on the encroachment of human activities in forests are being used. Although these approaches are a good start, more sophisticated approaches will be required to estimate the real sustainable harvest, identify individual species that require protection, and identify the areas that are safest for harvesting trees. Because current silvicultural practices target problems revealed by unsophisticated approaches, they are likely to be less effective than more scientifically rigorous criteria. Current methods focus on tangible products such as wood production, and do not adequately quantify intangible benefits such as protection of water quality or the benefits of biodiversity.

Results and Discussion

Community forestry is essentially about management of both people and resources, so both institutional and ecological criteria must be considered and given equal weight in any assessment of management outcomes. For sustainable community forestry to be carried out by CFUGs, these groups must also be capable of implementing the operational plans that they develop, whether by themselves or with assistance.

It is difficult to develop institutions that can manage common property, and this difficulty complicates efforts to assess the achievements of such institutions. It is difficult to recognize the impacts of a particular policy or proposal on a community, and how the community will respond to the policy and its impacts [41]. Several authors involved in community forestry development have used different methods to assess the effectiveness of the management being implemented. Ostrom [42] emphasized the crucial factors that must be considered to assess the success of institutions for managing common resources and tried to establish why some cooperative action groups can overcome the "tragedy of the commons" while others fail. Ostrom described eight essential principles for successful collective action:

- Clearly defined boundaries that exclude parties who have no rights to a resource.
- Development of a constitution that govern the use of benefits from common resources and that are adapted to local conditions.
- An Inclusive mechanism that allows resource users and those who are affected by resources use to have a voice in the decision-making process.
- Effective monitoring by those who are accountable to all stakeholders.
- A scale of graduated sanctions for anyone who violates the community's rules.
- Affordable and accessible conflict resolution and transformation mechanisms. The suggestions of Galtung [43] are relevant in this context: conflict can become a means of destruction or transformation, depending on how it is managed.
- Recognition of the community's self-determination by higher-level authorities (i.e., autonomy).
- A multi-layer organization that accounts for the implications of forest management at scales ranging from the local community to governments.

Although Nepal's CFUGs are attempting to follow many of these principles, aspects such as inclusion and monitoring require improvement.

Hobley [44] argued that the most suitable indicators for describing an institution's health depended on the perspective from which the organization was being assessed. For instance, an organization dominated by a male elite could be considered successful from a traditional forester's point of view. But, if those whose livelihoods depend on the forest are denied access to the forest or to the organization's decision making processes and suffer as a consequence, then it is a failure. Hobley listed institutional maturity criteria that could be used in such an analysis:

- Formation of groups to deal with topics that require specific expertise, but not so many groups that decision-making becomes difficult.
- A sufficiently large number of members to represent all stakeholders, and a low drop-out rate.
- Community agreement on membership.
- Adequate frequency of meetings and attendance.
- Attendance of women at meetings and proportional representation of women on committees and decision-making bodies.
- Cooperation on issues that affect more than one group (e.g., via FECOFUN).
- Training of group members in leadership and skills.
- Clear roles, responsibilities, and relationships that are understood by all participants.
- Member contributions to group activities in the form of labor and materials.
- Users take responsibility for forest protection and do not require externally funded monitors.
- Democratic changes in leadership (i.e., elections), or selection of leaders by consensus.
- Consensual production and implementation of small-scale work plans.
- Negotiated access to other forest areas for products that are not available in a group's forest.
- Evidence that work plans have been followed and that the specified outputs have been achieved.
- Consensual review and revision of work plans based on local experience, without requiring external support.
- Evidence of conflict resolution without recourse to external arbitration.
- Effective application of skills to maintain group assets.
- Mutual support among group members for non-project activities.
- Examples of successful collective bargaining with local elites.
- Ability to call on external agencies for support and services when the group lacks sufficient expertise.

Although Nepal's CFUGs are attempting to follow many of these principles, many CFUGs are either deficient in some areas or require considerable improvement.

Forest certification programs provide some evidence that forests are being well-managed, at least in the context of a specific standard, and chain-of-custody certifications are available that monitor the flow of wood and paper products from harvesting to processing. Since forests and societies are dynamic systems they tend evolve over time. Therefore the preferred outcome of sustainable forest management must also evolve in response to changing ecological and social needs. This problem is exacerbated by the fact that changing ecological and social conditions may require changes in the certification standard. A substantial obstacle for many forest managers in developing countries is that they lack the capacity to undertake a certification audit and subsequently maintain their processes at the level specified in the certification standard. Nepal also lacks the funding and sufficient trained assessors to perform such audits.

A recent trend in community forestry recognizes not only local forest-related needs, but also needs that arise from the manufacture of forest products for national and global markets. As a result, increasing attention is being paid to whether CFUGs can comply with international certification standards. In a 2005 initiative, 22 CFUGs in Nepal were certified by FSC to produce non-timber forest products for the international market. This certification prompted efforts to develop a set of national standards for FECOFUN certification.

Along with the development of community forestry practices in Nepal, researchers have studied their impacts. Agrawal and Ostrom [45] found that when local users do not exercise significant control over collective and constitutional choices related to rule design, management, and enforcement, the impact of decentralization is limited. This continues to be a problem in Nepal in the context of control of CFUGs by elite members of the community.

Varughese and Ostrom [46] assessed 18 forest user groups in Nepal and found that heterogeneity was not a strong predictor of the effectiveness of collective activity. The challenge of improving both the amount and quality of activities can be overcome by ensuring that all who control collective choices benefit from their efforts to design better rules. Timsina [47] agreed, noting that community forestry processes must address the political, economic, and social needs of the forest's users, while also providing a forum where the voices of the poor can be heard.

Adhikari et al. [48] used both quantitative and qualitative methods to study forest product collection from community forests, and found that this activity depended on land and livestock holdings, caste, the education level of stakeholders, and household economic status. They also noted that, for some key products, poorer households faced more restricted access to community forests than households with higher socio-economic status. CFUGs should be informed of these problems so that they can take steps to overcome them.

Shrestha and McManus [49] also used qualitative and quantitative methods to examine the emergence, evolution, and outcomes of collective action during community forestry in Nepal. They found that collective action was embedded in social, economic, and political relationships, and that powerful actors controlled the use of forests to ensure their conservation, resulting in underutilization of the products of these forests. Poor users, who depend heavily on the forests, tended to be worse off economically under community forestry, but still engaged in collective action for a variety of reasons. These findings contradicted the conventional wisdom that people only cooperate when they benefit from cooperation.

Thoms [50] argued that community forestry is having limited success at improving rural livelihoods. Although it achieves good conservation success, it fails to reduce income disparities between the richest and poorest households, can limit access to vital forest products, which create or maintain significant power disparities among CFUG members. These problems severely challenge the potential to develop community-controlled natural resources. In Nepal, overcoming these challenges will require a change in government policy to guarantee more inclusive local decision-making.

Agarwal [51] found that groups with a high proportion of women in their principal decision-making body achieved significantly greater improvements in forest conditions in Nepal and India. Moreover, groups with all-women executives in Nepal achieved better forest regeneration and growth than other groups, even when they managed smaller and more degraded forests. Older executives, and especially older women, also improved outcomes. The beneficial impact of women on conservation outcomes resulted from their emphasis on improved forest protection and on compliance with the rules. Increased guidance from the knowledge of plant species and methods of product extraction by women, as well as their tendency towards greater cooperation, also contributed. Agarwal's study therefore strongly supports a recommendation to find ways to ensure that women achieve better representation in CFUG committees.

The focus of most studies has been on socio-economic impacts or on the distribution of benefits rather than on environmental impacts. Poteete and Ostrom [52] suggested that little effort has been dedicated to studying the circumstances under which people have sustained and even enriched forest conditions through their stewardship. Such research would obviously provide important insights for Nepal. It is crucial to simultaneously evaluate the relationships among ecological, economic, and social factors to recognize the difficulty of achieving sustainable community forestry. It is still not known what combination of factors is required to develop and sustain institutions that can achieve sustainable community forest management. In addition, environmental impact assessments are receiving increasing attention in Nepal. Numerous field studies have found that community forestry practices have increased forest cover and improved environmental conditions [53–59].

This agrees with research on community forestry from other regions and countries, which has found that improved local control over forest management results in more ecologically sustainable forestry. Examples include: Sudha et al. [60] reported increased canopy cover, tree density, and species diversity in the community forests of India. Ravindranath et al. [61] reported regeneration of degraded forest lands and fragile ecosystems in south and southeast Asia. Poffenberger [62] reported increased forest cover, enhanced biodiversity, and improved rural livelihoods in southeast Asia. Wily [63] and Blomley et al. [64] reported increased understory regeneration, the return of wild fauna to the forests, and improved forest conditions in Tanzania. Blomley et al. [64] documented the re-establishment of 152 different tree, shrub, and vine species, as well as 145 bird and 21 mammal species. Deforestation rates in community forests have decreased in Mexico and Brazil [65–67].

The USDA Forest Service [68] and Shifley et al. [4] provided a definition of sustainability in the forestry context: "to enhance human well-being by using, developing, and protecting resources in a way that lets the people who depend on these resources meet their current needs, without decreasing the ability of future generations to meet their needs and while meeting the community's environmental, economic, and other needs." The Federal Register [69] provides a similar definition: "To create and maintain conditions under which humans and nature can exist in productive harmony and that permit both present and future generations to meet their social, economic, and other requirements." The World Commission on Environment and Development (http://www.un-documents.net/k-001303.htm) defined sustainable development as "Development that meets the needs of the present generation without compromising the ability of the future generations to meet their own needs."

Many forestry institutions now practice various forms of sustainable forest management, using different methods and proven tools. Sustainable forest management is based on both scientific and traditional knowledge that targets the environmental and socio-economic well-being of local communities, and particularly underprivileged communities.

A common theme in all descriptions of sustainability is the need to compromise between present needs and future benefits, thereby providing economic and ecological benefits today without taking actions that will decrease these benefits in the future. To determine whether these goals can be met, it is necessary to develop systems that can be used to monitor progress towards these goals. Although Nepal has a good start in this direction, additional work must be done to develop a more refined assessment system that can account for Nepal's social and environmental characteristics.

Conclusions

The main findings of the present study are that sustainability can be measured using numerous tools, but that the ability to use these tools have limited their adoption in Nepal. A particular problem is that international criteria and indicator systems must be somewhat general so they can be applied around the world. However, that means they cannot address the unique problems faced in specific local ecological and social contexts. Thus, although continuing efforts to adopt the FSC approach in Nepal is a sound strategy, the literature review suggested many ways to adapt this approach so that it works better in Nepal. Inequitable benefit sharing, exclusion of women and the poor from decision-making systems, and capture of these systems by the elite are major challenges that must be overcome. In some CFUGs, participation by a more heterogeneous community might increase conflicts during decision-making and seeking of consensus [70]. A problem-oriented methodology would be better system to use over more sophisticated methods as many CFUG members have no experience with statistics or mathematical modeling.

The subjectivity of sustainability measurements cannot be entirely eliminated, since stakeholders must decide which values they consider to be important. Better community awareness increases willingness to participate and seek consensus; this willingness develops the common understanding that is essential for a participatory approach to assessing sustainability. In addition, CFUGs sometimes fail to send their final management plan for approval by the local District Forest Office. In some cases, this may be done to retain privileges for the elite that might be disallowed by the government; in others, government officials would create obstacles to protect their own status and interests [39]. Government officials will therefore need to change their attitude from the traditional command and control to participatory forest management in which they assist and support forest management by CFUGs.

Sustainable forest management requires the use of criteria and indicators that allow the monitoring, reporting, and assessment of management activities at national, regional, and community levels. Experience with these concepts are rare in Nepal, particularly concerning criteria and indicators suitable for management activities conducted by CFUGs. However, the success of groups such as FECOFUN has provided examples that can be used by other groups.

Based on the literature review and the authors' personal experience, the following main significances of community forestry have been successfully experienced in Nepal:

- Communities can form CFUGs and participate actively in the protection, management, and utilization of their forests.
- CFUGs can develop a constitution that defines the frequency of meetings, and can achieve adequate attendance.
- Women, the poor, and other disadvantaged groups can participate effectively in committees and decision-making bodies, although their representation should be increased.
- Cooperation is possible to deal with issues that affect more than one group (e.g., FECOFUN).
- Some workshops have been conducted to build leadership capacity and lead teams, but should be made available to communities.
- CFUG constitutions clearly mention the roles, rights, responsibilities, and relationships among members, but the descriptions are often not clarified or made more objective.

- Users take responsibility for forest protection and management and do not require external funding to monitor their forest.
- Leaders are selected by voting or by consensus.
- CFUGs prepare operational plans that include criteria and indicators and guidelines for sustainable forest management. However these guidelines are not made more rigorous and objective.
- Regular monitoring collects evidence that operational plans have been followed and that the specified outputs have been achieved.
- Participants have learned to provide mutual support for non-project activities (e.g., farm work).
- CFUGs develop rules to protect their forest from illegal exploitation and mechanisms for collection and distribution of resources.
- Nepal's community forestry has begun to attract international recognition.

However, several aspects of CFUGs must be improved:

- Any given forest may be unable to supply all the services required by the CFUG that manages it [44]. Thus, a formal mechanism should be developed to obtain these resources from other CFUGs. In addition to promoting cooperation, this may improve socio-economic development for groups that have excess resources they can trade or sell.
- The elite still capture too much of the process and its benefits. As a result, government staff tends to interact more with the elite than with other community members, creating a feeling that the needs of these other members are not being recognized.
- Users of the forest are not fully identified during formation of a CFUG, leading to conflict when membership lists must subsequently be revised.
- Definition of a forest's boundaries is often inadequate, particularly when it is based on outdated survey maps. This can lead to conflicts over encroachment.
- Government forestry staff often draft the constitution, the operating plan, or both, without a review by CFUG members to ensure that their needs have been met.
- There is inadequate education about key forest management concepts and best practices for managing the CFUG.

Recommendations

Based on these problems, the following recommendations would improve the sustainability of community-based forest management in Nepal:

Improve Forest Management Plans

Each CFUG must develop and implement a forest management plan that clearly and objectively defines the long-term management objectives and show how they will be achieved. The plan must clearly define the following aspects: the forest's boundary, which areas or resources can be conserved or exploited, how conservation and exploitation should be performed, what regeneration or restoration should be performed and how. Also, there should be a clear understanding of how the benefits obtained from the forest should be distributed among CFUG members. The plan should be developed with assistance from professional foresters and approved by representatives from all socioeconomic levels, genders, and other groups within the community to ensure that all needs are met. Currently, use of this approach has been inconsistent, and although economic valuation studies have often involved the general public, most individuals were not actively involved the process.

Compliance with Government Regulations and Certification Initiatives

The development and implementation of a management plan must comply with national and local laws, as well as with any international treaties and agreements to which Nepal is involved. This will require assistance from professionals with experience in these matters. Rather than relying on international certification systems that are complex and expensive to implement, a domestic certification standard should be developed that will be more feasible in Nepal.

Improve Governance

CFUGs members must develop policies and procedures that promote transparency, accountability, participation, inclusion, equity, and the rule of law. Good governance must include mechanisms to manage conflict so that it becomes constructive rather than destructive. CFUGs must also develop mechanisms to support continuous learning and a flexible approach that allows plans and institutions to adapt to change. Nepal's current forest governance system must be revised to provide expert support for CFUGs, and to transform the government's role to support CFUG activities. CFUGs must prioritize sustainability in their management, while also looking for opportunities to improve the socio-economic benefits for their members. There is considerable variation in the degree to which current management methods reinforce sustainability; CFUGs will need to reassess their choices to ensure they are appropriate.

Include the Poorest Citizens in Decision-Making

To solve this problem, it may be necessary to revise the guidelines for developing a CFUG's constitution so that it specifies the level of representation of each socio-economic group in the CFUG's management committee from the poor to the elites.

Conserve Biodiversity and Other Key Ecosystem Resources

CFUGs must explicitly include biodiversity criteria and criteria for soil and water conservation in their plans. Locations with archeological, religious, or cultural significance should be identified and included in conservation planning. Biodiversity has not traditionally included humans, but cultural sustainability is also essential, and given the strong interaction between a people's culture and their environment, researchers must look for ways to account for cultural values both to preserve these values and to understand their impact on other forms of conservation.

Make Plans to Combat the Negative Impacts of Climate Change

Climate change could have both predictable and unforeseen consequences, on forest management. Such consequences must be accounted for by developing specific mechanisms to monitor these impacts so that CFUGs can respond appropriately. This can be integrated with ongoing efforts to monitor progress towards achieving the goals of the forest management plan. Nationally and internationally defined criteria and indicators are not extensively applied in Nepal, so additional work will be required to identify options that will be effective in Nepal. Monitoring should use "best practices" (i.e., proven management strategies that have been successful in the past) so that other CFUGs can be encouraged to explore these strategies. This will support the evolution of an adaptive co-management system that helps CFUGs discontinue some practices while adopting others.

No researchers have considered the problems and potential sustainability of community forestry in three key ecological regions of Nepal: the Middle Hills, Siwalik, and Terai. As well, no researchers have simultaneously examined the relationships among the ecological, economic, and social factors that affect sustainability in Nepal. Research will be required to provide the missing data.

Develop a Locally Implementable National Framework for Certification and Guidelines for Sustainability Indicators

Despite many obstacles, sustainable community forest management appears possible in Nepal. To achieve this goal, it will be necessary to develop a shared vision for what this means and the political will to implement such a system. A good first step would be to use the recommendations from this study to develop a more consistent national framework that is suitable for the conditions in Nepal. For certification to work, Nepal must develop the institutional capacity to perform its own certification audits of CFUGs, thereby reducing the dependence on international assessors.

Some topics that were not considered in the study should be explored in future research to determine their relevance in Nepal. One example is to identify a more progressive way of applying sustainability indicators that account for Nepal's unique cultural characteristics. In addition, there may not be sufficient data available to support the use of these indicators, and alternatives must be developed that can use the available data. If no indicator is suitable for a given purpose, a new indicator should be developed and the necessary data should be obtained.

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Complience with Ethical Standard

Conflict of interest The authors declare no conflict of interest related to this paper.

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