

# Assessing the Sustainability of Community Forest Management: A Study of Rani Community Forest, Makawanpur District, Nepal

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**Abstract:** Community forestry is widely acknowledged as a fundamental aspect of sustainable forest management in Nepal; however, comprehensive evaluation of its sustainability at the local level are still limited. The current study assessed the sustainability of Rani Community Forest in Makawanpur District through a Criteria and Indicators (C&I) framework that included socio-economic and ecological aspects. Four criteria and 30 indicators were used, addressing enabling conditions for forest management, socio-economic and cultural aspects, forest health and vitality, along with forest management and conservation practices. Data were collected through forest inventory, household surveys (n = 81), focus group discussions, and analysis of operational plan. Sustainability indexes were calculated for specific criteria and combined into Overall Sustainability Index (OSI). The findings revealed a moderate level of socio-economic sustainability (SESI = 0.77) and a strong level of ecological sustainability (ESI = 0.82), leading to overall sustainability index of 0.80. Good regeneration condition and growing stock, efficient protective actions, and timely operational plan updates led to enhanced ecological outcomes. However, limited backstopping, and inadequate livelihood diversification beyond timber sales continue to hinder socio-economic sustainability. The findings suggest that although Rani Community Forest is ecologically self-sufficient, enhancing institutional capacity, diversifying livelihoods, and ensuring financial transparency is essential for achieving long-term sustainability. The results emphasize the effectiveness of C&I-based methods for evidence-driven assessment and adaptive management of community forests in Nepal.

**Keywords:** Community forest, Criteria, Indicators, Forest management

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## 1. Introduction

Sustainable forest management (SFM), as a cornerstone of global sustainable development, has been a growing international concern since the United Nations Conference on Environment and Development, 1992 (ITTO, 2005; Devkota and Ghimire, 2023). The fundamental principles of sustainability encompass ecological integrity, social acceptability, and economic viability. These principles collectively emphasize the need to balance environmental conservation with social equity and long-term economic benefits (ITTO, 2005). Community forest (CF) approach is widely regarded as one of the most successful approaches to sustainable forest management in Nepal (Ghimire and Lamichhane, 2020). It was formally recognized as a priority program under the Master Plan for the Forestry Sector (MPFS) in 1989 and further reinforced by the

Revised Forestry Sector Policy of 2000 (Acharya, 2002). Under this program, designated areas of national forest are handed over to Community Forest User Groups (CFUGs) as community forests upon approval of the group's constitution and operational plan. Over the past five decades, community forestry has emerged as a central strategy not only for forest conservation but also for enhancing rural livelihoods and strengthening local institutions in Nepal. More than 23,000 CFUGs manage approximately 3 million hectares, or around 45% of Nepal's forest area (Ghimire & Lamichhane, 2020; Nuberg et al., 2025). These CFUGs playing a pivotal role in restoring degraded forests, enhancing forest productivity, and improving ecosystem service delivery and livelihood

of local people (Ghimire & Lamichhane, 2020; Dhungana et al., 2024).

Notwithstanding these significant achievement, comprehensive assessments of the long-term sustainability of community forestry at the local level are still limited (Pokharel et al., 2015; Devkota and Ghimire, 2023). Although many studies have reported ecological advancements like enhanced forest cover and biomass, there are fewer studies that have utilized comprehensive evaluation frameworks to concurrently examine the ecological, socio-economic, and institutional aspects of sustainability at the at the individual community forest level (Pokharel et al., 2015; Paudel et al., 2021; Devkota and Ghimire, 2023). Empirical evaluations utilizing standardized Criteria and Indicators (C&I) frameworks remain limited in Nepal, hindering the comparison of sustainability performance among various community forests (Pokharel et al., 2015; Devkota and Ghimire, 2023). Additionally, current research typically emphasizes either socio-economic outcomes or forest health in isolation, resulting in a significant gap in understanding how these aspects interplay to influence overall sustainability. This study fills the gap by utilizing a structured C&I framework to assess both ecological and socio-economic sustainability of a community forest in Makawanpur District, thus offering evidence-based insights into the strengths and limitations of community forest management at the local level.

Global initiatives to advance SFM have consistently emphasized the necessity of systematic evaluation SFM frameworks. The Forest Principles and Chapter 11 of Agenda 21 emphasized the development of measurable criteria and indicators (C&I) as essential tools for assessing progress toward SFM at both national and local levels (ITTO, 2005). Since then, the C&I approach has become a widely recognized analytical framework for monitoring changes in forest conditions and evaluating management performance. Beyond serving as structured instruments for assessing sustainability trends, C&I frameworks also promote stakeholder engagement by translating complex forestry concepts into measurable, and transparent indicators (ITTO, 2005; Pokhrel et al., 2013). Consequently, they play a vital role in supporting evidence-based decision-making and informed policy formulation aimed at achieving sustainability goals (Cheng and Durst, 2000; ITTO, 2005; MoFE, 2024). In this study, sustainability in community forestry is conceptualized as the rational use, management, and protection of forest resources in ways that continuously enhance the livelihoods and well-being of subsistence households in rural communities (Pokharel et al., 2015; Devkota & Ghimire, 2023). Accordingly, the sustainability of community forests is assessed across two broad dimensions: (i) the socio-economic and cultural aspects, including the extent to which approved management plans and regulatory provisions are effectively implemented in practice; and (ii) the biophysical condition of the forest indicating forest health and vitality. Drawing on this conceptual foundation, the present study employs the criteria and indicators framework as the primary methodological approach for evaluating the sustainability of community forestry.

## 2. Materials and method

### 2.1 Study Area

The study was carried out in Rani Community Forest situated in Ward No. 6 of Hetauda Sub-Metropolitan City, Makawanpur District, Nepal (Figure 1). The CF covers 151.87 ha with 810 households and lies between 350–750 m elevations. The area exhibits average temperatures of 15–25°C during winter and 30–40°C during summer. The terrain is moderately sloping (10–35°). The forest is primarily dominated by *Shorea robusta* C.F. Gaertn., along with other associated species *Terminalia alata* Roth, *Schima wallichii* (DC.) Korth, *Terminalia bellirica* (Gaertn.) Roxb. Etc. (CFOP, 2022).

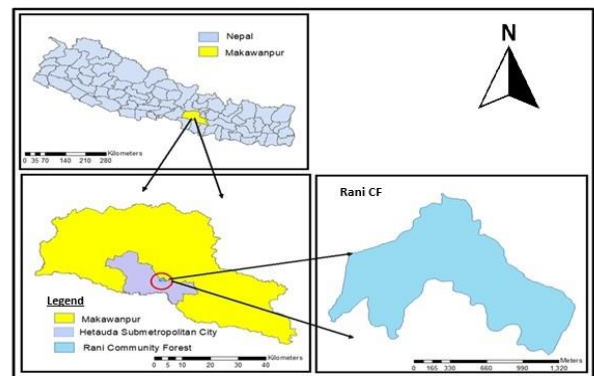


Figure 1: Map Showing Study Area

### 2.2 Sampling Design and Forest Inventory

A simple random sampling approach was utilized for both the ecological and socio-economic aspects of the research. For ecological data collection, the growing stock (GS) of the forest was sourced from the latest operational plan (OP) of the community forest. The regeneration status (seedlings and saplings) was determined via field sampling utilizing 31 circular plots, each covering an area of 25 m<sup>2</sup> (radius = 2.82 m), which reflects about 0.05% sampling intensity. The number of sample plots and the sampling intensity were determined according to the national Community Forestry Resource Inventory Guidelines issued by the Government of Nepal (DoF, 2004), which suggest a minimum sampling intensity of approximately 0.01% for regeneration assessment and 0.05% for overall forest resource assessment (Table 1). Given the relatively homogeneous forest composition dominated by *Shorea robusta* and associated species, the applied sampling intensity and number of plots were considered adequate to represent regeneration conditions across the 151.87 ha forest area. ArcGIS 10.3 was used to delineate the study area and locate sample plots. For the socio-economic survey, data were collected from 81 households (10% of total household) using semi-structured questionnaires. In addition, two focus group discussions were conducted to capture qualitative information from forest user group members.

**Table 1:** Classification of regeneration

Categories	Description
Seedling	> 30 cm to < 1 m in height
Sapling	> 1m height & > 10 cm in diameter

Source: (DoF, 2004)

### 2.3 Selection of Criteria and Indicators

Publications were included if they (i) were published A total four criteria with 30 indicators were selected to assess both socio-economic and ecological sustainability. The four criteria included: i. Enabling condition for forest management (Criterion 1); ii. Socio-economic and cultural aspects (Criterion 2); iii. Forest health and vitality (Criterion 3); and iv. Forest management and conservation practices Criterion 4). The complete list of criteria and indicators used in this study is provided in Annex I. Of the four criteria, Criterion 1 and 2 presents socio-economic sustainability, whereas Criterion 3 and 4 reflect ecological sustainability. These indicators were adapted from the framework proposed by Pokharel et al. (2013) and were refined through consultation with local stakeholders and review of the community forest operational plan. The full list of indicators used in the assessment is presented in Appendix I.

#### Sustainability Index (SI)

For the sustainability assessment, a sustainability index (SI) was calculated for each criterion, which was then used to determine the overall sustainability index. The following formula, as suggested by Singh (2017), was applied to compute both the sustainability index for individual criteria (SIIC) and the overall sustainability index (OSI).

Sustainability index for individual criteria (SIIC) = Sum of average score of all indicators within a criteria/ Number of indicators in each criterion..... (i)

Overall sustainability index (OSI) = Sum of scores of all criteria/ Number of criteria..... (ii)

Each indicator was evaluated using a three-point ordinal scoring system (1 = poor, 2= moderate, 3 = good), following the approach suggested by Pokharel et al. (2013). Scores were assigned based on a combination of household survey responses, field observation, operational plan review, and expert judgement. For socio-economic indicators, scoring was based on household responses regarding participation, benefit sharing, and institutional performance. For ecological indicators such as regeneration status and forest health, scoring was guided by regeneration density based on regeneration inventory recommended by Pokharel et al. (2013). The final score for each indicator was determined by triangulating information from various sources to enhance reliability and transparency. The sustainability status was then categorized and interpreted as good, fair, or poor based on the calculated index values. An index value of 81–100% was classified as good, 50–80% as moderate, and below 50% as poor which is recommended by Pokharel et al. (2013). The collected data were analysed

using the Statistical Package for the Social Sciences (SPSS) version2024.

## 3. Results

### 3.1 Socio-economic Sustainability

Criterion 1 (Enabling condition for forest management) evaluated the institutional, economic, and legal frameworks of community forest user groups (CFUGs), reflecting their overall commitment to sustainable forest management. The indicator mean for socio-economic sustainability under this criterion was 0.75 with average score of 2.25 (Table 2). Under this criterion the community forest demonstrated a very good internal fund generation mechanism along with adequate supporting institutions or organizations for forest management. However, it lacks adequate technical backstopping and skilled forest management capability. Similarly, Criterion 2 (Socio-economic and cultural aspects) assessed the interdependence of the local community with the forest. This criterion recorded an average score of 2.38, indicating a good performance, with a sustainability index of 0.79 (Table 2). Income-generating activities from the forest are moderate to high, facilitated by market availability, with timber sales during prescribed periods being the main economic source aside from internal fund generation. In addition, the community demonstrates strong awareness of their rights and responsibilities and remains highly motivated to conserve the forest. The overall socio-economic sustainability index of the forest is 0.77, indicating moderate sustainability under the current socio-economic conditions of the community (Table 2).

**Table 2:** Socio-economic sustainability index

Criterion	Index value	Overall socio-economic sustainability index (OSES) value
Criterion 1	0.75	0.77
Criterion 2	0.79	

### 3.2 Ecological Sustainability

Criterion 3 (Forest health and vitality) evaluated the overall condition of the forest, considering evaluates the forest’s regeneration status, growing stock and disease and invasion intensity. The assessment indicated that regeneration and growing stock is in good condition with average score for this criterion was 2.50, with a sustainability index of 0.83, reflecting a very good level of forest condition and production (Table 3). Similarly, Criterion 4 (Forest management and conservation practices) presents a combined information of the forest; forest management activities, the way users are planning to manage the forest and application of forest management practices. The average mean of criteria was found to be 2.44 and the individual sustainability index was found to be 0.81

which is a good index (Table 3). The community forest practices timely revision of its operational plan, which incorporates clear guidelines for timber management, harvesting procedures, forest protection mechanisms, and the enforcement of penalties.

The overall ecological sustainability index was 0.82, indicating that the forest is ecologically self-sustaining. Regular management practices, including periodic removal of weeds and shrubs, are in place. The forest exhibits a very good regeneration rate, while human-induced pressures are minimal. Moreover, the operational plan includes clearly defined penalty provisions, which are effectively enforced to safeguard forest health.

**Table 3:** Ecological Sustainability

Criterion	Index value	Overall ecological sustainability index (OESI) value
Criterion 3	0.83	0.82
Criterion 4	0.81	

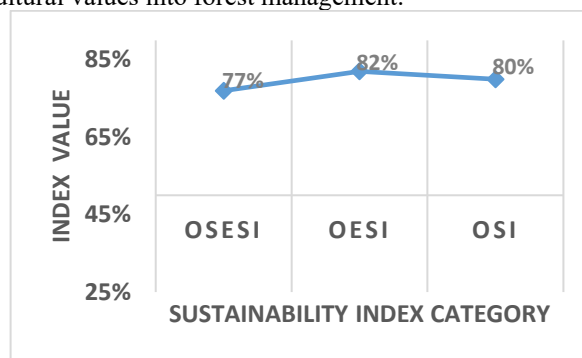
**Overall Sustainability Index (OSI)**

Based on the above findings, the Rani Community Forest demonstrated an overall sustainability index of 0.80. This indicates that the sustainability level of Rani CF is 80%. The sustainability performance is relatively balanced between socio-economic and ecological dimensions, with ecological sustainability at 82% and socio-economic sustainability recorded at 77%. However, there is also room for improvement in both the socio-economic and cultural aspects as well as ecological aspects. Still, Rani Community Forest requires greater attention to socio-economic upliftment, strengthening of the institutional framework and governance, and improvement of forest management activities.

**4. Discussion**

The overall socio-economic sustainability index (0.77) indicates a moderate level of performance, highlighting significant achievement alongside ongoing difficulties. Criterion 1 received a score of 0.75, signifying relatively strong internal funding generation and favorable local institutions. This reflects results from other community forests in Nepal, where revenue from timber sales and membership fees constitutes the foundation of financial sustainability (Pokharel et al., 2013; Devkota and Ghimire, 2023) Criterion 2 showed a relatively higher index value (0.79), highlighting strong awareness among users regarding rights and responsibilities, participatory decision-making, and inclusion of women and marginalized groups. These findings are consistent with earlier studies demonstrating that community forestry has significantly contributed to social capital formation and local empowerment in Nepal (Acharya, 2003; Kanel and Niraula, 2004; Gilmour, 2016). The protection of religious and culturally significant sites within the forest further underscores the integration of cultural values into forest

management. Accordingly, criterion 2 showed a comparatively higher index value (0.79), emphasizing a strong awareness among users about rights and responsibilities, participatory decision-making, and the inclusion of women and marginalized groups. These results align with previous research showing that community forestry has greatly aided in the development of social capital and local empowerment in Nepal (Gautam, 2009; Sunam and McCarthy, 2010; Ghimire and Lamichhane, 2020). The safeguarding of religious and culturally important sites in the forest highlights the incorporation of cultural values into forest management.



**Figure 2:** Value of OSES, OESI and OSI of Rani Community Forest

The ecological sustainability score of 0.82 suggests that Rani Community Forest is ecologically resilient and self-sufficient. Criterion 3 recorded a high index value (0.83), indicating strong regeneration status, good sufficient growing stock, and minimal weed invasion and disease levels. This result firmly backs prior findings indicating that community forestry has mitigated forest degradation and improved forest structure in various regions of Nepal (Pokharel et al., 2013; K.C., 2016; Ghimire and Lamichhane, 2021). Similarly, criterion 4 got a strong score (0.81), emphasizing timely updates to operational plans, explicit harvesting protocols, implementation of penalties, and consistent monitoring. These results support the findings that clearly established rules and local enforcement systems are crucial factors influencing ecological success in forests managed by the community (K.C., 2016; Devkota and Ghimire, 2023)

The overall sustainability index (OSI) of 0.80 shows that Rani Community Forest is operating at a fairly good sustainability level, with equitable inputs from ecological (82%) and socio-economic (77%) aspects. This finding corresponds with wider evidence from Nepal, indicating that community forestry has notably excelled in enhancing forest conditions while providing moderate livelihood and governance results (Adhikari et al., 2007; Kanel and Dahal, 2008). Therefore, the results assure that ecological recovery often precedes socio-economic transformation in community-managed forests, especially in mid-hill regions. Even after strong ecological outcomes, the relatively lower socio-economic sustainability highlights a significant trade-off often seen in community forestry systems. Ecological recovery frequently advances more rapidly than socio-economic change since community forestry policies in Nepal have traditionally emphasized forest conservation and restoration rather than livelihood

commercialization (Kanel and Dahal, 2008; K.C., 2016). For Rani Community Forest, various factors seem to affect this pattern. Initially, the forest management priorities of the CFUG executive committee predominantly emphasize conservation, concentrating on protective measures, regular harvesting, and adherence to operational plan regulations. Additionally, the economic advantages derived from the forest continue to rely significantly on timber extraction at specified times, while prospects for value-added forest ventures like non-timber forest products (NTFPs), ecotourism, and community-driven forest enterprises are still not fully realized. Third, limited technical support and market access might limit the CFUG's ability to diversify income sources and enhance forest-based livelihood options. Comparable dynamics have been documented in several community forestry studies in Nepal, where results of ecological restoration have been more apparent than changes in socio-economic conditions (Gilmour, 2016; Kanel and Dahal, 2008; K.C., 2016). To address this imbalance, it is necessary to enhance institutional capacity, facilitate better market access, and implement specific livelihood diversification initiatives that empower local communities especially low-income households to gain increased economic advantages from sustainably managed forests.

## 5. Conclusion

This research highlights that Rani Community Forest has a good level of overall sustainability, with particularly strong ecological performance and moderate socio-economic outcomes. The Criteria & Indicators based assessment revealed that effective forest conservation, good regeneration condition and growing stock, and well implemented forest management practices have fostered ecological self-sufficiency. Simultaneously, a lack of external funding, inadequate technical skills, and limited economic incentives beyond timber sales hindering socio-economic sustainability. The results suggest that long-term sustainability of community forestry in Nepal depends not only on maintaining forest health but also on strengthening institutional capacity, financial transparency, and livelihood diversification. The Criteria and Indicators framework had demonstrated a practical and reliable tool for assessing sustainability at the community level and can support adaptive management and policy learning. Scaling up such assessments across different ecological and socio-economic contexts would enhance evidence-based decision-making and contribute to more equitable and resilient community forestry systems in Nepal.

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