

# COMPARATIVE ANALYSIS OF COMMUNITY FORESTS IN NEPAL AND THEIR INFLUENCE ON FOREST COVER

by

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*Keywords: Forest cover, operational plan, community forest*

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## Colophon

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## Abstract

Within the middle hills of Nepal, OPs were found to prescribe the same operations, irrespective of species composition, forest conditions, and forest management objectives. The OPs play little, if any, role in practical forest management. The combined use of remote sensing and GIS technologies can be invaluable to address a wide variety of resource management problems, including the assessment of forest cover change and its causes.

In this research the OPs of two community forests in the middle hills, selected based on their change in forest cover, were compared with each other to see if forest cover change was caused by differences in OPs and their implementations. Three methods were used to see if similarities in forest cover of two community forests can be explained by how the OP is implemented by the CFUGs: forest cover measurements with annual landcover data, a content analysis of the OPs and ground truthing the current situation with the help of interviews and surveys (Likert scale). A significant difference was only found in the forest cover analysis. Machhedanda CFUG is more turbulent in their forest cover change compared to Baluwa Bhanjyang CFUG. The OPs were the same but showed differences in the way their activities were explained. Machhedanda CFUG is more socio-economic focused and Baluwa Bhanjyang CFUG is aiming on their forest conservation. Qualitative data shows that both CFUGs face communication challenges and struggle to fully implement their OPs. Further research may be needed to establish a stronger connection between OP implementation and forest cover change.

*Keywords: Forest cover, operational plan, community forest*

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List of abbreviations

Abbreviation	Definition
CFUG	Community Forest User Group
DFO	District Forest Office
FECOFUN	Federation of Community Forestry Users Nepal
GIS	Geographic Information Systems
OP	Operational Plan

## 1 Introduction

Community forestry has shown remarkable success in battling deforestation, forest degradation and promoting biodiversity over the past 30 years (Acharya et al., 2022). Nepal is primarily an agricultural country where most of the people depend upon agriculture for their livelihood where the rural farmers depend upon forests for their daily needs like fuelwood, fodder, leaf litter for composting, fertilizers, and lumber for construction (Bijaya et al., 2016). About 87% of domestic energy in Nepal produced by firewood is used for cooking and heating during winter (Rai, 2007).

Before to 1957, villagers managed their local forests to meet these needs, the management system was based on indigenous practices of protection and utilization of resources. These practices were locally developed and regularly revised (Acharya, 2002 as cited in Fisher, 1991, 1990; Gilmour & Fisher, 1991; Gautam, 1987). However, the year 1957 marked a significant shift with the enactment of the Private Forest Nationalization Act, leading to widespread belief that heavy deforestation ensued as communities perceived their forests as expropriated (Acharya, 2002).

To battle these challenges, the Nepalese government implemented early versions of the community forest program since 1978 and a full-scale implementation of the community forest program in the early 1990s. In the Forest Act of 1993, local forest-managing communities, called community forest user groups (CFUGs), are legally recognized as autonomous public bodies that can acquire, possess, transfer, and manage property (Ministry of Law and Justice, 1993). 28% of the forest area has been handed over to the local forest-managing communities, and more than one-third of the population is involved in community forestry (DoF, 2017).

### 1.1 Background

From the historical experience of changes in Nepalese forest management, it is recognized that unless people are given the authority to control and make decisions on the work plan of a forestry management system, people can have conflicts or disagreements among stakeholders involved in the management plan. Therefore, co-operation and collective actions will be obtained by transferring authority and responsibility for forest management, so that “the legitimate needs of these people for forest products were met” (Gilmour & Fisher, 1998) and incentives are made available to collectively control the forest through the practice of sustainable activities for income generation (Wakiyama, 2005). Toft et al. (2015) found that the operational plans (OPs) play little, if any, role in practical forest management. However, the OPs appear important to the CFUGs executive committees as a source of legitimacy around forest management decisions. According to Baral et al. (2020), a closer fit between the OPs and social, economic, and ecological realities is needed as the scientific forest management plans in community forests in the middle hills in Nepal do not match the reality on the ground. To ensure access to the forest resources and thereby generate revenue for community development, the CFUGs accept the plans to while the forest bureaucracy embraces the plans as it strengthens its authority. Although, neither the forest users nor the forest bureaucracy made use of the plans and the prescriptions in forest management.

Baral et al. (2020) also noted that all the OPs, within the middle hills of Nepal, were found to prescribe the same operations, irrespective of species composition, forest conditions, and forest management objectives. Also, no differences in prescriptions regarding silvicultural operations like pruning, thinning, and selective felling in prescriptions could be recognized for stands of different species composition, irrespective of their different ecological characteristics and uses. The implementation status was found sub-standard, implementing only the harvesting activities whereas neglecting the essence of forest management, i.e., silviculture (Ghimire et al., 2022). Although these difficulties could hinder the CFUGs

development, the community forestry program has been extremely successful in the middle hills since its implementation (Rai, 2007).

An OP is a document that covers the biophysical aspects of the forest and technical management prescriptions. These are prepared for a period of 5 or 10 years. CFUGs lose their right to forest management if their OP is expired (Baral et al., 2020). In an OP one can find management goals, activities to be undertaken and rules of forest product utilization. Also, an OP serves as an agreement between the District Forest Offices (DFOs) and CFUGs (Ghimire et al., 2022)

Baral et al. (2020) conducted their research in only one district (of which the name is kept anonymous) within the middle hills where 10% of the amount of CFUGs were randomly selected to give a picture of the OPs and their relevance. Therefore, it is hard to say if the OPs are the same throughout the whole middle hill district of Nepal as some middle hill districts are adjacent to other topographies. In the southern parts of Nepal, the Terai area, OPs are used that differ from the ones used in the middle hills as the OPs used in the middle hills did not work in the Terai area. Many forestry programs have been implemented but ultimately failed, due to the lack of consultation and ignoring the role of the local people in forest management (Rai, 2007).

Community based forest management policies implemented by local forest institutions can have significant impacts on forest management outcomes and forest cover (Hashiguchi et al., 2016). Factors related to increasing forest cover were emigration, occupation shift, agroforestry practices, as well as particularly by plantation on barren lands, awareness among forest users, and conservation activities conducted by local inhabitants after the government forest was handed over to community members as a community forest management system. Community forestry funds play an important role in rural development in Nepal, contributing to both community development and forest conservation (Bhandari et al., 2019).

Nepal is a cultural mosaic inhabited as it is by an amazingly diverse array of ethnic, caste, linguistic and religious communities (Pradhan et al., 2011). Changes in land use are the result of interactions of multiple factors, where migration from uphill to low land and towards roads and urban places contributed to both loss and gain of forest and changed land-use patterns in the middle hills of Nepal (Figure 1, middle mountains) (Bhawana, 2017).

One reason for changes in land-use patterns is forest fires and Bhujel et al. (2022) concludes that over the past 20 years, the temporal and spatial forest fire incidences were found to vary with increase in fire incidences affecting environment and socio-economy. 2016 was a peak year when it comes to forest fire incidents. The active fire season and fire days are increasing in recent years due to both natural and anthropogenic factors. Bhujel et al. (2022) shows in their results that the Terai and Siwalik regions are mostly affected by the forest fires.

Matin et al. (2017) showed that there is a higher chance of forest fire incidences in forests closer to settlements and roads. Besides forest fires, cropland abandonment is another reason for changes in land use patterns. Bista et al. (2021) remarks that at the parcel level, slope, walking distance to the cropland parcels, and shading effects were major determinants of cropland abandonment. At the household level, occupation of household head, labor migration, gender, amount of agricultural landholding, and caste significantly affected cropland abandonment. Farmers' reported reasons for cropland abandonment confirmed these findings; that is, lack of labor and crop raiding are the dominant factors contributing to cropland abandonment. Rouw et al. (2023) concludes a negative successional pathway away from their original forest species composition to degraded shrub land and low grass in mountainous areas. Livestock was related to the negative successional pathway.

To address a wide variety of resource management problems, including the assessment of forest cover change and its causes, a combined use of remote sensing and Geographic Information System (GIS) technologies can be invaluable (Tripathi et al., 2020). Comparing the forest cover change in community forests in the Siwalik hills (figure 1) with that of other management regimes, silvicultural practices in community forest areas have brought relatively better positive changes in the forest condition (Pokharel et al., 2018).

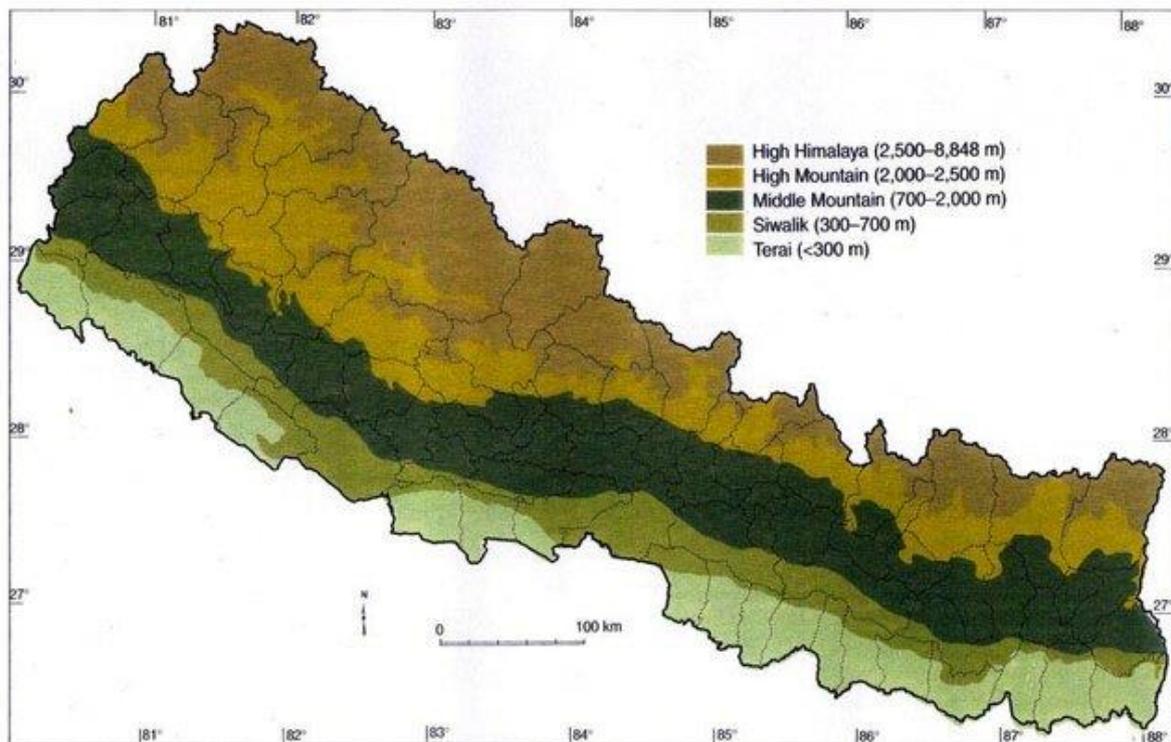


Figure 1, the five different physiographic regions of Nepal, categorized by their elevations. The two selected community forests will lie within the Middle Mountains/Hills (Dark green) (source: Bourai et al. (2002), who got it from Topographic Survey Branch, Department of Survey, His Majesty's Government, Nepal (1983))

## 1.2 Federation of Community Forestry Users Nepal and District Forest Offices

FECOFUN was founded in 1995 to mobilize and articulate the interest of CFUGs by increasing awareness and by strengthening them in a coordinated manner and to link forest users from all parts of the country and represent their interests at the national level (Kumar, Nalini B., 2002). FECOFUN promotes cooperation among Forest User Groups, coordinates with government agencies, supports income generation, and advocates for proper forest resource use. They also focus on education, health, leadership development for marginalized groups, and maintaining institutional memory. Working procedures involve capacity-building, conflict resolution, technical assistance, studies, and marketing forest-based products (Objectives, 2023). CFUGs are registered with DFOs as perpetually self-governed bodies according to the Forest Act, 1993 and Forest Regulations, 1995 (GON/MFSC 1995b). Recognized as self-governed local organizations for the management, conservation, and utilization of forests in Nepal, CFUGs play a crucial role in sustainable forestry practices. OPs are used by the CFUGs to manage their forests and achieve their own specific objectives. The CFUGs face issues when working with the OPs Baral et al. (2020) argues there is a need for a closer fit between the OPs and the social, economic, and ecological realities they are embedded in. The changing nature of these conflicts raises new challenges in terms of the need for more developed resolution strategies and new mediators, in whom

all affected parties have faith. Increasingly, organizations such as FECOFUN have begun playing a role in conflicts between forest development (regarding social, economic, and ecological realities) and CFUGs (Homepage, 2023 September 15).

Villagers who depend on forests for their livelihoods are organized into a CFUG and are entitled to manage and utilize part(s) of accessible national forests as community forests according to their OP approved by the DFO (Hemant et al., 2007).

If approved, five or ten-year OPs are developed and implemented (Luintel et al., 2018).

Note that management plans and OPs are two separate terms. A management plan is used by the DFO with objectives for the whole district, whereas an OP is used by the CFUGs for their land/forest.

There are 74 DFOs under the Department of Forests. The major activities of the DFO related to community forestry include mobilizing people's participation in community forestry program, handing over community forests to user groups, supporting user groups by providing technical skills in field activities, like forest inventory and creating the OP, monitoring activities of the user groups and conducting various practical trainings such as forest inventory or OP preparation (Kanel, Poudyal, & Baral, 2006).

### 1.3 Problem description

Although Baral et al. (2020) noted that his 34 selected OPs within the middle hills of Nepal were found to prescribe the same operations, FECOFUN is currently working on a clearer understanding of which community forest has a better OP or to what extent they reach their objectives and what the causes are for no implementation of all programs mentioned in OP. CFUGs located in different sub-districts show a difference in OP. A comparison of OPs of community forests as in this study is therefore needed so future OPs can be improved regarding forest cover change by both geospatial and ground truthing information (A. Chapagain. Personal communication September 15, 2023). Also, as their database is incomplete a comparison can help FECOFUN to complete the database of compared CFUGs. Next to that, FECOFUN wants to know the change in biomass over time (for which forest cover data is needed) of multiple community forests with the use of GIS. The change in forest cover over time between two community forests can be a way to investigate to what extent OPs differ and if this has an impact on forest cover. In this research, two CFUGs were investigated in how their OPs differ and to what extent their OPs are implemented regarding change in forest cover. Finally, the results were compared and checked if the two community forests can benefit from each other, and a recommendation will be given to FECOFUN.

### 1.4 Problem statement

As FECOFUN is working on a clearer view on CFUGs and their OPs, it is unknown to what extent the OPs are followed by the members of the CFUGs and if this affects the forest cover. Ground truthing and geospatial analyses are therefore necessary to improve the current OPs and their implementation so forest cover can sustain or grow further.

### 1.5 Objective and Research questions

The objective and research questions are formulated so the problem statement can be resolved.

#### 1.5.1 Main objective

The main objective of this research is to find out if two community forests located in the middle hills area differ in OP and how truthful the OPs are followed regarding their approach to forest cover

change. A recommendation will be given to FECOFUN so that they can develop a plan regarding the improvement of the fit between OP and forest cover.

### 1.5.2 Main question

The main research question is as follows:

*Can similarities or differences in forest cover of two community forests be explained by differences in operational plan and how this is implemented by the forest user groups?*

### 1.5.3 Key questions

The following sub questions are used to gather data in a structural manner in order to answer the main research question and to achieve the main objective. The sub questions are as shown below:

1. *Is there a difference in forest cover between the two community forests over time?*
2. *Can differences in operational plans of the two community forests be identified? If so, what are these?*
3. *How do the two community forest user groups differ in implementation of operational plans?*

Once these key questions are answered, a final answer on the main objective can be given. As well as a recommendation for FECOFUN.

### 1.5.4 Scope and delimitation

This research has its focus on finding differences in OPs, and especially to what extent the forest user groups follow/implement these OPs and what aspects promote or hinder this. This is then linked to the forest cover. The middle hills have been chosen so the variable in topography is no longer a factor. Due to a limited amount of time as the period of the fieldwork is during the two biggest festivals of Nepal, this research only focuses on the impact of these approaches regarding the forest cover.

### 1.5.5 Expected results

In this research the OPs of two community forests in the middle hills (Figure 1) were compared with each other. By ground truthing the current situation with the help of interviews and surveys the current OP and to what extent the CFUGs follow these were measured.

FECOFUN mentioned that as the community forests lie in different sub districts, and thus managed by different DFOs, the operational plans could differ. Although, this is not certain as Baral et al. (2020) shows in their results that OPs lack the level of details necessary for their implementation while being identical in content at the same time. This could indicate that the forest group users of the two community forests do not follow the OPs accordingly. This could result in different approaches as the two community forests likely differ in other aspects such as language, ethnicity, and training.

## 2 Methodology

In this chapter the study area and method of this research is explained. Normally, the study areas are known before conducting the research. In this case, the study areas are not known beforehand and therefore a selection procedure as described in 2.1 Study area is done.

### 2.1 Study area

On the following map (figure 2) the working areas within the districts in are visible in green and yellow, the green the project areas of FECOFUN contain 1200 CFUGs which are facilitated to secure community forest rights for better forest governance, livelihoods, and community-based forest enterprises. The yellow marked areas are only partly facilitated. The green marked areas contain available GIS data (Shapefiles of community forests and Landsat images from 2000 until 2019, unsupervised). The annual land cover data of Nepal (2000–2019) (FRTC 2022) with a spatial resolution of 30 meters, developed using a harmonized and consistent classification system, will support assessment and monitoring of land cover change in the country and will serve as key dataset in various thematic applications (FRTC 2022). In this case the categorization of land use in the selected CFUGs.

FECOFUN aims to calculate the biomass gained or lost between 2000 and 2019. To achieve this, a smaller number of CFUGs (located in the Intensive Working Municipalities, marked in green) will be compared based on forest cover and biomass data.

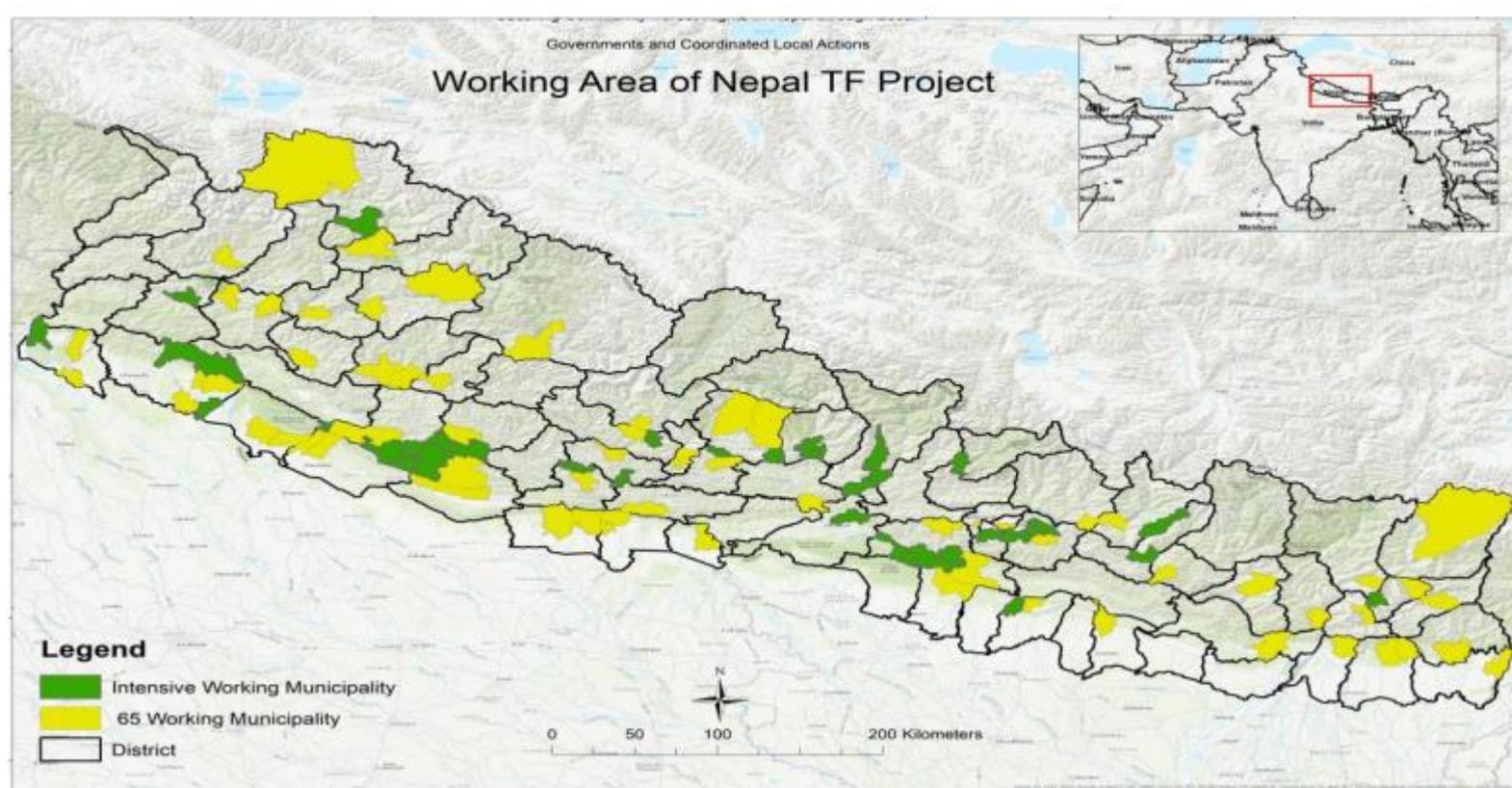


Figure 2, Project areas of FECOFUN with 1200 CFUGs in it (CF DataPortal, 2023).

During this process two community forests with a similar topography, located in the middle hills of Nepal (figure 1), were chosen to conduct this research on. The reason for the forest covers to be similar is to minimize this factor and focus on the differences of the OPs to what extent the CFUGs implement them. The change in forest cover is between 2000 and 2019 as this data from FRTC 2022 is used by

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FECOFUN for other projects as well. The reason for the selection of two CFUGs in the middle hills was to minimize the variable of topography and its impact on implementation of the OPs and therefore the forest cover. This way the two community forests are chosen in an unbiased manner, where the main variable should be the OPs.

2.2 Selected study areas

Baluwa Bhanjyang and Machhedanda were the chosen Community Forests, located in the southern parts of the mid-hills and have a forest cover difference of 1,8%. Both community forests lie within the same district of Makawanpur but are located in different municipalities and thus coordinated by different DFOs. This can create differences in the implementation of OPs. Baluwa Bhanjyang lies within the Manahari Rural Municipality, whereas the Machhedanda community forest lies within the Makwanpurgadhi Rural Municipality. See figure 3. Baluwa Bhanjyang falls under the DFO located in Rapti and Machhedanda falls under the DFO located in Hetauda.

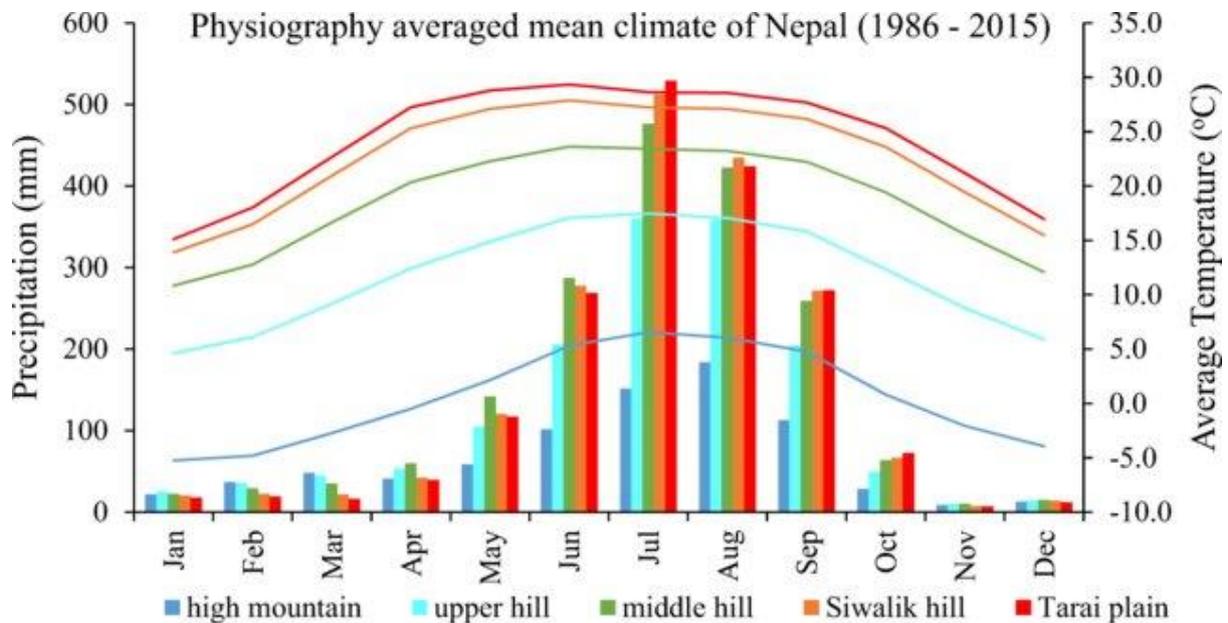
Locations of the two community forests



Figure 3, Map of the locations of the two selected community forests. Both community forests lie within the Mid-Hills, but closely to the border of the Siwalik region (green).

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Four months of monsoon season (June–September) with 80% rainfall and eight almost dry months is a characteristic of the Nepalese rainfall pattern (Sharma, et al., 2013). Data in the next two subparagraphs were derived from the Community Forest DataPortal.



Bars represent precipitation (mm) and lines represent average temperature (°C)

Figure 4, graph of the precipitation (bars) and average temperature (lines) of the middle hills (green) throughout the year. Source (Talchabadel, 2019).

### 2.2.1 Machhedanda CFUG

Machhedanda CFUG has a total population of 318 residents, of which 151 women and 167 men, living in 98 households. The altitude ranges from 1215 meters to 2106 meters above sea level.

In the 201,9 hectares sized area the forest cover in 2019 was 177,14 ha (87,7%) and the average growing stock is 106,41 m<sup>3</sup>/ha. There, the plant species khote salla (*Pinus roxburghii*), chilaune (*Schima wallichii*), bajh (*Quercus* spp.), dale katus (*Castanopsis indica*), guras (*Rhododendron arboretum*) and kafal (*Myrica esculenta*) are the most prominent tree species. This temperate forest is inhabited by wild animals like leopard (*Panthera pardus*), rabbit (*Oryctolagus cuniculus*), deer (*Muntiacus muntjac* and *Naemorhedus goral*), monkeys (*Macaca mulatta* and *Macaca assamensis*), fox (*Vulpes bengalensis*), forest cat (*Felis catus*), pangolin (*Pholidota*), monitor lizard (*Varanus*), porcupine (*Hystricidae*) pheasant (*Phasianus colchicus*), dove (*Columbidae*), parrot (*Psittaciformes*), common myna (*Acridotheres tristis*), long tail (*Psarisomus dalhousiae*), Indian cuckoo (*Cuculus micropterus*), house sparrow (*Passer domesticus*), green pit viper (*Trimeresurus albolabris*), mountain pit viper (*Protobothrops mangshanensis*), pythons (*Pythonidae*) and turtles (*Testudinidae*).

### 2.2.2 Baluwa Bhanjyang CFUG

Baluwa Bhanjyang CFUG has 298 residents, of which 158 women and 140 men, living in 71 households. The altitude ranges from 700 meters to 1300 meters above sea level.

The community forest has a total area of 180,16 hectares with a forest cover of 161,63 hectares (89,5%) in 2019 and an average growing stock of 153,20 m<sup>3</sup>/ha. In this subtropical forest one can find plant species such as the sal tree (*Shorea robusta*), asna (*Terminalia elliptica*), sandan (*Ougeinia*

*oojeinensis*), chilaune (*Schima wallichii*) and bahera (*Terminalia bellirica*). Animal species such as rabbit (*Oryctolagus cuniculus*), leopard (*Panthera pardus*), fox (*Vulpes bengalensis*), porcupine (*Hystricidae*), common myna (*Acridotheres tristis*), feral chicken (*Gallus domesticus*), peacock (*Pavo cristatus*), long tail (*Psarisomus dalhousiae*), Indian cuckoo (*Cuculus micropterus*), house sparrow (*Passer domesticus*), green pit viper (*Trimeresurus albolabris*), mountain pit viper (*Protobothrops mangshanensis*), pythons (*Pythonidae*) and turtles (*Testudinidae*) roam this community forest.

### 2.3 Research design and data collection

Three methods were used to answer the key questions and finally the main question to give a solution.

#### 2.3.1 Forest cover analysis

As the two community forests with a similar forest cover were chosen, the forest cover change from 2000 to 2019 was determined by using the GIS data (land use layers) of each provided year (provided by FRTC (2022)). This gave information on how the forest cover changes though time, what land types the forest cover interferes with and what the net change in forest cover is after 20 years.

#### 2.3.2 Content analysis of OP

Then, the OPs were obtained at the DFOs. This was done at the start of the fieldwork period, right before visiting the CFUGs.

The two OPs were not compared with each other directly but were compared with the Community Forest Development Guideline (2014) developed by the Department of Forest. This document comes with a framework for forest management plans and offers a set of activities and prescriptions that should be described in the OPs. The reason for using this document was that the same criteria can be applied on the two operational plans and allowed to pinpoint specific areas where the operational plans vary or align with each other. This (or a similar) document was provided by FECOFUN.

The OPs of the CFUGs were in Nepali; a translator was therefore needed. FECOFUN was able to provide a translator.

This methodology is similar to what Baral et al. (2020) employed, but with the modification of using two OPs for comparison and with a specific focus on forest cover change, analyzed from the geospatial data. Baral et al. (2020) conducted a content analysis (Hsieh and Shannon 2005) of community forest OPs which was done to examine their contents. Similarities and differences in operational objectives and silvicultural prescriptions were the focus. The review followed the Community Forest Development Guideline (2014), so called "Guideline", developed by the Department of Forest. The Guideline provided a framework for forest OPs and stipulates a set of activities and prescriptions that should be described in the plans.

In this research, the differences of the objectives and activities between the OPs are described in the results section. Also, the OPs were checked to see if they have the same activities mentioned in the Guideline by conducting a directed content analysis. This was done by creating a code scheme like the example in table 1. Here the activities from the Guideline were laid out and compared with both OPs. Scores ranging from 0 to 3 are given to both OPs, where score 0 = no mention of activity, 1 = basic mention of activity, but without details, 2 = activity mentioned with some details, 3 = activity mentioned and completely detailed with time planning, consequences, and examples. This created a list of scores for both OPs, which will be used for statistical analysis. The analysis only indicates if the OPs have the same activities compared to the Guideline, a descriptive comparison of the activities in the OPs was given as well.

Table 1, Example on how the data of OPs will be structured (Directed content analysis). Where the score 0 = no mention of activity, 1 = basic mention of activity, but without details, 2 = activity mentioned with some details, 3 = activity mentioned and completely detailed with time planning, consequences, and examples.

Activity found in Community Forest Development Guideline (2014)	Activity similar or different in OP Community Forest Machhedanda CFUG	Activity similar or different in OP Community Forest Baluwa Bhanjyang CFUG
Activity X	2	1
Activity Y	2	2
Activity Z	1	0

### 2.3.3 Likert scale data and interview analysis

When the two OPs were analyzed, both CFUGs were visited for interviews. With the help of interviews, both CFUGs were checked to what extent they follow and implement the OPs and if this impacts the forest cover. This was done by giving a ranking score according to the Likert scale, which gives quantitative data per objective/activity. These answers were backed up with obtained qualitative data from the interviews and focus group sessions. The questions were based on the objectives and activities obtained from the Operational Guidelines for Community Forestry Development Programme (1995), which is similar to the Community Forest Development Guideline (2014) and were used by the DFO to assess the general state of a community forest. This method was chosen, instead of deriving the interview questions from the OPs, since OPs can differ, and the interview questions would then not be the same for each community forest. The questionnaire can be found in appendix I.

## 2.4 Data analysis

The specific data analyses of the three methods are explained here. In the Results section, the individual method-specific results are provided and explained. In the discussion the results of the three methods were triangulated to enhance the robustness and validity of the overall results and interpretations. This was done so the main question can be answered with more ease.

### 2.4.1 Forest cover analysis

The GIS data was analyzed so the change in forest cover can be quantified. This is done with GIS programs QGIS or ArcMap. All 18 land use layers were stacked on each other and the intersect tool was then applied to identify and extract areas where features overlap in all layers. This resulted in a new output feature class containing the shared features or portions of features (forest cover in hectares) from all 18 layers within the areas of the CFUGs. This data was processed in Excel using a pivot table so the forest cover change per year could be calculated. According to Puyravaud (2003), following formula should be used to ease comparisons between sites of annual rates of forest change, the forest area and time of measurements:

$$P = (100/t2 - t1) \times \ln A2/A1$$

where A1 and A2 are the forest cover in hectares at time t1 and t2 in years, respectively, and P is the percentage of forest cover loss or gain (Tripathi et al, 2020). This was done for each following year, giving 18 annual growth rates of the forest cover from 2000 until 2019 per community forest. This can show trends in how the forest cover changes throughout time. Normally a paired T-test would be used

to test on significant differences throughout time, but in this case two different groups (CFUGs) were compared. Therefore, an independent samples T-test or Mann-Whitney U test were the right choice. The retrieved forest cover data of both community forests was checked on the normality and variances with the help of a Shapiro-Wilk since these cannot be significant in order to use an independent samples t-test. The Mann-Whitney U test was used, if the normality has been violated. Besides statistics, the results were explained and interpreted as well. The results were used to answer the first key question later.

#### 2.4.2 Content analysis of OPs

To answer the second key question, the information obtained from the OPs was structured as shown in table 1. All objectives and activities were examined and compared with each other, as well as the results from the open interview questions.

A Mann-Whitney U Test was implemented on these two datasets. This answer tells if the OPs of the community forests focus on the same activities or not. Next to that, a descriptive comparison of the objectives and activities was given.

#### 2.4.3 Likert scale data and interview analysis

To answer question three, interviews were conducted both quantitative (Likert scale) and qualitative. Some interview questions weighed heavier than others as these are more directly linked to changes in forest cover. With guidance from the FECOFUN and DFO of both districts the questions were weighted from 0,5 to 1,5, where 1 is a neutral weight. In appendix I the questionnaire, the weights for each question and scores can be found.

Interpretation of the Likert scale data was done by applying the intraclass correlation coefficient analysis. This statistical analysis shows to what extent the two community forests agree with each other.

Finally, if the Likert scale data was ordinal, a Mann-Whitney U test was used. If the data showed a normal distribution, which was tested with a test of normality, an Independent Samples T-test was used. This showed if a significant difference in the development of the CFUGs was present or not.

### 3 Results

With the help of ArcMap, the given community forests were analyzed on their forest cover percentage. Finally, the two selected community forests were compared. The results of forest cover analysis, OP comparisons and interview findings are explained in this chapter.

#### 3.1 Forest cover analysis

The annual forest cover data was obtained from the dataset of FRTC (2022), except for the year 2012 because this year was unavailable. In both community forests changes in forest cover are most drastic in the regions where the forest contacts the croplands. Only the “Forest” is used to calculate the forest cover, since this gives the best certainty of forest cover.

##### 3.1.1 Machhedanda

In the Makwanpurgadhi Rural Municipality, the CFUG of Machhedanda, with a total area of 201,9 hectares, can be found. Figure 5 shows the difference in land use from 2000 to 2019. A lot of croplands in 2000 turned into forest in 2019, as well as grasslands and other wood lands. The middle part of the CFUG, where the cropland prevails, is on a steep slope. The northern parts of the area are on a higher elevation along the ridge of the mountain, the southern part is closer to the valley and along the main road where most settlements are located. Suntil, in the center are smaller settlements connected to roads leading to the ridge.

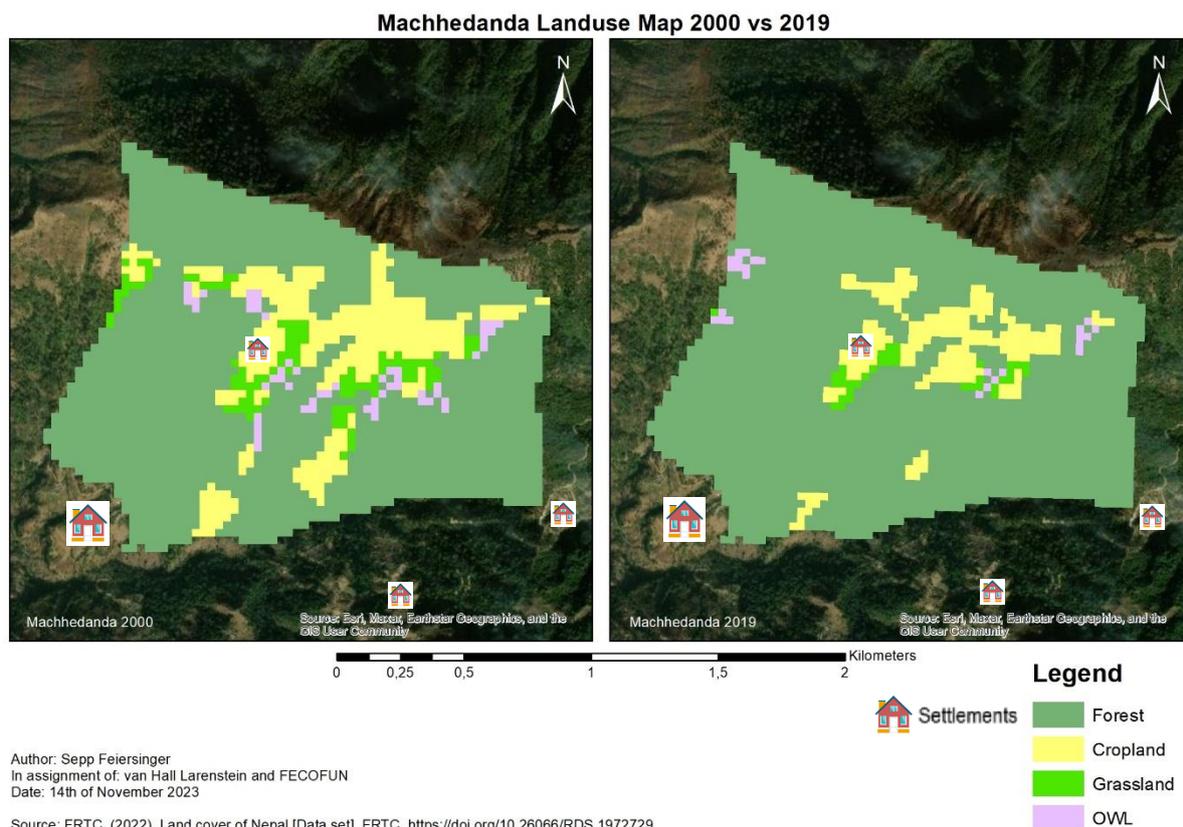


Figure 5, the map shows the increment of forest cover over the years (2000-2019). OWL stands for: Other Wood Lands.

Figure 6 and Figure 7 show how the forest cover changed and increased over the years. The decrease in forest cover from 2007 to 2015 was caused by forest fires and road constructions according to the CFUG. In total a forest cover change of 11,2% over the 20 years was detected.

COMPARATIVE ANALYSIS OF COMMUNITY FORESTS AND THEIR INFLUENCE ON FOREST COVER

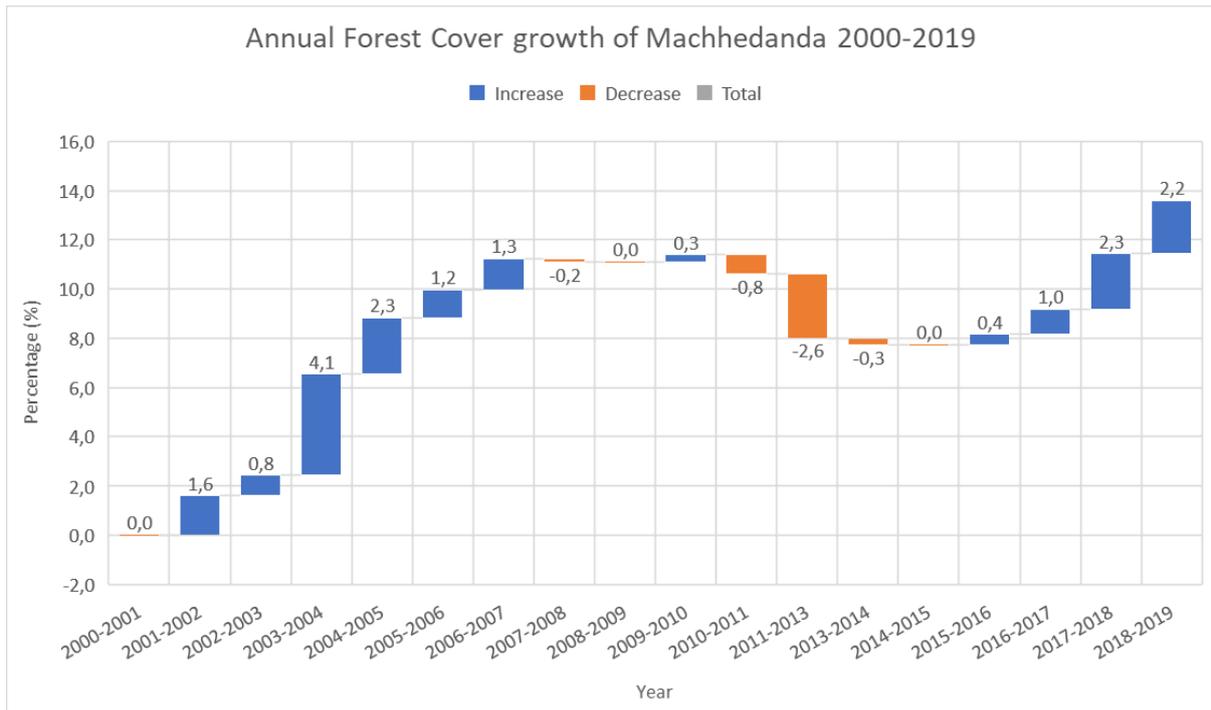


Figure 6, Annual Forest cover growth shown in percentages. A clear decrement in forest cover can be seen from 2007 to 2019.

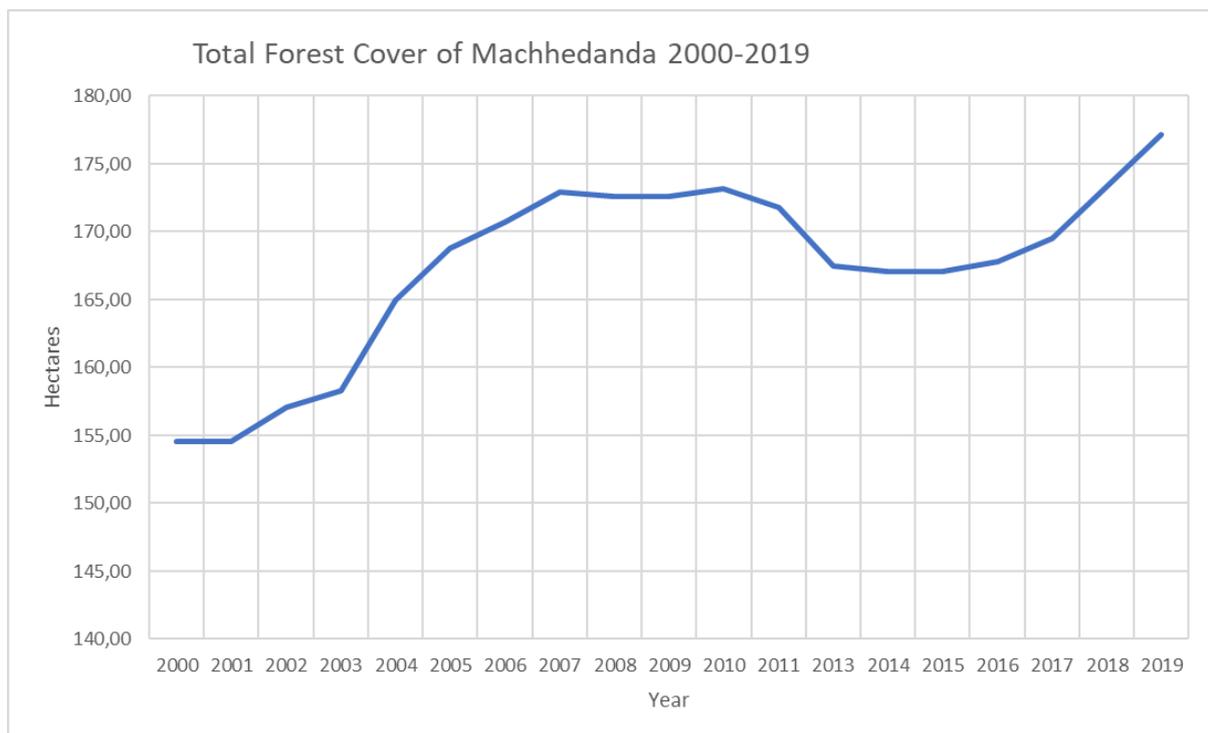
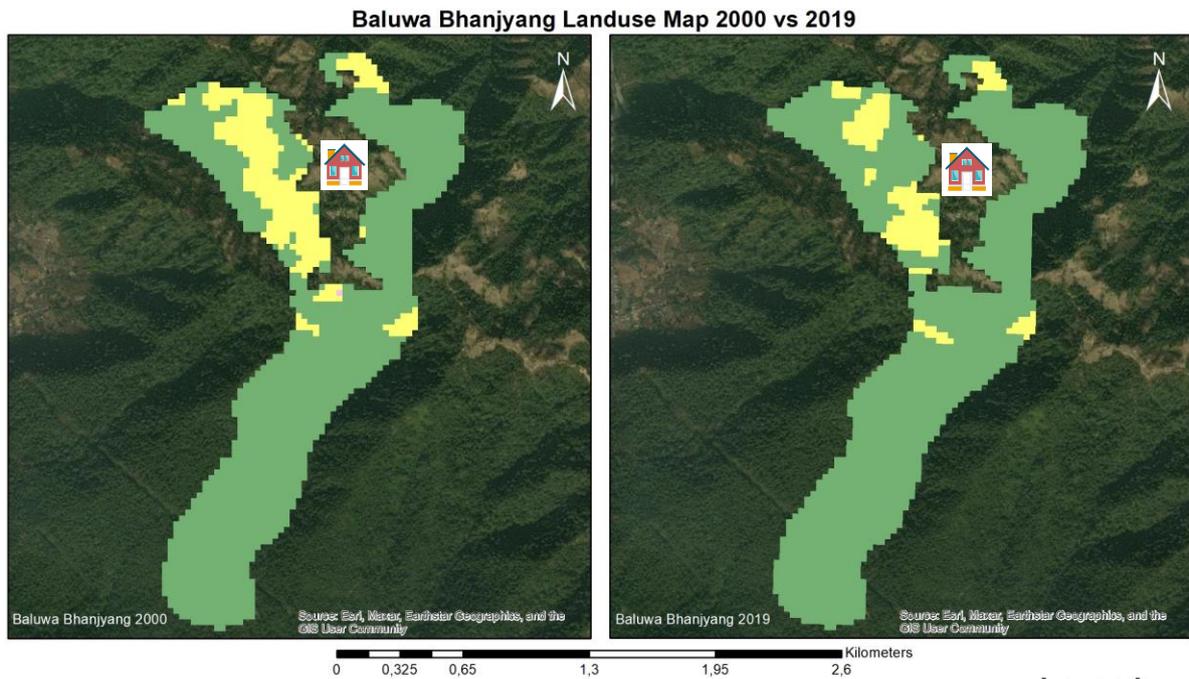


Figure 7, The total forest cover growth given in hectares. The forest grew by 22,60 hectares from 2000 to 2019.

### 3.1.2 Baluwa Bhanjyang

In the 180,5 hectares sized Baluwa Bhanjyang CFUG, the change seemed to occur mostly in the places (croplands) where most villagers farm. The road goes from the west up the ridge to the east and follows the western border of the area, the ridge inbetween the two northern parts of the area is where the settlements are located (figure 8). Figure 8 shows this change in forest cover between 2000 and 2019, Figure 9 shows the annual growth of the forest cover in percentage. Here, a dip is visible that shows a decrease in forest cover.



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In assignment of: van Hall Larenstein and FECOFUN  
Date: 24th of November 2023

Source: FRTC. (2022). Land cover of Nepal [Data set]. FRTC. <https://doi.org/10.26066/RDS.1972729>

Figure 8, the forest cover increasing. Here the villagers live in the north between the calculated areas. Close to these settlements the area changed the most.

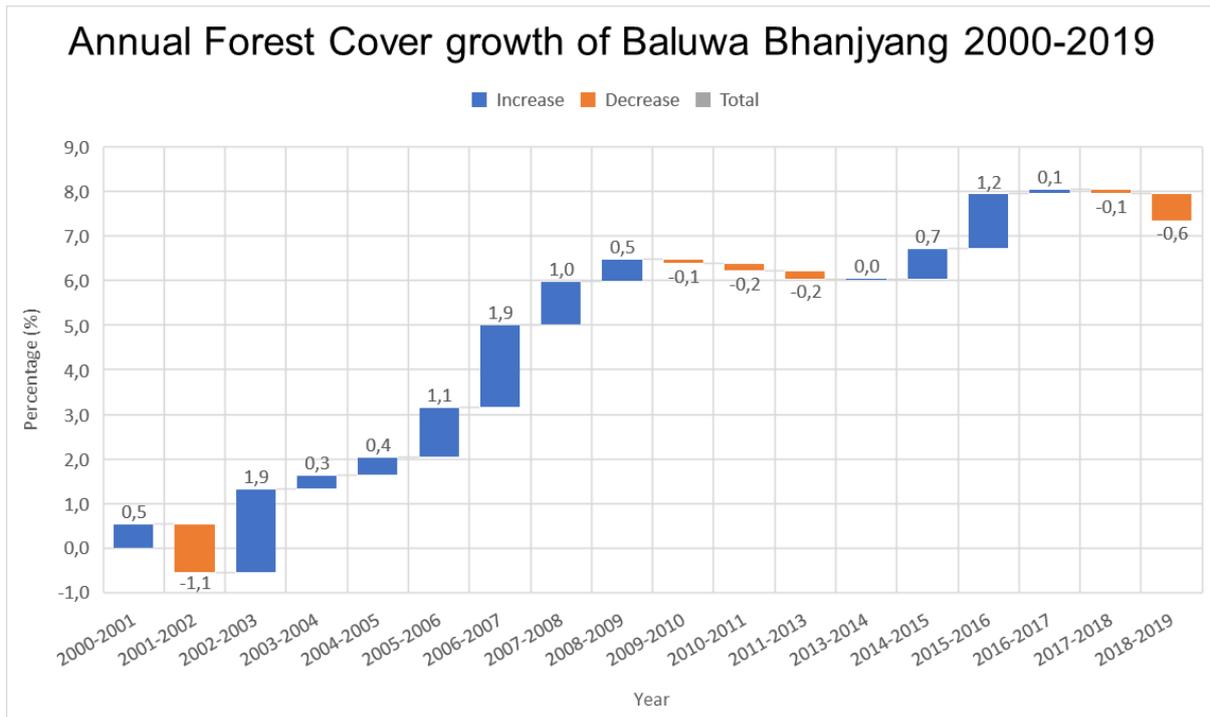


Figure 9, the annual growth of forest cover given in percentage. A slight decrease in forest cover from 2009 to 2014 is visible. In 2017 until 2019 a more severe decrement is visible.

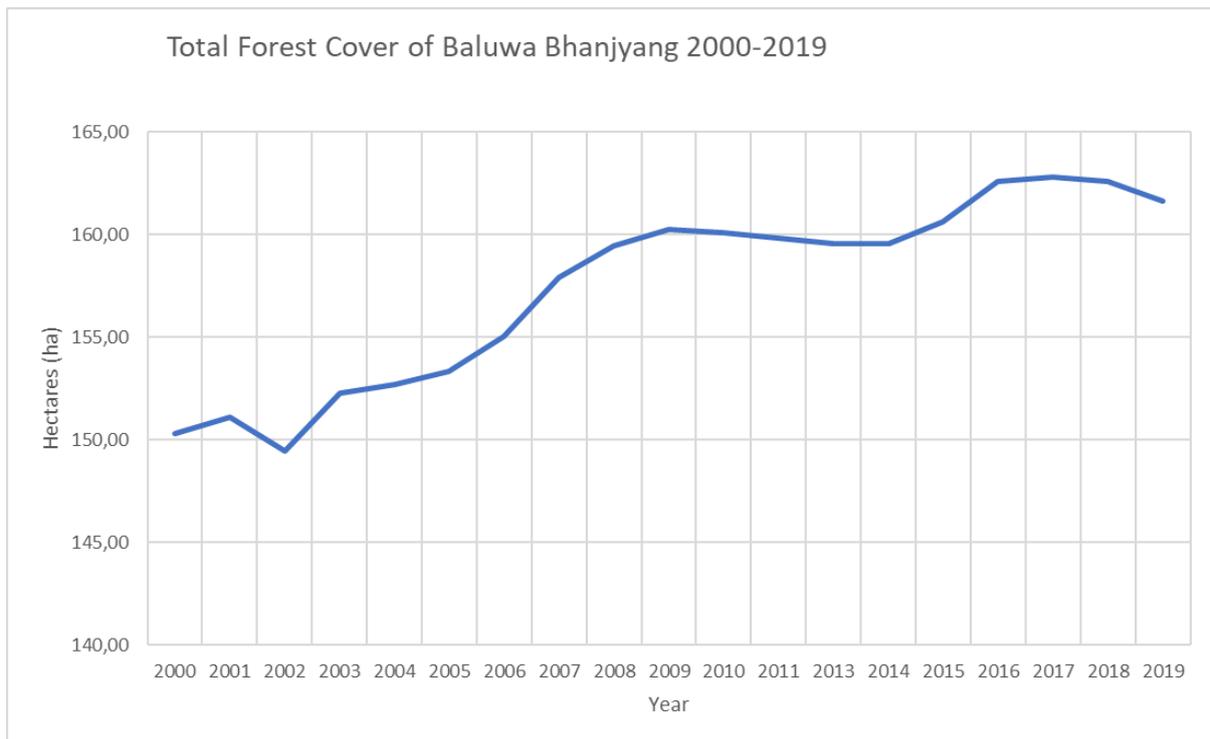


Figure 10, The total forest cover growth given in hectares. The forest grew by 11,35 hectares from 2000 to 2019.

## COMPARATIVE ANALYSIS OF COMMUNITY FORESTS AND THEIR INFLUENCE ON FOREST COVER

## 3.1.3 Comparison

In the map of Machhedanda CFUG (figure 5) the forest grew, and the other land uses decreased (cropland, grassland, and other wood land). The map of Baluwa Bhanjyang CFUG (figure 8) shows that the other land uses (cropland and other wood land) decreased, and the forest increased.

Visually, the annual forest cover growth graphs in figure 11 look the similar to each other as they both show a decrement in forest cover around the same periods. The annual forest cover growth graphs of both CFUGs show decreases of forest cover at some periods, but in both CFUGs a decrease over a longer period was seen from 2010 until 2015 for Machhedanda CFUG and from 2009 until 2014 for Baluwa Bhanjyang CFUG.

Looking at the annual difference in forest cover in table 2, in most cases the annual growth rate of Machhedanda CFUG was higher than that of Baluwa Bhanjyang CFUG. Also, the decrement mentioned earlier is more than that of Baluwa Bhanjyang CFUG. Machhedanda CFUG had a total forest cover growth of 22,6 hectares, whereas Baluwa Bhanjyang CFUG had a total forest cover growth of 11,36 hectares. A difference of 11,24 hectares (4,9%).

Machhedanda CFUG:

Mean forest cover growth per year: 0,771

Standard deviation: 1,499

Total forest cover change: 11,2%

Baluwa Bhanjyang CFUG:

Mean forest cover growth per year: 0,408

Standard deviation: 0,791

Total forest cover change: 6,3%

Table 2, Yearly forest cover in hectares from 2000 until 2019. With the annual difference in forest cover shown in percentages.

Year	Machhedanda CFUG			Baluwa Bhanjyang CFUG		
	Forest cover (ha)	Forest cover (%)	Annual difference (%)	Forest cover (ha)	Forest cover (%)	Annual difference (%)
2000	154,54	76,5	2000-2001	150,27	83,2	2000-2001
			0,0			0,5
2001	154,54	76,5	2001-2002	151,09	83,7	2001-2002
			1,6			-1,1
2002	157,06	77,8	2002-2003	149,46	82,8	2002-2003
			0,8			1,9
2003	158,32	78,4	2003-2004	152,26	84,3	2003-2004
			4,1			0,3
2004	164,98	81,7	2004-2005	152,71	84,6	2004-2005
			2,3			0,4
2005	168,77	83,6	2005-2006	153,34	84,9	2005-2006
			1,2			1,1
2006	170,75	84,6	2006-2007	155,05	85,9	2006-2007
			1,3			1,8
2007	172,91	85,6	2007-2008	157,93	87,5	2007-2008
			-0,2			1,0
2008	172,64	85,5	2008-2009	159,46	88,3	2008-2009
			0,0			0,5
2009	172,64	85,5	2009-2010	160,27	88,8	2009-2010
			0,3			-0,1
2010	173,18	85,8	2010-2011	160,09	88,7	2010-2011
			-0,8			-0,2
2011	171,83	85,1	2011-2013	159,82	88,5	2011-2013
			-2,6			-0,2
2013	167,50	83,0	2013-2014	159,55	88,4	2013-2014
			-0,3			0,0
2014	167,05	82,7	2014-2015	159,55	88,4	2014-2015
			0,0			0,7
2015	167,05	82,7	2015-2016	160,64	89,0	2015-2016
			0,4			1,2
2016	167,77	83,1	2016-2017	162,62	90,1	2016-2017
			1,0			0,1
2017	169,49	83,9	2017-2018	162,80	90,2	2017-2018
			2,3			-0,1
2018	173,36	85,9	2018-2019	162,62	90,1	2018-2019
			2,2			-0,6
2019	177,14	87,7		161,63	89,5	

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To analyze if the data is normally distributed, the Shapiro-Wilk test of normality was used for both groups (appendix II, table A1). Both CFUGs had a p-value lower than 0,05, meaning that the samples were not normally distributed, therefore the Mann-Whitney U Test was used (n=18 per group).

The Mann-Whitney U Test revealed a significant difference in the annual forest cover percentages between Machhedanda CFUG and Baluwa Bhanjyang CFUG (appendix II, table A2), where the confidence interval was set at 95%.

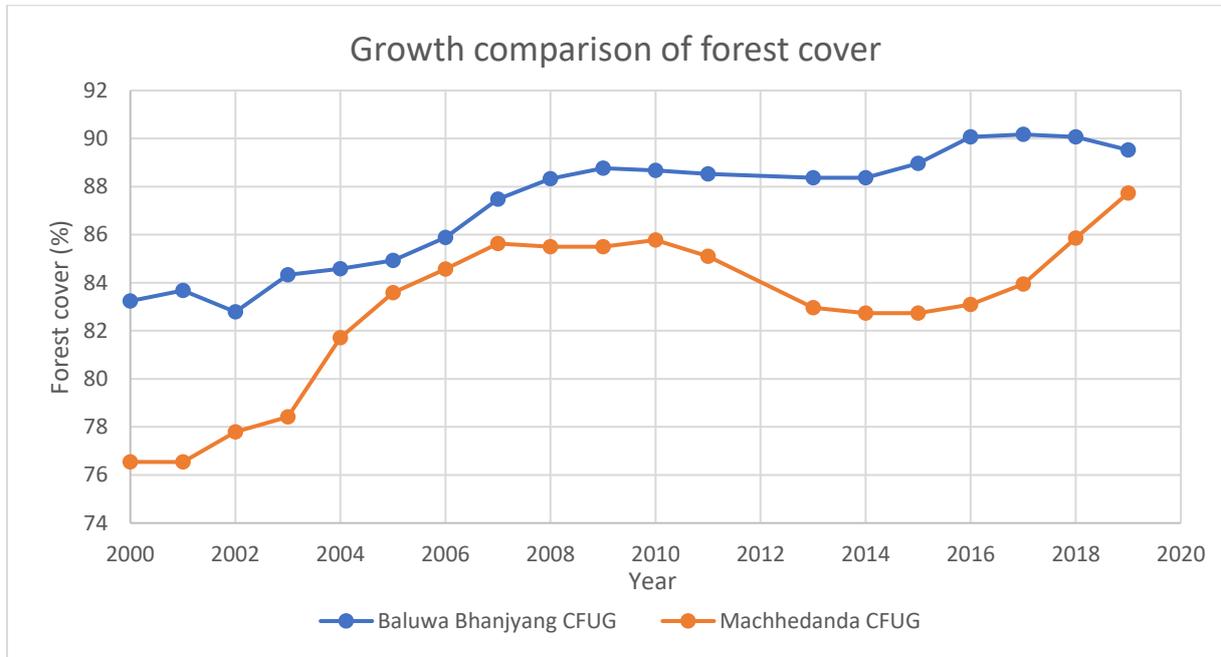


Figure 11, the growth curve of both CFUGs where machhedanda CFUG starts with much less forest cover, but almost meet on the same amount of forest cover in 2019. Both show the same patterns, but that of Machhedanda CFUG was more intense.

### 3.2 Content analysis of OPs

At first glance the OPs of the two community forests were the same but built differently. In the following sub paragraphs the aims, objectives, activities, and approaches of OPs regarding forest cover are laid out and compared with these of the Community Forest Development Guideline (2014). The guideline has a framework of management goals, activities to be undertaken and rules of forest product utilization that should be present in the OPs.

#### 3.2.1 Objectives

In general, the aim of Machhedanda CFUG is to balance the local standard of living and the environment by providing sustainable forest products to the consumers through sustainable forest management. Whereas the general aim of Baluwa Bhanjyang CFUG is to apply good governance to the community forest by applying sustainable forest management, supplementing the forest products of the consumers, protecting biological diversity, ensuring the rights of all categories of consumers, increasing access to the forest, and developing the environment to support meaningful conditions and payment of carbon credits.

On other pages of the OPs, short-term and long-term objectives were found. A full overview of short-term and long-term objectives of both community forests OPs can be found in Appendix II.

The short-term objectives make the groundwork for immediate needs and challenges, whereas the long-term objectives aim for the benefits and to sustain them. It is unclear over what time periods the short-term and long-term objectives are meant to be achieved, but as both OPs are valid from 2021 to 2026, the short-term objectives should be able to be achieved before the current OPs expires.

In general, the differences were that Machhedanda CFUG focuses more on social economic development and status through sustainable forest management, controlling poaching, achieving crop self-sufficiency and engaging low-income members in income-generating activities (short-term). On a long-term the focus is to improve social development by striving for employment opportunities and development of enterprises based on forest products, while maintaining an environmental balance and protecting forests.

Whereas Baluwa Bhanjyang CFUG has the short-term focus on efficient utilization of forest products, meeting consumers' needs, while conserving the forest. Their long-term focus is to address landslides and erosion, implementing adaptation programs to combat climate change effects and uplift the livelihood of women and underprivileged consumers through proper management and utilization and distribution of non-timber forest products and other programs while increasing the carbon sequestration to raise living standards.

#### 3.2.2 Activities

At first glance, the main difference was that Machhedanda CFUG had a tabular format with activities (without descriptive detail of activity itself), included with a budget, a time frame and frequency for each activity. Which was similarly written in the Community Forest Development Guideline (2014). Whereas the Baluwa Bhanjyang CFUG had a descriptive version of all their activities where only the activities, their reasons, and consequences for (not) implementing them were explained. No budget, time frame or frequency of each activity was seen here.

A code scheme (see table 3) was made, based on the framework of activities found in the Community Forest Development Guideline (2014). This code scheme tells if the activity from the framework of activities was found in the OP and to what extent the activities were explained. The higher the total

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score, the greater the emphasis on various activities regarding forest cover. The total score of Machhedanda CFUG was 18, whereas Baluwa Bhanjyang CFUG totally scored 26.

*Table 3, Score explanation: 0 = no mention of activity, 1 = basic mention of activity, but without details, 2 = activity mentioned with some details (what, where and when can be answered), 3 = activity mentioned and completely detailed with time planning, consequences, and examples.*

Activity regarding forest cover	Mentioned in OP of Machhedanda CFUG?	Mentioned in OP of Baluwa Bhanjyang CFUG?
<b>Forest Conservation Activities (Marking)</b>		
Theft and illegal harvest Control	0	2
Forest Fire Control	0	2
Animal Grazing Control	0	2
Encroachment Control	0	2
<b>Forest Promotion Activities</b>		
Nursery Establishment / Maintenance	2	0
Plant Production Wood Species	1	0
Plant production - non-timber species	1	1
Wire Fence / Biological Fence	0	1
Plantation	2	1
Replanting	0	0
Weeding and Cleaning	2	1
Bush cleaning	0	2
Pruning	2	2
Thinning	2	2
Singling	0	0
Reproduction Management	0	1
Herb/non-timber forest products Management	2	0
Forest Path Construction / Maintenance	1	2
Construction / Maintenance of fire protection line	2	1
Actions related to soil conservation	0	2
Wildlife Conservation and Biodiversity Conservation Work	1	2
<b>Total score</b>	<b>18</b>	<b>26</b>

Machhedanda CFUG did not mention in any way about theft and illegal harvest control, forest fire control, animal grazing control or encroachment control. Whereas Baluwa Bhanjyang CFUG mentioned these four forest conservation activities with more details.

Nursery establishments/maintenances were only mentioned by Machhedanda CFUG, just like construction/maintenance of fire protection lines. Both CFUGs mentioned basic silvicultural activities

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such as pruning, thinning, and cleaning, but in their different ways (table with budget, time frame and frequency vs written descriptions). Baluwa Bhanjyang CFUG mentioned activities and details to conserve the soil, as well as the biodiversity and wildlife.

Both CFUGs have supplied their activities with some details, but Machhedanda CFUG is missing the description that Baluwa Bhanjyang CFUG used for their activities and Baluwa Bhanjyang CFUG lacks a time planning, budget and frequency for each activity.

In general, Machhedanda CFUG mentioned activities that seem to be more useful to produce (fire)wood and Non-Timber Forest Products (NTFP) like plantation, plant production, nursery establishments and NTFP management. Whereas Baluwa Bhanjyang CFUG has their focus more on the conservation of the forest (biodiversity, soil, and wildlife conservation) and the control of theft/illegal harvest, forest fires, animal grazing and encroachment. Until, all activities mentioned in the OPs of both CFUGs were insufficient for implementation as questions like how, when, and why can arise.

Despite variations in the layout of activities to achieve the objectives, the Mann-Whitney U Test focused only on the factors of presence (score = 1, 2 or 3) and absence (score = 0), neglecting the consideration of the extent to which information was provided. Thus, no significant difference has been found between the activities from the OPs of Machhedanda CFUG and Baluwa Bhanjyang CFUG when compared to the activities mentioned in the Community Forest Development Guideline (2014), see appendix II table A3. This result showed that the OPs overlap in the activities they mentioned, however the CFUGs focused on different objectives, and it can be seen in table 3 that the non-matching activities steer more toward the achievement of their different objectives.

### 3.3 Likert scale data and interview analysis

Due to sparse time and costs, 32 interviews from each community forest were conducted, this represents at least 10% of the total population which is the minimum requirement. They gave answers to 15 questions in the form of Likert scale scores (quantitative data) and explanative answers (qualitative data). Appendix I shows the interview questions that were used to get the quantitative data, if someone scored below 3 (to a moderate extent) qualitative data was collected by asking them for their reason of giving that score. In most cases, the interviewees gave an explanation whether they gave a higher score or a lower score.

#### 3.3.1 Likert scale data analysis

Below in figure 12, the weighted Likert scale scores are shown per question. The scores in these graphs were the average of 32 participants. The graph shows the differences in given answers between the two CFUGs. The scores differ the most on question O1, A6 and A10, these questions were regarding the contribution to protection, development, and sustainable utilization of the CFUG, establishment of a transparent and accountable system for the CFUG, and the use of results from monitoring and evaluation activities. Higher scores on the Likert scale represent a greater level of agreement with the positive impact of the CFUG on the aspects mentioned in the questions. The Likert scale data was interpreted by applying the intraclass correlation coefficient analysis, see appendix II table A4. This statistical analysis shows to what extent the two community forests agree with each other. Here, the intraclass correlation of the average measures were observed, where 0 means a complete disagreement and 1 means a complete agreement between the two community forests. With an Intraclass Correlation of 0,971 there seems to be a very high agreement between Machhedanda CFUG and Baluwa Bhanjyang CFUG.

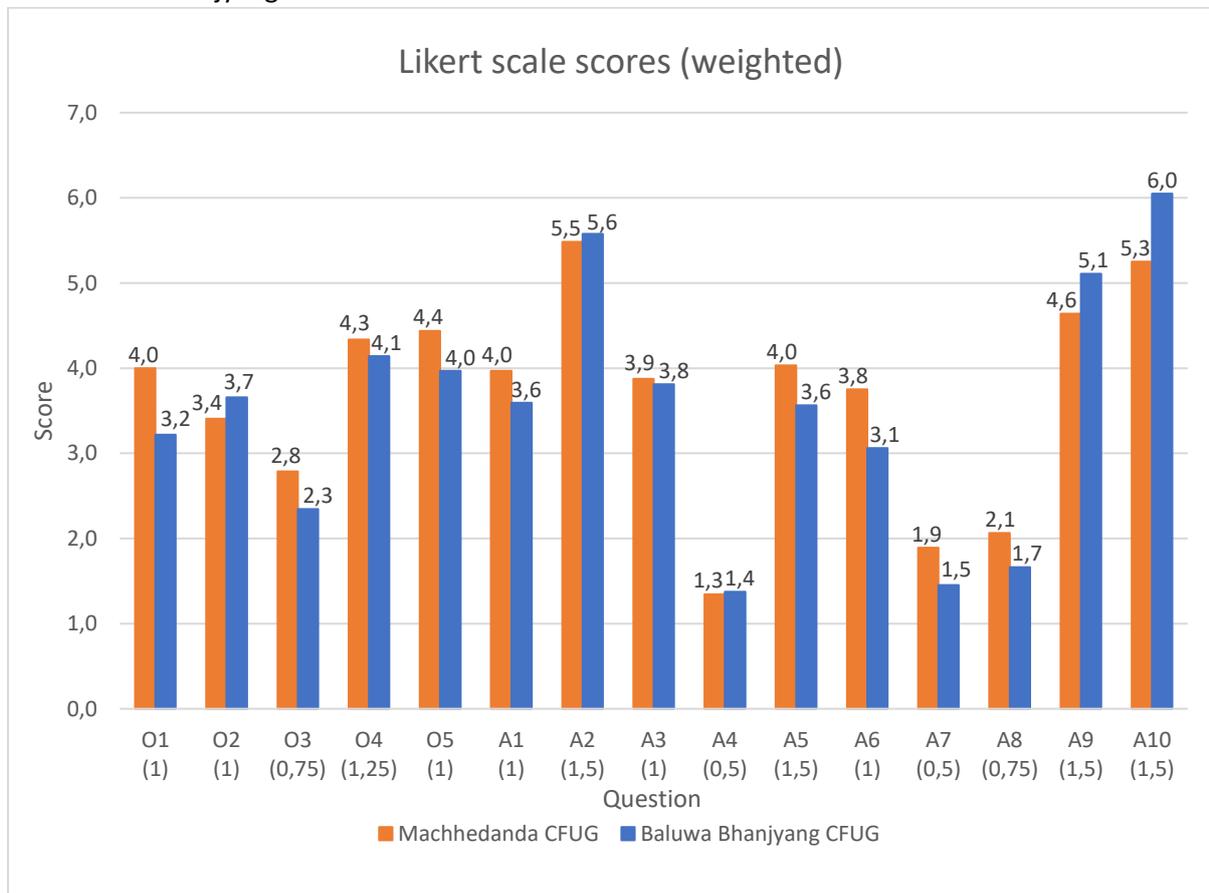


Figure 12, Average weighted Likert scale scores. O1 stands for question Objective 1 and A1 stands for question Action 1.

While collecting the Likert data at the CFUGs, it was notable that the committee members gave higher scores than the non-committee members. The reason for that was that the committee members have more insights into everything that is going on. In figure 13 the difference in scores given can be seen.

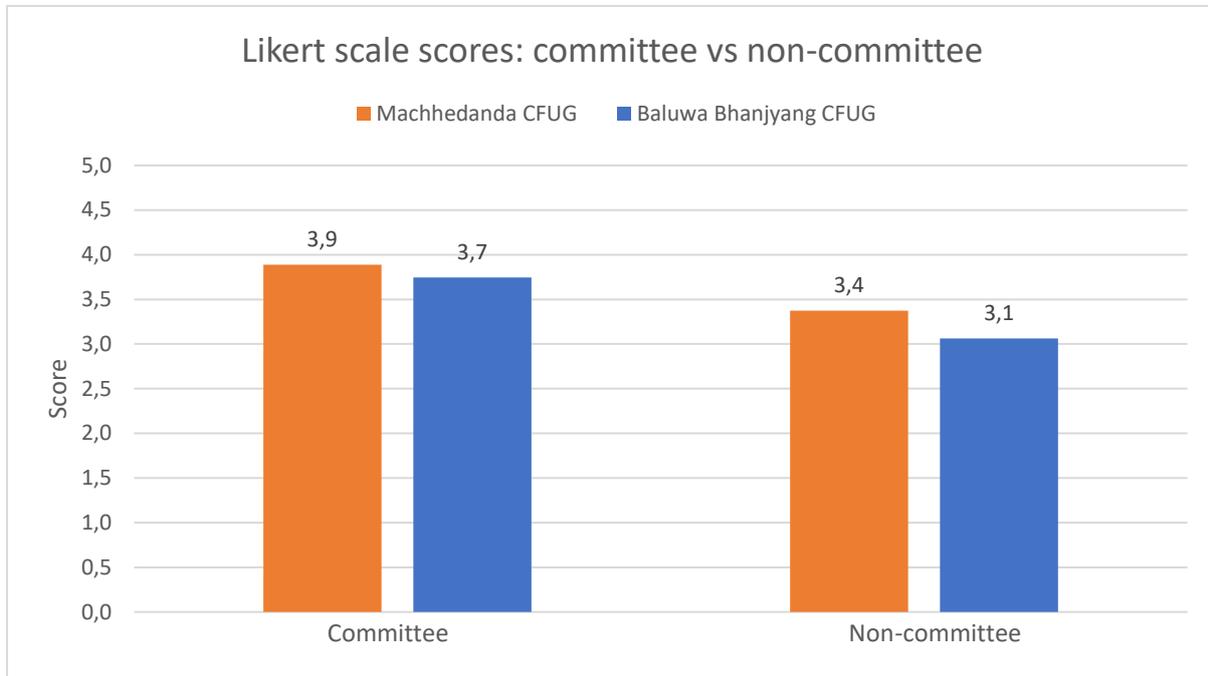


Figure 13, The difference in Likert scores given between committee vs non-committee members.

Appendix II table A5 shows the overall mean and standard deviation of the two community forests. Appendix II table A6 shows if the data is normally distributed according to the Shapiro-Wilk test and usable for a T-test.

Finally, as the data is normally distributed, appendix II table A7 shows if a difference in variances is present. Which is not the case, meaning that for the independent samples t-test the calculated results are shown when the equal variances are assumed. The results of the T-test can also be found in appendix II table A7, showing that there is no significant difference in people's opinions about the general development regarding forest cover between the Machhedanda CFUG and Baluwa Bhanjyang CFUG.

As for the opinions given for each CFUG, a significant difference was found between the committee and the non-committee members. This is the case for both CFUGs, see appendix II table A8.

### 3.3.2 Qualitative data comparison

The questions had to be explained by the translator as most interviewees did not understand the questions, some only spoke their native language (Tamang) and a second translator from the CFUGs helped to gather information. Committee members, villagers of the CFUG and the DFO gave answers. The committees of both CFUGs consists of 13 people, of which 5 were female. In total there were 5 key positions in the committee group, 2 women fulfill a key position within the committee group of both CFUGs (treasurer, (vice)chairperson, (co)secretary) which make them 50% men and 50% women CFUGs.

When showing the forest cover growth table to the chairperson of Machhedanda CFUG, he could immediately point out that the decrease in forest cover was due to forest fires in that period and

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probably due to construction/maintenance of new roads. The committee members of Baluwa Bhanjyang CFUG mentioned that their decrease in forest cover was due to forest fires as well, but also due to landslides. In the eyes of the DFO of both districts, there is a moderate impact of protection, development, and sustainable utilization in their CFUGs. *“The rehabilitation has been done quite well, mostly by implementing afforestation and conservation activities on the barren lands.”* (Field note, 2023). Both CFUGs mentioned that croplands that were hard to reach or affected by forest fires/landslides were left behind.

During the interviews at the CFUGs it was clear to see a distinct in how the two CFUGs utilize the community forest, Machhedanda CFUG extracts wood and the harvest of NTFPs were used for income-generating activities (resin tapping and medical herbs) as mentioned in the OP. There was no agroforestry for commercial purposes, but only for themselves and their cattle. The chairperson mentioned that they want more ideas and training in income-generating methods.

Whereas Baluwa Bhanjyang CFUG only extracts wood. It was said by committee members that due to technical incompetencies they were not able to create income-generating activities. The CFUG did not receive much support from the DFO to make this happen either. There was no ecotourism in either CFUGs. When it comes to the development and implementation of income-generating activities, both CFUGs struggle with starting an enterprise as problems arise on policy levels, and they have a lack of resources to start these programs.

The DFO assisted Machhedanda CFUG to implement programs mentioned in OP. The CFUG focuses less on the conservation, social upliftment, capacity building, and silvicultural treatment and focus mostly on the programs related to harvesting and plantation. Indicating that the OP is not fully followed. It was said by multiple interviewees that there is a lack of communication, as they did not attend any meeting since the current OP came out. From then there were no activities such as weeding, pruning, and cleaning as well.

In Baluwa Bhanjyang CFUG, forest fires and landslides come in the way and lead to delay of implementation programs. The topography also makes it more difficult, as it is hard to implement the programs on the steep slopes. Although, it seems not to have that much impact as multiple members said: *“The OP is followed, but not as excessive as this OP does not require much work.”* (Field note, 2023). The DFO mentioned that this CFUG was independent enough to implement the program according to the OP.

Machhedanda CFUG is split up into 4 blocks and manage the records of finances and activities per block. This division is helpful for their time planning. According to the committee members, they follow the OP to record all their activities and financial expenses. But the CFUG villagers mention that there is not enough transparency/accessibility and were only informed during the yearly meetings with the whole CFUG which did not happen since 2021. The committee members hold a meeting every 3 months, but in some cases exclude the general members so only the (sub)chairperson, treasurer and (co)secretary are included as they do the most important work. This creates a big difference between (higher ranked) committee members and the rest of the CFUG when it comes to insights into activities and finances. Baluwa Bhanjyang CFUG is also split up into 4 blocks, but they mention that the quality and efficiency of record keeping is poor due to a lack of technical proficiency. Here, all households are yearly informed, and the committee members have a meeting every 3 months which they schedule by themselves and not according to a time plan. Officers from the DFO visited the CFUG recently to check how everything goes by attending the committee meetings. The DFO visits them once per year, at the end of the fiscal year (June).

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Both CFUGs collaborate with their DFO when the OP is about to expire, then rangers are sent to the CFUG and assess the status in all aspects of development. Besides that, both CFUGs said that they can monitor regular activities as they must show their records to the DFO when they visit. Baluwa bhanjyang CFUG has two forest guards to monitor and secure the forest management in all ways, but only for 6 months per year during the dry season due to a lack of finances. The forest guards update the committee members regarding any problems and monitoring results of the forest. Machhedanda CFUG monitors their forest on a rotational basis and follow procedures against poachers and thieves.

The DFO considers Machhedanda CFUG as a moderately self-sufficient CFUG due to different legal barriers and nonchalant leadership. Money earned from resin tapping, firewood and collective revenues is used to buy materials for construction purposes. *“As long as the forest is big and the village remains small, the forest can provide sufficiently.”* (Field note, 2023), said by the chairperson of Machhedanda CFUG. They have a river down in the valley, providing the whole CFUG with drinking water. Whereas Baluwa Bhanjyang CFUG has only one small stream of water flowing next to the house of the Treasurer. They suffer more from droughts and want the DFO to build a water tank in the forest as a measure against forest fires. *“We can collect water in the valley; hence it is necessary to collect this in a tank and pump it up to higher forested areas for irrigation.”* (Field note, 2023). Other than that, they see themselves as self-sufficient. Households have enormous pots filled with collected water, which they boil before consumption. Construction material is what they get elsewhere with money earned from the sold firewood.

The DFO and FECOFUN support both Machhedanda CFUG and Baluwa Bhanjyang CFUG for a few days per year with plantation programs beside the programs mentioned in the OPs. According to the OP of Machhedanda CFUG, only native tree species are planted in their area.

With the help of the DFO, Machhedanda CFUG is now able to identify requirements and problems but there is a problem in creating solutions. During the committee meetings they discuss, form solutions, and approve solutions. These are forwarded to the DFO.

According to the DFO, the orientation and capacity building training made Baluwa Bhanjyang CFUG capable enough to identify requirements, problems and to some extent tailor a solution. Although, the interviewees said that they are not completely able to identify, evaluate and work on solutions for problems. It is challenging to hold meetings with the whole CFUG (and get opinions of everyone) too often, since not everyone has enough time as they are busy with other work. A lack of communication seems to be present in both CFUGs.

When asked to what extent they provide/follow training to implement skills in the programs of the OP, both answered that they do not provide training. Although, Machhedanda CFUG follows an awareness program instead. There, they learn about the impacts of forest fires, illegal harvesting and how the OP affects the forest in basic terms. The chairperson said: *“So far, there is no initiative to provide training, but we think that the awareness program is enough.”* (Field note, 2023). This was argued that the DFO should be the one to initiate a training program. Baluwa Bhanjyang CFUG are not able to gather resources to carry out training programs. The OP does not mention training programs either. The DFO did not help or reach out to them for such programs, mainly due to no communication regarding this topic.

It was mentioned in Machhedanda CFUG that there is not enough men power to implement the activities as fathers and older men get a job in town and the younger people leave the community forest to study elsewhere. This leaves the women behind in the community forest who work mostly in

## COMPARATIVE ANALYSIS OF COMMUNITY FORESTS AND THEIR INFLUENCE ON FOREST COVER

the croplands close to the settlements. Whereas most villagers of Baluwa bhanjyang CFUG stay in the community forest, they do not go elsewhere for work or studies. Both CFUGs have electricity, Baluwa Bhanjyang CFUG was installing the cables during the visit. Some households had solar panels.

Both CFUGs have their communication issues as they do only have one meeting per year that includes everyone from their CFUG. The committees are more involved in the management of the CFUGs, they hold meetings at least every 3 months. Machhedanda CFUG did not hold a meeting with the whole CFUG since the issue of the OP (2021) as they supplied themselves with enough harvested firewood. And as only the harvest programs are followed from the OP, there is not much communication about the status of the forest. Only meetings with a part of the committee were held (the ones with a key position). Baluwa Bhanjyang CFUG seems to have more connection with their DFO, this way they receive more input. Also, they said they have a lot of work to do and gathering everyone to hear all their opinions is a difficult task.

Machhedanda CFUG uses the forest more in a productive way, whereas Baluwa Bhanjyang CFUG focuses more on the conservation of the forest.

## 4 Discussion

In this chapter the main findings of the three methods are briefly described and then triangulated with each other and reviewed with literature to give a stronger link between the OPs, their implementation, and the forest cover change.

The main finding of the forest cover analyses was that the Mann-Whitney U Test revealed the difference of total forest cover growth between Machhedanda CFUG and Baluwa bhanjyang CFUG from 2000 until 2019 to be significant. Both the increment and decrement of forest cover of Machhedanda CFUG were more intense than that of Baluwa Bhanjyang CFUG.

In the OPs a difference in objectives between the two CFUGs is notable; Machhedanda CFUG focuses on the social economic development, whereas Baluwa Bhanjyang CFUG focuses on the general conservation of their forest. The content analysis of the two OPs showed no significant difference on their activities. Yet, the OPs differ in their explanation of activities; Machhedanda CFUG had a table where a budget, time frame and frequency mentioned for each activity, whereas Baluwa Bhanjyang CFUG had none of these but a descriptive explanation of why and how the activities should be implemented. Both OPs mentioned activities they use to achieve their objectives. Regarding the results of the Likert scale data, no significant difference was found between the two CFUGs as well. However, the qualitative data showed a difference in approach. During the interviews it was noticeable that the committee members of both CFUGs had more insights and could answer the questions with more ease.

The annual forest cover growth graphs of both CFUGs show decreases of forest cover at some periods, but in both CFUGs a decrease over a longer period was seen from 2010 until 2015 for Machhedanda CFUG and from 2009 until 2014 for Baluwa Bhanjyang CFUG. Machhedanda CFUG had a greater decrease in forest cover from 2010 until 2015 than Baluwa Bhanjyang CFUG had in 2009 until 2014. During the interviews it was mentioned by the committee of both CFUGs that the reasons for the long period of forest cover decrease were mainly forest fires, although the interviewees of Baluwa Bhanjyang CFUG emphasized the fact they have forest fires more than Machhedanda CFUG did. Looking at the objectives and activities in the OPs of both CFUGs, Baluwa Bhanjyang CFUG clearly stands out regarding forest fire control measures.

Bhujel et al. (2022) showed in their results that the Terai and Siwalik regions are mostly affected by the forest fires, and that from 2000 until 2020 the annual forest fire incidents increased. As Baluwa Bhanjyang CFUG is very close to the border of the Siwalik, where it is annually warmer and hotter in the pre-monsoon (Talchabhadel, 2019), the risk of forest fires may therefore be greater than in Machhedanda CFUG. The OP of Machhedanda CFUG mentioned nursery establishment/maintenance and plantation and said they follow the OP procedure. This could be the reason for almost twice as many hectares that turned into forest than that of Baluwa Bhanjyang CFUG. Both CFUGs get help a few days per year from FECOFUN and DFO to plant trees, this is apart from the programs mentioned in their OPs. Matin et al. (2017) showed that there is a higher proximity of forest fire incidences in forests closer to settlements and roads. Since most forest cover changes happened in the areas close to where settlements are located and where off roads are leading to, this could be one of the reasons for forest fires occurring at these places.

Both CFUGs mentioned that croplands that are hard to reach or affected by forest fires/landslides are left behind. The DFO mentioned that the rehabilitation has been done quite well, mostly by implementing afforestation and conservation activities on the croplands. This can be seen in figure 5 and figure 8, where the area of the croplands decreases over time. Especially Machhedanda CFUG mentioned a lack of men power is the cause for being behind schedule of implementations of OPs

programs. Bista et al. (2021) reported that farmers' reasons for cropland abandonment confirmed their findings; that is, lack of labor and crop raiding are the dominant factors contributing to cropland abandonment. According to Rouw et al. (2023), livestock can have a negative effect on the succession of new growing in abandoned croplands. Since Baluwa Bhanjyang CFUG mentions strict grazing control activities in the OP, there is a probability of a succession undisturbed by livestock which could have led to an increase in forest cover.

Baral et al. (2020) stated that the OPs lack a level of detail necessary for their implementation while being identical at the same time. They discussed that many of the prescriptions are copied from one plan and pasted to another. This does not seem to be the case in this research as the OPs list different activities used to achieve their objectives. Although the OPs do not show statistically significant differences, the way in explaining the activities differs greatly (tabular way vs descriptive way). This could be because the two CFUGs are located in different sub districts and therefore are supported by two different DFOs. Ghimire et al. (2022) states that the implementation status was found sub-standard, implementing only the harvesting activities whereas neglecting the essence of forest management, i.e., silviculture. This seems to be the case in this research for both CFUGs as well.

Only Baluwa Bhanjyang CFUG mentioned the DFO visiting them regularly to check on the status of the CFUG. While this was not said during the interviews in Machhedanda CFUG and seems like what Toft et al., (2015) states; the community level manager (chairperson) appears knowledgeable about forest conditions and the management plans are not used in practical forest management since most of the activities are done superficially without looking through the OP. This is because the forestry officials (DFO) take no action even if the prescriptions are not implemented.

As Baluwa Bhanjyang CFUG scores very high on question A10, their opinion tells that they make most use of results from monitoring and evaluation activities. As the DFO visits regularly, the results can be communicated easier and requirements, problems and solutions can be identified and processed easier. This could be the reason for a more stable forest cover growth than Machhedanda CFUG (figure 9 vs figure 6). The significant difference found between committee and non-committee members showed a barrier in communication. During the interviews the committee members stated everything regarding forestry is transparent and shared during the meetings which are at least every 3 months. As they stay up to date with the current state of the CFUG, the rest of the CFUG (non-committee members) can only attend the yearly meeting. Some non-committee members wanted to know more about the status of the CFUG, whereas others did not seem to care. The main reason for that is that they already have a lot of work to do on their own. It should be possible to gather all CFUG members for more frequent meetings. Like Toft et al., (2015) discusses, it appears that CFUG managers, despite being saddled with less useful OPs and without relying on these in their management, are generally capable of and interested in sustaining their community forests. The DFO seems to play a big role in the local management. Both CFUGs have a lack of communication and transparency and do not completely follow the activities mentioned in the OPs. Also, both CFUGs want more training which is not provided. More training and better communication and transparency could help them to implement activities other than harvesting. The DFO could help them with these two issues for a better development of the CFUGs and therefore a conservation or increase in forest cover.

In agreement with Baral et al. (2020), a closer fit between the OPs and social, economic, and ecological realities is needed as the scientific forest management plans in community forests in the middle hills in Nepal do not match the reality on the ground.

Looking at the methodology, the limitation of using the GIS data from FRTC (2022) was that it had a spatial resolution of 30 meters. The shapefile of Baluwa Bhanjyang CFUG was not complete and had

to be redrawn according to OP. This happened after the forest cover analysis when the OP mentioned that the CFUG is bigger. FECOFUN works on updating their database (CFDataPortal), so this should in the near future not be a problem anymore.

Regarding the content analysis, the Community Forest Development Guideline of 1995 was similar to the 2014 version but did not have a framework for activities and prescriptions. Since the 2014 version was not available in English, and translation would have taken too much time, the 1995 version was used to create the questionnaire. Later, the framework with all the activities mentioned in the 2014 version was translated and used for the content analysis of the two OPs. For future studies or repetitions of this study, it is recommended to use the Community Forest Development Guideline of the 2014 version.

Differences in tree species could be a cause for different forest cover growth rates, future research may be necessary to see if different tree species affect the forest cover over time. The cause for the difference in vegetation could be the fact that Baluwa Bhanjyang CFUG lies close to the border of the Siwalik.

The OPs did not match with the provided GIS data (2000-2019) as the OPs are valid from 2021 to 2026. Yet, according to the DFO and the villagers, not much changed in the OPs as the long-term objectives are meant to be achieved over a longer period than 5 years. All silvicultural practices described in the current OPs were mentioned in the previous OPs as well.

The questions during the interviews could be interpreted differently as not everyone interfered with the OPs as much as the committee members for example. In some cases, 2 translators were needed, one to translate from Tamang to Nepali and another one to translate from Nepali to English. This way it took longer to get a clear answer. Due to costs and lack of time only 10% of the population was interviewed, 32 interviewees per CFUG. This is globally considered the minimum norm. Expanding the interview sample beyond 10% of the population may provide a more comprehensive understanding of community perspectives.

## 5 Conclusion

The difference in forest cover between Machhedanda CFUG and Baluwa Bhanjyang CFUG from 2000 until 2019 is 4,9%. Where Machhedanda CFUG had a forest cover growth of 11,2% (22,60 hectares), and Baluwa Bhanjyang CFUG had a forest cover growth of a lesser 6,3% (11,35 hectares), this is a significant difference. Both the increment and decrement of forest cover of Machhedanda CFUG were more intense than that of Baluwa Bhanjyang CFUG. Forest fires were the main cause of forest cover decrease.

The OPs show different objectives and activities to achieve these. The activities mentioned are similar according to statistics but differ in their way of writing (tabular way vs descriptive way) regarding forest cover. Both lack necessary details, echoing findings from previous studies. The emphasis on various activities differs between the OPs so that the activities are more applicable for achieving the objectives. Machhedanda CFUG mentions activities that seem to be more useful to produce (fire)wood and Non-Timber Forest Products (NTFP) like plantation, plant production, nursery establishments and NTFP management. Whereas Baluwa Bhanjyang CFUG has their focus more on the conservation of the forest (biodiversity, soil, and wildlife conservation) and the control of theft/illegal harvest, forest fires, animal grazing and encroachment.

Both CFUGs have a lack of communication within their CFUGs. Committee members showed more insight, and a noticeable barrier exists between committee members and the rest of the CFUGs. A yearly meeting does not seem to be enough for non-committee members. Both CFUGs do not seem to follow the operational completely, the emphasis lays more on the harvest of firewood. Machhedanda CFUG extracts wood and harvests NTFPs which were used for income-generating activities (resin tapping and medical herbs) as mentioned in the OP. Baluwa Bhanjyang CFUG only extracts wood. It was said by committee members that due to technical incompetencies and policy restrictions they are not able to create income-generating activities. Baluwa Bhanjyang CFUG has forest guards that guard and monitor the forest. They also seem to have more contact with their DFO than Machhedanda CFUG.

The objectives in OPs and approaches of the CFUGs differ and could be a reason for the slight difference in forest cover growth. Both CFUGs had problems with the complete implementation of their OPs, however they managed to increase the forest cover. The challenges faced by Machhedanda CFUG and Baluwa Bhanjyang CFUG can be resolved by improving their communication, providing their activities with more detail, and training for the CFUGs to learn how to implement the activities other than harvesting. The absence of statistically significant differences between OPs and opinions shows the importance of considering subtle qualitative distinctions in understanding complexities of community forest management. With that in mind, differences in forest cover of two community forests can be explained by how the OPs are implemented by the forest user group. Further research may be needed to better understand how a stronger connection between OP, OP implementation and forest cover change can be established.

## 6 Recommendations

The conclusion has led to the formulation of the following recommendations for FECOFUN to strengthen the role of CFUGs:

To create a base document which contains a catalogue for different types of approaches, since the current basis document to create OPs is the same for every CFUG. This should help to focus more on the needs of the CFUG. This should be implemented by the DFO when creating a new OP. The base document should come with a framework of what type of details should be given to the CFUG to make the activities implementable by the forest use group.

This base document can also provide a guideline for the DFO to advocate the CFUGs on policies and create a procedure that can make it easier for the CFUGs to start up enterprises. This can help the CFUGs to focus on what is necessary to be able to start up bigger enterprises and how to deal with confronting policies.

To encourage the younger generation to stay in the community forests and promote knowledge sharing within CFUGs, FECOFUN could create a collaboration between the Institute of Forestry in Hetauda and the DFOs and CFUGs, where students from nearby CFUGs can do their school projects under supervision of the local DFO. Creation of new OPs, monitoring of the forests and research are topics that can be worked on.

This study acts as a model, implementable for FECOFUN for future comparisons of CFUGs. A step-by-step guide was made and handed over to them.

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## Appendixes

I

**Objectives from the Community Forest Development Guideline (1995): To what extent are these achieved and how does this affect the forest cover?**

**Objective 1: To encourage the CFUG to protect, develop, and utilize the community forest in a sustainable manner.**

*To what extent has the CFUG successfully contributed to the protection, development, and sustainable utilization of the community forest, and how has this affected the change in forest cover?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, please share why the CFUG faces challenges in achieving this objective.*

Weight: 1,00

Average score for Machhedanda CFUG: 4,0

Average score for Baluwa Bhanjyang CFUG: 3,2

Average weighted scores:

Machhedanda CFUG: 4,0

Baluwa Bhanjyang CFUG: 3,2

**Objective 2: To implement the approved forest management programs.**

*To what extent has the CFUG successfully implemented the approved forest management programs, and how has this affected the change in forest cover?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, please share why the CFUG faces challenges in achieving this objective.*

Weight: 1,00

Average score for Machhedanda CFUG: 3,4

Average score for Baluwa Bhanjyang CFUG: 3,7

Average weighted scores:

Machhedanda CFUG: 3,4

Baluwa Bhanjyang CFUG: 3,7

**Objective 3: To keep the accounts of the CFUG up to date.**

*To what extent has the CFUG successfully kept their accounts up to date, and how has this affected the change in forest cover?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, please share why the CFUG faces challenges in achieving this objective.*

Weight: 0,75

Average score for Machhedanda CFUG: 3,7

Average score for Baluwa Bhanjyang CFUG: 3,1

Average weighted scores:

Machhedanda CFUG: 2,8

Baluwa Bhanjyang CFUG: 2,3

**Objective 4: To monitor the effectiveness of the forest management done by the CFUG.**

*To what extent has the CFUG successfully monitored the effectiveness of forest management, and how has this affected the change in forest cover?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, please share why the CFUG faces challenges in achieving this objective.*

Weight: 1,25

Average score for Machhedanda CFUG: 3,5

Average score for Baluwa Bhanjyang CFUG: 3,3

Average weighted scores:

Machhedanda CFUG: 4,3

Baluwa Bhanjyang CFUG: 4,1

**Objective 5: To make the user group self-sufficient.**

*To what extent has the CFUG successfully achieved self-sufficiency, and how has this affected the change in forest cover?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, please share why the CFUG faces challenges in achieving this objective.*

Weight: 1,00

Average score for Machhedanda CFUG: 4,4

Average score for Baluwa Bhanjyang CFUG: 4,0

Average weighted scores:

Machhedanda CFUG: 4,4

Baluwa Bhanjyang CFUG: 4,0

**Actions from the guideline: To what extent are these actions followed and how does this affect the forest cover?**

**Action 1: Identification of requirements, problems, and solutions**

*To what extent do you identify requirements, problems, and solutions of the CFUG?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,00

Average score for Machhedanda CFUG: 4,0

Average score for Baluwa Bhanjyang CFUG: 3,6

Average weighted scores:

Machhedanda CFUG: 4,0

Baluwa Bhanjyang CFUG: 3,6

**Action 2: Conducting a forest inventory**

*To what extent do you conduct a forest inventory for the CFUG to assess the current state of forest resources and identify potential areas for improvement?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,50

Average score for Machhedanda CFUG: 3,7

Average score for Baluwa Bhanjyang CFUG: 3,7

Average weighted scores:

Machhedanda CFUG: 5,5

Baluwa Bhanjyang CFUG: 5,6

**Action 3: Developing a forest management plan**

*To what extent do you develop a forest management plan for the CFUG, that includes guidelines for sustainable forest use practices, for example selective logging, agroforestry, and fuelwood management?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,00

Average score for Machhedanda CFUG: 3,9

Average score for Baluwa Bhanjyang CFUG: 3,8

Average weighted scores:

Machhedanda CFUG: 3,9

Baluwa Bhanjyang CFUG: 3,8

**Action 4: Mobilizing resources and support**

*To what extent do you mobilize resources and support from relevant stakeholders, such as government agencies, NGOs, and private sector partners?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,00

Average score for Machhedanda CFUG: 2,7

Average score for Baluwa Bhanjyang CFUG: 2,8

Average weighted scores:

Machhedanda CFUG: 1,3

Baluwa Bhanjyang CFUG: 1,4

**Action 5: Providing training and capacity building**

*To what extent do you provide/follow training to implement skills in the programs of the OP?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,50

Average score for Machhedanda CFUG: 2,7

Average score for Baluwa Bhanjyang CFUG: 2,4

Average weighted scores:

Machhedanda CFUG: 4,0

Baluwa Bhanjyang CFUG: 3,6

**Action 6: Establishing a transparent and accountable system**

*To what extent do you establish a transparent and accountable system for the CFUG?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,00

Average score for Machhedanda CFUG: 3,8

Average score for Baluwa Bhanjyang CFUG: 3,1

Average weighted scores:

Machhedanda CFUG: 3,8

Baluwa Bhanjyang CFUG: 3,1

#### **Action 7: Keeping accurate records**

*To what extent do you keep accurate records of all income and expenses related to the community forestry project, including donations, grants, and other sources of funding?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If your answer is to a moderate extent or lower, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 0,50

Average score for Machhedanda CFUG: 3,8

Average score for Baluwa Bhanjyang CFUG: 2,9

Average weighted scores:

Machhedanda CFUG: 1,9

Baluwa Bhanjyang CFUG: 1,5

#### **Action 8: Developing and implementing income-generating activities**

*To what extent do you develop and implement income-generating activities that are sustainable regarding forest management? Examples: ecotourism, non-timber forest product (NTFP) harvesting and small-scale agroforestry.*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If you gave a lower score, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 0,75

Average score for Machhedanda CFUG: 2,8

Average score for Baluwa Bhanjyang CFUG: 2,2

Average weighted scores:

Machhedanda CFUG: 2,1

Baluwa Bhanjyang CFUG: 1,7

#### **Action 9: Conducting regular monitoring and evaluation**

*To what extent do you conduct regular monitoring and evaluation activities to assess progress towards the targets and identify areas for improvement?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If you gave a lower score, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,50

Average score for Machhedanda CFUG: 3,1

Average score for Baluwa Bhanjyang CFUG: 3,4

Average weighted scores:

Machhedanda CFUG: 4,6

Baluwa Bhanjyang CFUG: 5,1

**Action 10: Using the results of the monitoring and evaluation activities**

*To what extent do you use the results of the monitoring and evaluation activities to adjust the forest management plan and improve the effectiveness of the project?*

1 (Not at all)

2 (To a small extent)

3 (To a moderate extent)

4 (To a large extent)

5 (To a very large extent)

*If you gave a lower score, can you please share why? Do you think this can affect the forest cover and how?*

Weight: 1,50

Average score for Machhedanda CFUG: 3,5

Average score for Baluwa Bhanjyang CFUG: 4,0

Average weighted scores:

Machhedanda CFUG: 5,3

Baluwa Bhanjyang CFUG: 6,0

II

### Statistical data of 3.1.3 Comparison

Table A1, Both CFUGs showed a score lower than 0,05 on the Shapiro-Wilk test of normality. This means that the samples of both CFUGs are not normally distributed.

#### Test of Normality

Community forest		Shapiro-Wilk		
		Statistic	df	Sig.
Results	Machhedanda CFUG	,880	19	<b>,022</b>
	Baluwa Bhanjyang CFUG	,878	19	<b>,020</b>

Table A2, The Mann-Whitney U test showed a significant difference in the annual forest coverage (%) between the two CFUGs.

#### Hypothesis Test Summary

Result	Null Hypothesis	Test	Sig. <sup>a,b</sup>	Decision
	The distribution of the annual forest cover (%) is the same across the two CFUGs	Independent-Samples Mann-Whitney U Test	<b>&lt;,001<sup>c</sup></b>	Reject the null hypothesis.

- a. The significance level is ,050.
- b. Asymptotic significance is displayed.
- c. Exact significance is displayed for this test.

### Statistical data of 3.2.2 Activities

Table A3, The Mann-Whitney U Test indicates no significant difference between the two OPs.

#### Hypothesis Test Summary

Result	Null Hypothesis	Test	Sig. <sup>a,b</sup>	Decision
	The distribution of scores is the same across the activities of the two OPs.	Independent-Samples Mann-Whitney U Test	<b>,112</b>	Retain the null hypothesis.

- a. The significance level is ,050.
- b. Asymptotic significance is displayed.

### Statistical data of 3.3.1 Likert scale data analysis

Table A4, The Intraclass Correlation tells that there is a very high agreement between the two community forests as the Intraclass Correlation is very close to 1.

<b>Intraclass Correlation Coefficient</b>			
	Intraclass Correlation	95% Confidence Interval	
		Lower Bound	Upper Bound
Single Measures	,944	,841	,981
Average Measures	<b>,971</b>	,914	,990

Table A5, The number of samples, total mean score of all 15 questions and standard deviation (and error mean) for each community forest.

### Group Statistics

	Community Forest	N	Mean	Std. Deviation	Std. Error Mean
Score	Machhedanda CFUG	15	3,684375000	1,1995315364	,3097177109
	Baluwa Bhanjyang CFUG	15	3,505729167	1,4102450280	,3641237005

Table A6, Both community forests do not show a significant difference as the p-values (Sig.) are higher than 0,05, meaning that the data is normally distributed and usable for a T-test.

### Test of Normality

	Community Forest	Shapiro-Wilk		
		Statistic	df	Sig.
Score	Machhedanda CFUG	,940	15	<b>,384</b>
	Baluwa Bhanjyang CFUG	,951	15	<b>,538</b>

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Table A7, The Levene's test shows no significant difference between the variances. The two-tailed p-value of 0.711 indicates that there is no significant difference in people's opinions about the general development regarding forest cover between Machhedanda CFUG and Baluwa Bhanjyang CFUG.

**Independent Samples Test**

		Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Score	Equal variances assumed	,197	<b>,660</b>	,374	28	<b>,711</b>

Table A8, The Independent Samples Test shows a significant difference between the scores of the committee members and of the villagers of the CFUG. This is the case for both CFUGs.

**Independent Samples Test**

		Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
Machhedanda CFUG scores	Equal variances assumed	,424	<b>,520</b>	2,213	30	<b>,035</b>
Baluwa Bhanjyang CFUG scores	Equal variances assumed	,449	<b>,508</b>	3,286	30	<b>,003</b>

III

**Short-term and long-term objectives found in OPs.**

**Machhedanda CFUG:**

The short-term objectives are:

- To control poachers.
- To become self-sufficient in the continuous utilization of crops.
- To develop the social and economic development of the group by sustainable management of the forest.
- To develop herbal cooperatives by managing non-timber forest production.
- Sustainable management of water resources.
- To develop tourism.
- To supply the daily required forest produce.
- To engage members with low income in income-generating activities by encouraging them. Plantation of fast-yielding grass and firewood species.

The long-term objectives are:

- To provide employment opportunities.
- Continuous and sustainable use of forest products.
- Bringing improvement in the status of the forest.
- To increase public participation in forest development work.
- To develop the bushy forest as a forest that provides firewood and fuelwood.
- To protect water springs, present in the forest.
- To improve the social and economic status of the members of the CFUG.
- To improve social development by proper utilization of produced forest produce resources.
- To maintain environmental balance by protecting forests.
- Wildlife and biological diversity.
- Scientific Forest management through public participation.
- To develop the group, to conduct community programs (herb cultivation, sustainable collection of herbs, etc.), public awareness, support, and conservation programs.
- Development of the enterprise based on forest products (to do activities such as Tapari manufacturing from Sal tree leaves, bio-brickets, handicraft, wood processing, pole production).
- Fish farming activities will be conducted in artificial conservation ponds.
- To conduct economic regeneration activities based on forest.

**Baluwa Bhanjyang CFUG:**

The short-term objectives are:

- Conservation, promotion, and management of forests.
- To make good use of the forest without any negative impact on the forest.
- To meet consumers' needs regarding daily forest products such as fuelwood, fodder, wood and other need efficiently and effectively.
- To Encourage people's participation in conservation, utilization, and development of forests. Remove unnecessary species and promote useful species such as sal, chilaune.

## COMPARATIVE ANALYSIS OF COMMUNITY FORESTS AND THEIR INFLUENCE ON FOREST COVER

- To advance the institutional development of the consumer group.
- Increasing women's participation in community forest development.
- To plant trees in places where natural regeneration is not possible.
- To plant trees in empty places by promoting natural regeneration.
- To identify different types of non-timber forest products in the forest and commercial cultivation.
- To consider the negative effects of climate change by planning and implementing adaptation programs to avoid the effects.

The long-term objectives are:

- Making the forest green and beautiful.
- To protect the biological diversity of important plants and animals by giving importance to the growth and development of multi-purpose species.
- Uplifting the livelihood of women and underprivileged consumers through proper management and utilization and distribution of non-timber forest produce and other income programs.
- Increase in carbon sequestration to raise living standards.
- To diversify the group's sources of income by developing forest-based enterprises and tourism
- To control landslides and erosion.