Photo: Fritz Berger

Dolaghat, Kavrepalanchowk, 1985

Dolaghat, Kavrepalanchowk, 2010

# DOES TENURE MATTER?

# ASSESSMENT OF CHANGE IN FOREST COVER IN NEPAL

## Environment and climate series 2011/2

HELVETAS Swiss Intercooperation | NEPAL

RIGHTS + RESOURCES

HELVETAS Swiss Intercooperation Nepal produced this booklet through a collaboration with Rights and Resources Initiative. This aims to highlight key issues, achievements, and opportunities in the field of forest cover change.

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Shiva Prasad Aryal
Country Director
HELVETAS Swiss Intercooperation Nepal

Bharat K Pokharel
Deputy Country Director
HELVETAS Swiss Intercooperation Nepal

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Through publications, it contributes to the generation of knowledge and the process of learning through sharing on development and co-operation. For more details or comments, please contact:

HELVETAS Swiss Intercooperation Nepal
Dhobighat-3, P. O. Box 688
Lalitpur, Nepal
Phone: +977 1 5524925 E-mail: po@helvetas.org.np
Fax: + 977 1 5531109 Web-site: www.helvetasnepal.org.np

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# Summary

This study is based on the mapping and analysis of the forest condition in different forest tenure regimes and is expected to benefit everyone who is interested in forest tenure regimes and their effect to environment. This study applied GIS and Remote Sensing as the major tools for the analysis. The study revealed that forests have improved in all tenure regimes. Community forestry did the best by increasing the new forest area by almost 33% and improving existing forest quality by 20%. In comparison, the government managed forest regime increased the new forest area by 17% and improved the quality of forest by 15%.

However, individual farmers were found to be improving the condition of existing forest by 25% or more on their private land, although they lagged behind in creating new forest areas. The study shows that only 11% of newly created forest area is on private land. All changes that occurred in 20 years are the result of tenure reform that the Government of Nepal made 30 years ago so that local communities held the key.

The findings of the study may surprise those who still believe in the so-called 'Theory of Himalayan Degradation'. This may also surprise the forest planners and academics that still rely on national survey data, which shows that country's forest resources are generally deteriorating, and the deterioration trend is even higher in the hills and mountains (FRA 1999). In the eight VDCs covered by the study, some elements of deforestation and degradation are noticed, but the quantum of improved and the new forests far outweighs both deforestation and degradation.

# 1 Introduction

## 1.1 Background

Never before in history had the issue of forest tenure came into prominence than what is the case now. This is attributed mainly to climate change crisis and mechanism through which the polluter countries intend to collaborate with developing countries to fight against climate change induced possible disaster. Indeed, complex tenure arrangements are more the rule than the exception (Unruh 2008). The debate of climate change and other issues have brought the forestry tenure issue to the limelight. Beyond climate change and disaster, there is much debate on the role of tenure in sustainable forest management, with implications on forest conservation and the livelihoods of forest-dependent communities, since most of them are poor living in developing countries.

Our focus here is rather limited. It intends to provide a brief analysis of the relationship between forest tenure and forest cover change and eventually governance, equity and livelihoods. The objective is to discover whether there is evidence that particular forest tenure regimes have significant relationships with forest cover change; in other words, whether they are successful at halting deforestation and degradation.

Detailed study on the change in forest cover on different tenure regimes will surely help to recognize the effective and efficient tenure system in terms of forest conservation and sustainable management, and livelihoods of forest dependent people.

Nepal is one of the few countries to formulate progressive forest policy and legal frameworks to recognize different types of forest tenure system based on the ownership (such as state and privately owned forests) and management regimes (State, Community, and privately managed forests). Under this framework, community forestry has been practiced for more than two decades. Local communities are now managing about one fourth of the country's forest. Studies are also being carried out on the impact of community forestry on forest condition (environmental sustainability) and peoples' livelihood (poverty reduction). What is less researched is a comparative study of the impact of various

management regimes to the change in forest condition and peoples' livelihoods. It is in this context that this study is an attempt to begin to fill this gap.

This study was conducted to complement a comprehensive study on the impact of community forestry to livelihoods and a particular case study at Dolakha district in Nepal that analysed forest cover change 1990 and 2010 (Niraula and Maharjan 2011). It is based on a remote-sensing and GIS-based methodology that digitally mapped forest cover and tenure regime boundaries. This case study found that compared to government forests and private forests, community forests have relatively higher rates of afforestation and lower rates of deforestation. The authors attribute this to forest user groups' collective action for forest management, practices of good governance, and monitoring and enforcement of local rules that the groups themselves prepare. These findings corroborate an earlier photo monitoring analysis that compared photographs of landscapes over time to assess forest cover change (Pokharel and Mahat 2009) in part of Sindhupalchowk and Dolakha road corridor of Central Nepal.

## 1.2 Definition of the concept of Forest Tenure[1]

Since the study aims to assess the nexus between tenure and change in forest cover, it is necessary to clarify the concept and definition of tenure that are used in this report.

Forest tenure refers to the social relations and institutions governing forestland and resources. Tenure determines who is allowed to use which resources, in what way, for how long and under what conditions, as well as who is entitled to transfer rights to others and how (Larson et al., 2010).Tenure can be considered as a bundle of rights, a bundle which includes access, use, management, exclusion and alienation (Schlager and Ostrom 1992). Rather than being held exclusively by one stakeholder, different parts of the bundle of rights can be held by different actors, as when a state grants access, use and management rights to community groups on what remains state-owned forestland.

Furthermore, the bundle of rights may also include a combination of rights that are defined by statutory law (*de jure*) and *de facto* rights that are defined locally, through practice. For the sake of analysis, the following categories of Sunderlin et al. (2008) are used here in this study to denote various types of tenure categories, in which various bundles of rights are enjoyed by the owner of the land be it the state, community, or private.

- Public lands administered by government (which can also include some protected areas and forest lands awarded as concessions for extractive industries)
- Public lands designated for use by communities and indigenous people: land set aside on a semi-permanent but conditional basis and where governments generally retain strong authority
- Private lands owned by communities or indigenous peoples: forest lands where (in theory) rights cannot be unilaterally terminated by a government without some form of due process and compensation

[1] Sections 1.2 and 1.3 has been largely drawn from a global review of international peer-reviewed academic literature on the relationship between tenure and forest cover change (see Helvetas Swisss Intercooperation, 2011)

(so a more extensive bundle for communities than above)
- Private lands owned by individuals or firms: where a government cannot unilaterally terminate the rights without due process or compensation.

## 1.3 Global literature and hypothesis of the study

Globally, 80% of forests are still owned and administered by states. However, as Sunderlin et al. conclude, the transition from state owned and administered forest to other tenure regimes continues, albeit at a slow pace. As well, it is not known which regimes consistently perform better in terms of forest management, eventual forest condition, and positive forest cover change.

For example, Elinor Ostrom (2010) argues that forests under different tenure regimes – government, private, communal – sometimes meet enhanced social goals as biodiversity protection, carbon storage, or improved livelihoods and fail to provide such goals at other times.

Eric Coleman (2009) specifies, "Conditions in community-managed forests are not statistically different from government or privately managed forests." However, he suggests that local communities might play an important role in achieving positive forest conditions given that full management responsibilities are conferred upon them. This finding is corroborated by other literature reviews and global comparative studies.

Casse and Milhoj (2011) conducted a literature review of 56 case studies from developing countries and concluded that there is no systematic correlation (negative or positive) between presence of community forestry initiatives and forest conditions, regardless of whether in terms of lowering deforestation rates, increasing biomass, or improving forest conditions (perception based valuation).

Likewise, in their review of literature on the relationship between tenure and forest cover change, Robinson et al. (2011) found both positive and negative outcomes for forest cover across all the most common types of tenure. There is no clear evidence to suggest that a specific tenure type will ensure forest conservation because negative forest cover outcomes are found in all tenure types.

Nevertheless, Larson et al. and others have found a relationship between tenure and forest cover change. They found that under reformed tenure, forest cover has increased, natural regeneration has been protected, landslides have been reduced, and some endangered flora and fauna have been safeguarded. One important, and obvious, reason is that most of these forests were highly degraded at the time of hand over to communities.

Other authors highlighted the particular success of the Nepal's case. For example, Casse and Milhoj note that Nepal is an exception that comes closest to being a successful case of coupling forest conservation with community management of forest because of forest tenure reforms (even with limited rights for communities).

We therefore hypothesize that positive forest cover change depends on a secure tenure regime governed by a bundle of rights including local rule-making, local

rule-enforcement, and significant and successful application of the principles of good governance.

Like Broegaard (2005), we demonstrate that tenure security and more specifically the forest users' or private owner's perceptions of tenure security are crucial to forest users' decision-making. Tenure security refers to the assurance that norms governing tenure and the allocation of the bundle of rights will be enforced (Robinson et al. 2011). The implications of this are clear from the fact that much of the world's richest forest is in areas with less tenure security, where it is not clear who has the authority to make decisions about the future of the forests, both in terms of livelihoods and of conservation. What is clear is that, as Casse and Milhoj (2011) observe, countries with the largest and densest areas of forest are not necessarily those that recognize community rights.

For this study, we used Sunderlin et al.'s categories of tenure classification to analyse data of forest cover change in all these categories. We used the definition of forest cover change according to the study of Niraula and Maharjan (2011), which this study means to complement. Niraula and Maharjan measured forest cover change in terms of new forest area, improved area, deforested area, degraded area, and unchanged area of change with Landsat images and aerial photographs. They cross-referenced this with qualitative assessments by forest users, a method used by many of the case studies reviewed. Other indicators of forest cover change used by some studies reviewed included forest density and biodiversity, which were in the improved forest category.

We hypothesize that unclear or insecure tenure and poor governance are important drivers of deforestation and degradation, and thus crucial aspects to address in forestry and agriculture. The tenure security of people managing natural resources, including forests, is essential to promote equitable distribution of benefits and responsibilities and fulfil the long-term objectives of sustainable management of forests. In addition, for both adaptation and mitigation schemes of climate change to be sustainable, it is crucial that the people managing resources are able to plan activities with a mid to long-term perspective. This is only possible if tenure is clear and secure. Insecure tenure discourages long-term planning in favour of maximum short-term profit (Arial 2011).

Tenure security, as defined by Robinson et al. (2011) is the expectation that the norms governing the bundle of rights that constitutes official tenure will actually be continued, honoured, and enforced. The writings of Broegaard (2005) on this issue have been influential. He argues that the factor that is relevant for decision-making is perceptions (in this case, of farmers) about the security of tenure. He writes that "perceived tenure security is defined as a composite

**Considering this literature, we hypothesize that full tenure security and its clarity (on all bundles of rights) and good governance[2] are the main drivers of positive change in forest cover.**

[2] Principles of good governance here refer to Rule of law, transparency, accountability, participation, responsibility, and ethics, inclusion and equity, effectiveness and efficiency, consensus and decision making, decentralized and devolution, empowerment, sustainable management of resources (Pokharel et. al., 2009)

concept combining the farmers' own assessment of their tenure situation when asked directly, and their fears (or absence of fear) for future conflicts regarding their property rights.

Analysing data from forests in twelve different countries, Gibson et al. (2005) sought to identify the factors associated with successful resource management (i.e. leading to better forest conditions) at the local level that are necessary and those that are just important. They found that that rule enforcement must be present for successful outcomes on the landscape. According to these authors, rule enforcement by a local user group is significantly correlated to forest condition, whether or not user groups are formally organized, dependent on the forest for a series of resources, or possess social capital. Further, Gibson et al. point out that this holds true in government-owned, community-owned, or co-managed forests.

A later study by Chhatre and Agarwal (2008) looks into how local enforcement is related to changes in the condition of forest commons and concurs with these findings. Their statistical analysis of data on forest commons from nine (152 cases) countries confirms that better local enforcement is associated with higher probability of forest regeneration.

Additional variables, such as forest size, group size, collective action, and level of forest use and dependence may be important to understand the effect of enforcement in different conditions. For example, Chhatre and Agarwal show that, controlling for other factors; larger forests are associated with low probability of regeneration and high probability of degradation.

Coleman concludes that the main lesson to be drawn from his study is not necessarily that local efforts to engage in monitoring and sanctioning are more effective than external efforts, but simply that local efforts could have important bearings on effectiveness.

The study by Persha et al. (on the basis of data from 84 forests in six countries) indicates that forest systems are more likely to have sustainable outcomes (above average tree species richness and subsistence livelihoods) when local forest users participate in forest rule-making. They found that the relationship is also significant in the opposite direction: unsustainable forest system outcomes are more likely when users do not participate in rule-making.

In view of the global literature mentioned above, our value added to the debate would be to demonstrate that tenure security and good governance practice do not only apply to collective action at the community level but also with private or state managed forest resources. So, we conceptualize that the scale of tenure rights (i.e. full, partial, or insecure rights) and type of governance system determine the outcomes of forest cover change (i.e. improvement in forest condition, creation of new forest area, deforestation or degradation, or unchanged forest condition).

## 1.4 Overview of Nepal's forest tenure system and community forestry

As stated by Singh and Chapagain 2006, two laws and the policies related to them have the greatest influence on forest resource tenure: the Forest Act of 1993 and

the Lands Act of 1964. The first relates to the forestry tenure system, which provides two categories of forest tenure system -- state and privately owned forests. Under state-owned national forests there are various management regimes such as community-based forests, which includes leasehold, religious, and community forests; and state-managed forests, which include government-managed national forest, protected forest areas, etc.

The following are the categories of forest defined by Nepal's Forest Act 1993:

- **State owned National forest:** All forests other than private forest, regardless of the demarcation of their boundaries and including cultivated or uncultivated land, roads, ponds, lakes, rivers, streams and the shingly land that is surrounded by or in the vicinity of a forest.
- **Government-managed forest:** National forests managed by the government.
- **Protected forests:** National forests that the government has declared protected in consideration of their environmental, scientific, and cultural importance.
- **Community forests:** National forests that have been entrusted to user groups (as defined in clause 25 of the Act) for development, conservation, and utilization in the interest of the community.
- **Leasehold forests:** National forests that have been leased (according to clause 32 of the Act) for specified purpose(s) to a legally defined institution, forest-based industry, or community.
- **Religious forests:** National forests that have been entrusted to any religious entity, group, or community as specified in clause 35 of the Act.
- **Private forests:** The planted or protected forests on land that belongs to an individual as per the prevailing law.

It is evident that ownership of all, except private forests, rests with the State. The differences among categories of national forest regard only access and management right to the forest.

Similarly, the Lands Act of 1964 provides for ownership of land by individuals and other legally defined entities. It is designed primarily for cultivable land and fixes ceilings on the amount of land owned in the various regions – the hills including the mountains, Kathmandu Valley (where the capital city is located), and Terai. However, it does not restrict landowners in the ways they use the land, which can include forestry purposes if the landowner chooses. Considering that farming systems in most parts of the country integrate crops and livestock, implying a need for fodder and bedding materials for livestock, the Lands Act also provides for land area in addition to cultivated land. The owner can use this "homestead land" for planting fodder and other trees and grasses.

As highlighted by Anderson 2011, in the 1950s and 1960s a concern for the protection of natural resources led many Asian countries to nationalize all land, forests, and water resources that were not private property. With the Private Forest Nationalization Act of 1957, the government of Nepal nationalized

forests of a size above a certain ceiling, which until then were owned and controlled by individuals, who retained rights to specific resources, such as fuelwood, timber, fruits, fibres, other NTFP, fodder, and leaf litter from forest floor for composting with manure. The rights were not uniform for every village, but were widely respected. Following nationalization, heavy deforestation occurred due to the disruption of community management systems, cadastral survey mapping for private land demarcation, and ill administration of land survey and forestry departments. State-managed forests virtually became a form of open access areas.

In the last 20 years, the scenario of Nepal's hills became somewhat different. According to Paudel et al. 2002, there has been a significant improvement in all LIFE indicators (Livelihood, Income, Forest condition, and Equity), particularly in forest conditions, that can be attributed to tenure reforms since the 1970s in Nepal. Until then massive deforestation and environmental degradation were witnessed, largely linked with nationalization of forests and exclusion of forest dependent rural populations. This insecure tenure arrangement led to the alienation of ordinary citizens from their own resource base, which resulted in resource degradation along with other political, economic, and social factors. The reform that began in the late 1970s and particularly during the early 1990s nevertheless is clearly seen to have had positive impacts on all LIFE indicators.

The pronouncement of the Forest Sector Master Plan in 1989 put community forestry as the priority sector and brought legal reforms. The Forest Act of 1993 and the Forest Regulation of 1995 provide the tenure of specific forests to the communities concerned through entity called Community Forest User Groups (CFUGs). Those make clear provisions regarding rights and responsibilities related to community forests, which envisage the CFUGs as sovereign entities to govern, control, manage and use the forests as specified by Operational Plans they prepare under the support and supervision of outside agencies including the Forest Rangers. CFUGs are legally registered at the District Forest Office (DFO) with the group constitution and the operational plan as integral part of handover certificate given by the DFO. The plan describes how to protect, manage and utilize the forest, fix the price of, sell or dispose of its products, and punish violators. The Operational Plan is valid for five to ten years and renewable after termination. This provides the basis for communities to organize, govern, and work through collective action.

The CFUG can collect forest products and distribute them among its members according to the rules stipulated in the Operational Plan. A community forest should be managed and its products utilized in such a way that there is no negative impact on the environment. CFUGs can use and sell their forest products to outsiders if there is a surplus after the requirements of group members have been met. They are authorized to fix the prices of forest products for sale to outsiders, but these prices cannot be lower than that revenue fixed by the government. The forestland cannot be sold or used as collateral for loans.

CFUGs are responsible for protecting the community forests from encroachment, such as the construction of residential buildings; activities that might cause erosion and landslides, such as quarrying or collecting stones or soil; and catch or kill wildlife (Government of Nepal, 1993; 1995). These local institutions are now spread over Nepal, with over 16,000 groups managing almost one third of country's forest resources. They represent what we term here in this study as a community-managed forest tenure regime that falls under the category of designated for use by communities and indigenous people' as per Sunderlin. The other two categories, the state and private forest regimes are quite straight forward to understand so the institutional arrangement of these regime are not described here.

With this the following section now presents an overview of the methodology used for the selection of study site, research methodology as well as approaches applied and analysis conducted.

# 2 Study Methodology

The study team purposefully selected Nepal for this study mainly for two reasons. Firstly, Nepal is one of the pioneer countries to practice community forestry since the 1980s. Therefore, it is time to see the impact of it in compare to other regimes such as government and privately managed forest regimes. Secondly, the comprehensive livelihood study is going on in Nepal, which aims to assess the impact of community forestry to various livelihood capitals of local forest users and enabling environment to it. However, it was learnt that the later does not pay much attention to assess the natural capital formation aspect (i.e. forest cover change – additionality). This aspect is important because the time that forest was handed over to local communities the condition of most forest was degraded. This study therefore was felt necessary to fill the gap in the on-going livelihood study mentioned above.

In this context, the study methodology has three aspects as follows.

- Global literature review on the relationship between forest tenure and change in forest condition[3] – this is to learn from other countries which have practiced community forestry
- National literature review focusing mainly on the overview of Nepal's forest tenure system and community forestry policy and practice – this is to understand the enabling environment
- Field study and GIS analysis of a landscape covering 5,796 ha forest area under three management regimes – this is to do with ground truthing both in terms of forest condition and governance condition

The first part of this methodology is already described in previous section. The remaining two parts are briefly highlighted below.

## 2.1 Field study site

We selected a part of the Indrawati sub-watershed of Sindhupalchowk District as a study site because its location included all forest management regimes (government, community, and private forests) and part of a national park as protected area. This site also met the criteria of having management regimes at least 20 years old and all types of forest management regimes. It has comparable areas of different types of forest regimes, which are adequate for analysis. As well, there

[3] See HELVETAS Swiss Intercooperation 2011 - Environment and climate series 2011/4

is no direct support from outside donors at the current time and has the same type of external support to all regimes.

This sub-watershed has easy access for logistical purposes, as it lies northeast of Kathmandu District in a sub-basin of the Koshi Watershed. It borders China in the north and is surrounded by Rasuwa and Nuwakot districts to the west, Kathmandu and Kavre districts to the south, and Dolakha district to the east. The study site covers eight Village Development Committees (VDCs) -- Bansbari, Bhotechaur, Haibung, Mahankal, Melamchi, Sindhukot, Talamarang, and Thakani of Bansbari Range Post of Sindhupalchowk district (Fig. 1). About 2,493 ha of forest in these eight VDCs is administered as government-managed forests including 577 ha of Shivapuri National Park; 1,766 ha of forest is managed by 51 CFUGs as community forests (1,539 ha and 3,777 households) and leasehold forests (227 ha); and 1537 ha of forest area managed by individuals as private forests (see details in table 5). The presence of these forests under different forest tenure regimes was a key basis for the selection of the study site.

This area had faced heavy deforestation before the 1970s when the forests were depleted to such extent that no forest products mainly wood were available in the area. Local communities had to travel long hours to gather timber, firewood, and fodder for their daily subsistence needs.

The Australian Forestry Project started piloting community forestry in the 1980s by promoting extensive plantations on bare slopes and involving local communities. The full implementation of community forestry started in the early 1990s. This

**FIGURE 1 ▌Map showing location of eight VDCs of study area**

is the reason why we chose the 20-year period as the important timeframe for any change in forest cover. The timeline of the study of forest cover change is therefore between 1990 and 2010.

## 2.2 Research Methods

The analysis was based on geographic information compiled from satellite images, survey data (data purchased from the Department of Survey (DoS), Nepal) and field data. The methods involved are mostly computer based with some ground truthing exercise carried out with the active participation of local Community Forest User Group (CFUG) members, Forest Department's field staff, and local resource persons. They were involved both at the time of preparation of digital forest boundary maps and recording of data. The various research methods are described briefly below.

**Satellite Images:** Landsat TM images of 1990 and 2010 were acquired from the United States Geological Survey (USGS)

**TABLE 1 ▌Land cover classification scheme**

| Land cover classes | Description |
|---|---|
| Dense forest | Areas covered with trees with > 40% crown cover |
| Sparse forest | Areas covered with sparsely distributed trees with 10 - 40% crown cover |
| Agriculture | Cultivated areas, settlements roads and tracks |
| Grassland | Open areas with short vegetation, may even have few scattered trees |
| Barren land | Areas with no vegetation cover, quarry, uncultivated agricultural lands |
| Sand | Sand and gravel deposits along the riverbanks |
| Water bodies | Perennial rivers, ponds, lakes; rivers without water or very little water may appear in barren land category and small streams with trees along the bank may appear in sparse forest |

Environmental Resource Observation and Science Centre (EROS) archive to serve as main source of data for the study. Cloud free images taken during the same season were acquired for the study in order to minimize the effect of climatic conditions.

**Aerial Photographs:** Aerial photographs available at DoS, Nepal from the beginning of the 1990s were also acquired for identification of land cover of the base year of 1990.

**Forest Mapping:** Teams aided by GPS and local assistants were mobilized in each VDC to identify and digitize forest boundaries of different management regimes of the study sites. Geographic information acquired from the GPS-based forest boundary survey was processed in the Map Source application and Google Earth, which with high resolution GeoEye satellite data served as a good platform for visually verifying the geographic information acquired from the GPS-based forest boundary survey and for creating forest boundary layers. These layers were then exported to the ArcGIS 9.3 application where they were developed into forest boundary maps.

**Remote Sensing:** Image subsets were independently classified using supervised maximum likelihood classification, which was used because of the familiarity of the area to the researchers. Image subsets were then classified emphasizing six main categories of land cover. These include Forest, Grassland, Agriculture, Barren land, Sand, and Water bodies. Forest areas were further classified into Dense Forest (with >40% crown cover) and Sparse Forest (with 10 – 40% crown cover) (see Table1). For this, several training samples were compiled for each land cover category.

**Verification and Post Classification:** The "salt and peppery" classified land cover maps resulting from pixel-by-pixel supervised maximum likelihood classification were generalized using 3x3 majority smoothing filter. Thus generalized salt and peppery classified land cover maps were then verified using the remaining 50% of training samples. The verification results showed that the classification results were satisfactory (overall accuracy 90.77% and 87.45% for 1990 and 2010 respectively – *See Annex 5 and 6*). The District Forest Office (DFO) of Sindhupalchowk and key informants from the studied VDCs were consulted further to verify the classification

results. Discrepancies found through such consultations were corrected in the final maps before incorporating them in GIS application for further analysis.

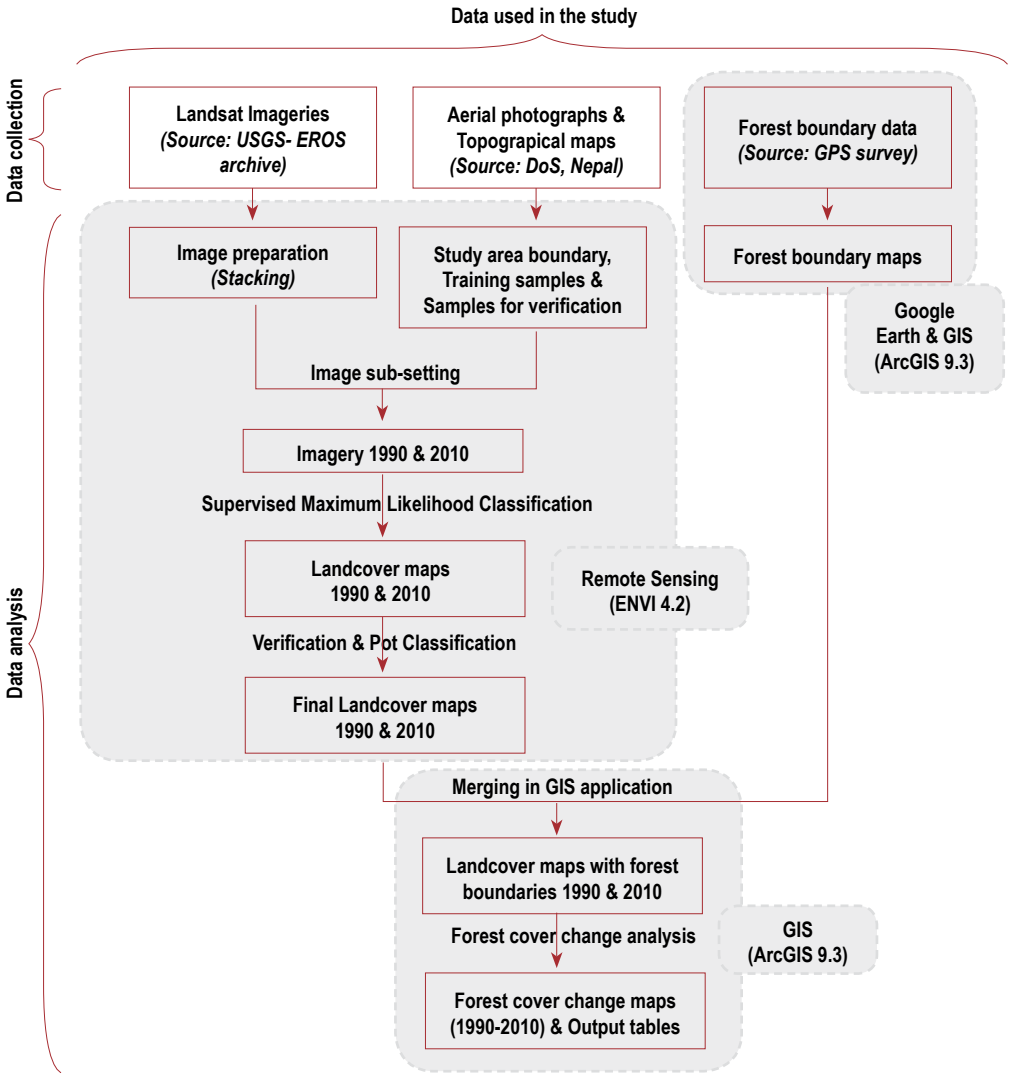
**GIS Analysis:** Classified images and forest boundary maps were analysed in ArcGIS 9.3 by using Spatial Analyst. GIS analysis based on forest cover change matrix classified and generated database on forest cover change in the area.

**Forest Cover Change study:** Forest cover change study is based on the classification matrix for forest cover change (Niraula and Maharjan 2011), which uses three fundamental classes as non – forest, sparse forest, and dense forest to analyse the observed process on change.

### Forest Cover change classification scheme

| Forest cover change class | Definition |
|---|---|
| Improved forest | Sparse forest in 1990 changed to Dense forest in 2010 |
| New forest area | Non- Forest in 1990 changed to sparse or dense forest |
| Unchanged forest | Sparse or dense forest in 1990 with no change |
| Degraded forest | Dense forest in 1990 changed to sparse forest in 2010 |
| Deforested area | Sparse or dense forest in 2010 changed to Non-forest |
| Unchanged Non-forest | Non- forest in 1990 with no change |

**FIGURE 2 I Flowchart showing methodology of GIS data analysis**



# 3 Results and Analysis

## 3.1 Forest cover change

The following maps show the situation of the forest areas in the years 1990 and 2010. These maps are the result of GIS and remote sensing analysis of LANDSAT imageries.

**FIGURE 3 ▌Land cover in 1990**

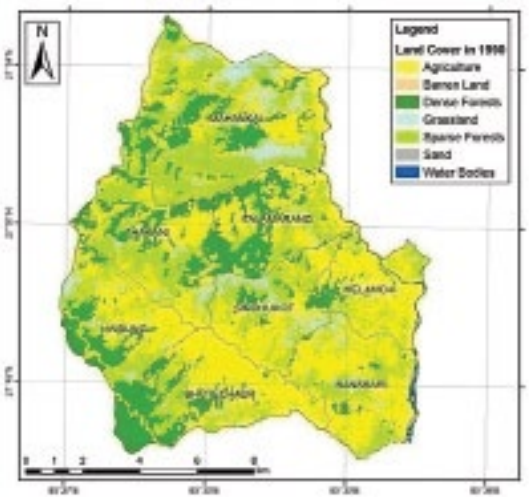
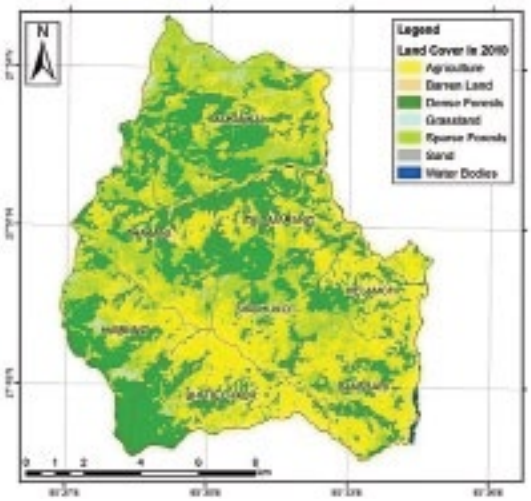



**FIGURE 4 ▌Land cover in 2010**



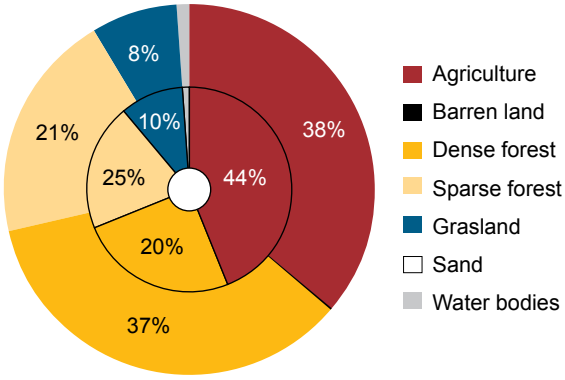

The land cover classes of the study area obtained are as follows:

**TABLE 2 ▌Status of Land cover in 1990 and 2010**

| Land cover | 1990 | 2010 |
|---|---|---|
| Agriculture | 5,580.82 | 4,812.86 |
| Barren land | 10.40 | 34.58 |
| Dense forest | 2,569.23 | 4,718.86 |
| Sparse forest | 3,191.11 | 2,749.04 |
| Grassland | 1,314.58 | 395.94 |
| Sand | 33.94 | 6.50 |
| Water bodies | 90.19 | 72.50 |
| TOTAL | 14,780.27 | 14,800.27 |

Areas in hectare

**FIGURE 5 ▌Comparison of Land cover change**
***(Inner circle represents 1990 and outer 2010)***



Analysis of LANDSAT imageries shows that forest cover in all eight VDCs has increased in terms of both area and quality of forests in overall forest regimes (Table in Annex 4). The implications are decreases in agriculture area and grassland. However, it should not be misunderstood that the promotion of forest decreases agricultural land. Rather, the limitations of the remote sensing applied in the study leads to the recognition of trees on private farmland as forest cover. This requires extensive ground verification before deriving any conclusion.

## 3.2 Forest Tenure Categories

As the scope of the study is to assess the change in forest cover in various management regimes as classified by Sunderlin et al. 2008, the assessment of non-forest land use areas, such as agriculture, sand, and water bodies is not included here. The existing status of forest tenure in the study area is illustrated in Table 3 and Figure 6 below. The table and graphs show that 43% of forests are government-managed, nearly 30% community-managed, and 26% privately managed.

All categories of forests have defined boundaries and tenure clarity. However, not all the forest categories under "Private Forest Owned by individuals and firms" are necessarily privately owned in legal terms, neither are they designated to individuals by the state for use. For the purpose of simplicity and harmonized categories mentioned above, we have considered all forests used and managed by private individuals as privately owned forest. During the field study, we found some contested areas of private forests that are not registered legally but being managed by individuals. These types of forests are highly unsecured in terms

**FIGURE 6 ▌Status of Forest tenure in Study VDCs of Sindhupalchowk District (2011)**

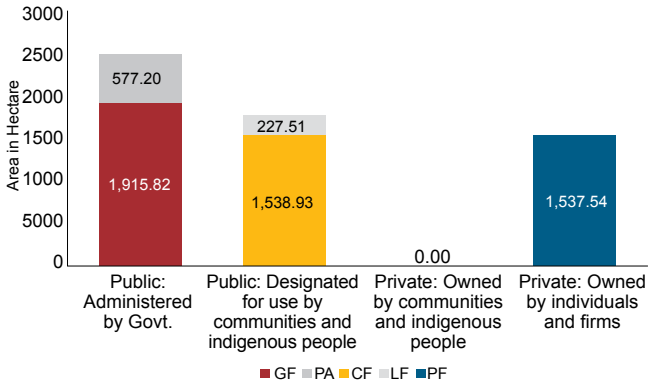



**TABLE 3 ▌Existing forest area under different forest tenure regimes**

| Type of Forest | Area in Hectare | Percent |
|---|---|---|
| **Public: Administered by Govt.** | | |
| Government Managed Forest (GF) | 1,915.82 | 33.05 |
| Protected Forest National Park (NP) | 577.20 | 9.96 |
| **Public: designated for use by communities and indigenous people** | | |
| Community Forest (CF) | 1,538.93 | 26.55 |
| Leasehold Forest (LF) | 227.51 | 3.92 |
| **Private: Owned by individuals and firms** | | |
| Private Forest (PF) | 1,537.54 | 26.52 |
| **Total forest Area** | 5,796.99 | |

**FIGURE 7 ▌Map showing classified forest tenure regimes in the study area**

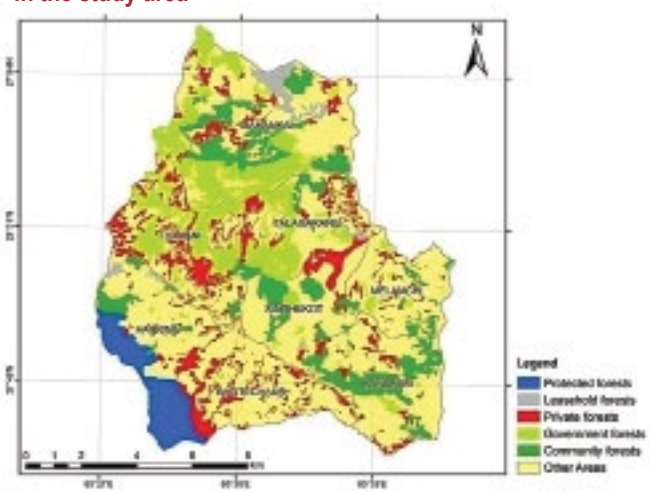
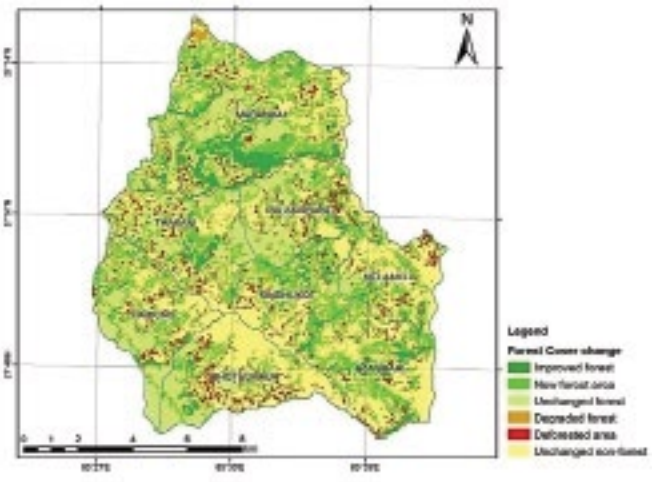



**FIGURE 8 ▌Illustration of forest cover change in the study area**




of tenure rights and therefore very vulnerable to deforestation.

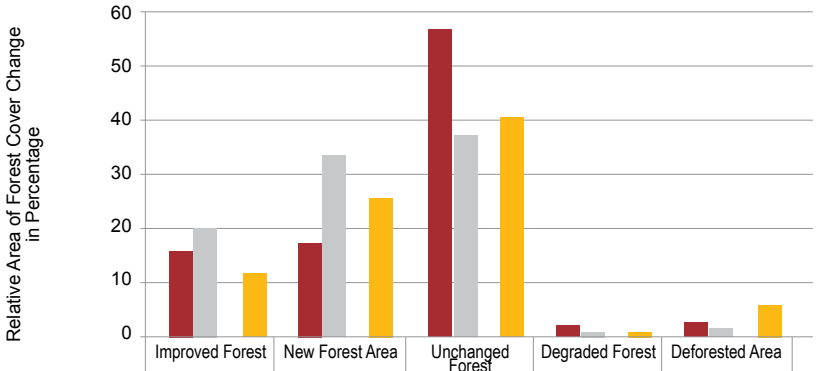
## 3.3 Analysis of forest cover change in different tenure regimes

As described earlier, this study will analyse each forest tenure regime according to attributes of changes mentioned below in the map that occurred between 1990 and 2010.

The map clearly shows that areas of deforestation (in red) exist in all types of regimes but to a lesser degree in community forests and more in private forests. Unchanged forest is high in the government-controlled regime.

A general overview of the forest cover change in the area may be an overall increase in forest area and forest quality, but the situation may vary within a particular forest management regime. An analysis of this result follows in the next sections.

**FIGURE 9 ▌Chart and table showing forest cover change in various forest tenures**




| | Improved Forest | New Forest Area | Unchanged Forest | Degraded Forest | Deforested Area |
|---|---|---|---|---|---|
| Public: Administered by Govt. | 15.81 | 17.22 | 56.76 | 2.25 | 2.65 |
| Public: Designated for use by communities and indigenous people | 20.06 | 33.43 | 37.23 | 1.04 | 1.61 |
| Private: Owned by communities and indigenous people | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Private: Owned by individuals and firms | 11.83 | 25.77 | 40.52 | 0.99 | 5.99 |

### 3.3.1 Tenure security

It is obvious that there is a net increment in the composite status of the forest resource in the study area particularly when all eight VDCs within the study area are considered as a single unit and when no distinctions are made between the different tenurial regimes under which the respective resources are governed. The changes at differential locations and tenurial regimes are in general positive at the best or deforested at the worst. In some areas, degradation or deforestation may be noticed but its scale is too small to alter the overall composite positive change scenario.

In the eight VDCs covered by the study, though some elements of deforestation and degradation are noticed, the quantum of improved and new forests far outweighs both deforestation and degradation. Although a large area has remained unchanged, at least these areas remained immune from further deforestation and degradation. This is however is not to suggest that uniformity is a norm all over the study area and the tenure types. The areas might have a spectrum ranging from an encouraging level of forest recuperation to virtual stagnation to forest depletion by either deforestation or degradation. Broadly speaking the following observations hold true: (See Figure 9 for details.)

- Community forest regimes have done extremely well in terms of both in creating new forest and improving forest quality. For example, about 33% of community forest has been created as new forest areas and 20% of forest areas have shown improvement in forest quality.
- There are substantial areas of no change. It is found that almost 56% of government forest is unchanged whereas only 40% of private forests and 37% of community forests do not show any change in terms of the area and the quality.
- In all regimes, there are some areas that have both 'deforestation' and 'degradation'. Private forest has more deforestation than other regimes. For example, about 5.9% private forests have been completely deforested and only 0.9% is degraded.

Fully explaining these variable situations might require more extensive fieldwork than what was possible during this undertaking. It can however be speculated that the outcomes may be a result of a feeling of full tenure security and the governance practice as discussed below.

Let us consider community forests, government forests, and the private forests in turn. We might note that community forestry has surpassed the other two forms of tenurial regimes both in forest regeneration (i.e. forest improvement and new forest creation) and in checking forest depletion (deforestation in particular). It also has surpassed the other regimes in reducing the extent of 'unchanged forests' apparently by way of bringing those under active management. This is partly shown by the increase in the extent of Improved Forest and New Forest under this tenure category.

The main element responsible for triggering these positive dynamics might be a paradigm shift on policy regarding tenurial regimes. While the

government had shown its preparedness to decentralize the forest management at the level of village council back in 1980s, it eventually ventured to handover such control to local users as right holders by way of promulgation of the new forest policy (1989), New Forest Act (1993), and the Forest Rule (1995). Community forestry has been considered as a process to empower the local communities to promote good governance ensuring robust forest management and equity among the users.

A decision to disaggregate figures on Leasehold forests from the rest of the community forests (can be called Prototype Community Forests) might also provide important insights. It would be evident that leasehold forests stand considerably higher in all aspects ranging from forest regeneration to checking forest degradation. Leasehold forests are surpassed by Prototype Community Forests only in their relative degree of success in checking deforestation (this is at least after considering the proportional area under leasehold forests compared to community forests which is about one fifth of its size).

We have also noted that not only have community forests had regeneration but also government forests, though by slightly smaller extent. This might have gone against the common logic that the villagers would not be interested to put effort into regenerating a resource whose ownership lies elsewhere. However, both the government policy and the practice were just good enough to trigger initiatives among communities to start taking *de facto* control over the resources, thus checking the rampant destruction. The forest policy 1989 is generous enough to state that 'all the accessible forests in the hills will be handed over as community forests to the extent the people are willing and capable of managing them.' This policy may have caused people to initiate some form of initiatives leading to improvement and creation of new forests. Baral (1992) notes that people have resorted to indigenous systems of forest management in areas where they have realized that the forest authorities were unable to employ an effective system of forest control.

It is important to note that positive improvements are not an invariable norm. Both deforestation and degradation are relatively high in government forests. The status of most forest areas is 'unchanged', which is the predominant statues in all tenure types. It is quite likely that people in community forests have taken initiatives to regenerate their forests with a basic premise that those forests will eventually benefit them. However, unlike the community forests, government forests have ownership without good governance practices and lack collective sanctioning mechanisms leading to differential outcomes between the community and government tenurial systems.

However, forest in Shivapuri National Park provides clues of particular significance. Disaggregation of Shivapuri data from rest of the government-administered forest clearly indicates that it has remained rather poor in all aspects of forest management ranging from resource regeneration to checking degradation and converting unchanged forest conditions into a productive system. Possibly the strict government regulations and surveillance did not provide incentives for local communities to take meaningful positive measures to regenerate the resource base the way the communities might have done elsewhere.

It is easy to explain why private forests have done so badly in checking deforestation. The deforestation in private forest at 5.99% surpasses all the tenure types including government forests. This may be because of tenure uncertainty and insecurity in those areas where individuals have not registered land as private. The land might be under government ownership but used by individuals as *'chutdarta'*[4]. In addition, it may also have something to do with combined effects of a number of factors including market forces in the wake of a relaxation of tenure rights through royal interests (2045), by which people would get a grant of government land as private property and practice unsustainable harvesting for short-term profit. Private owners might also have decided to clear the forests to plant crops and convert forest to agricultural land for food security.

However, there may be doubts that the overall area under the private forest regime is so high in comparison to other regimes. The depicted private area (1,538 ha) is almost equal to that delineated as community forest (1,539 ha) and somewhat comparable with the more extensive area still under government control (1,915 ha). It is possible that large-scale contestation prevails in the allocations, which will require more fieldwork to verify. With better scrutiny of the data, large areas categorized as private forests might actually be government forests in terms of ownership. This would help to rationalize the intensive deforestation due to tenurial insecurity among the local population.

The discussion above might partly explain why the resources under different tenure types were largely immune to further depletion or had regeneration. The evident attributable reason was full tenure security of the local communities. The forest under regimes with more secured tenure regenerated more than the ones whose tenurial security was less clear.

The variation is in private forests where deforestation remained highest due to several factors including land contestability and unclear tenure of major areas. However, this cannot be explained adequately and there may be other causes. In community forests, at least partial tenure security is guaranteed, the duration of tenure is clear, and there is an agreed plan. Communities have practiced relatively good governance to make optimum use of tenure rights. Government forests have secured tenure but lack good governance practice to make optimum use of resources under secured tenure *(see the next section).* It is apparent that the other attributable reason lies on the process aimed at ensuring the tenure and the good governance in all regimes, which will be covered below.

### 3.3.2 Governance Practice

It could have been revealing to look at how the governance under each of tenure regimes would lead into specific type of forest performance. However, a paucity of data would not allow us to look comprehensively into

[4] Private land that is not registered and with boundaries that were not demarcated during the cadastral survey time for different reasons such as being absent at the time of the survey, unaware of the importance of registration, or avoidance of land tax. The lack of registration might also be due to negligence on the part of the state survey team.

such specific details. So, let us simply ponder on how community forestry has generally remained outstanding compared to the other tenurial regimes on various attributes ranging from forest improvement to new forest creation to minimizing the extent of the unchanged forests. Clues behind its success in minimizing the area deforested or degraded are a matter of great interest. It appears that the principal causal factor is the community governance practice of collective decisions, unlike in the government forests - that are controlled by the government, and private forests controlled by individual households.

A number of factors might have hindered more positive changes in the government forests. The district forest offices, the legal custodian of the government forests, are neither staffed adequately to govern the forests nor motivated enough to do so.

Governance in private forests has issues that probably limit their better rejuvenation. Those include restrictive regulatory measures against sales, which might have de-motivated the owners from growing more trees and acted against interests to invest more in the business. The governance within the intra-household level also might have discouraged individual members from being motivated to create more forest-based wealth in comparison to agricultural products that can be produced quickly.

Most rural Nepali households are characterized by a virtual monopoly by male members in making decisions regarding the disposal of the tree products and the way the proceeds from the sale may be used. Such a monopoly might have worked as disincentive to the women. The state lacks any mechanism to address such a socio-cultural anomaly. The Community Forestry Division of the Department of Forest used to have a component on private forestry, although its role was limited to production and distribution of free seedlings for private plantations. Even this minuscule role of the Division has now been abandoned, leaving the private forestry sector in virtual disarray. No wonder, the state of governance within the sector is far from being addressed which, in turn, may have been reflected in forest quality under this particular tenure type.

Besides communities' collective action and self-sanctioning mechanisms, forests under community tenure seem to have other advantages in comparison with the forests under government or private tenure. The Community Forestry Division exists to promote community forestry. It has received overwhelming support, including that of donors since the 1990s. A more concerted effort by both the government agency and donor-supported projects may have created a specific type of purposeful social engineering for each community group and single patch of community forests. Collective action by local communities to practice local democratic governance may have had a more positive effect on forest cover change.

The government's Community Forestry Operational Guidelines show a way to the intervening agencies (forest rangers and other facilitating entities) regarding how to hand over a particular patch of forest as community forest. The guidelines have been revised progressively for

the fourth time, which is increasingly concerned with better community level governance leading to better social equity. The guidelines depict the intervention as a community empowerment process rather than a technical blueprint. They emphasize inculcating a sense of tenurial security within the community concerned and ensuring local autonomy, equity, and consensus on decision-making over the use of the forests, use of funds, and sanction arrangements. The guidelines also promote inclusiveness in terms of identifying users, making a constitution, and writing an Operational Plan to govern the use of forests. They include overall concerns over women, poor, and disadvantaged members of the community, in order to promote poverty alleviation by way of intensive forest management and enterprise development.

With all these factors and enabling policy environment, the community forest regime functions relatively well leading to positive outcomes in forest cover change and eventually to contributions to people's livelihoods. (See box below)

The arrangements in community forestry differ from both government and private forests, which lack any social empowerment process geared towards better local governance. A decade ago, the Australian-supported community forestry project constantly emphasized creating robust community institutions for good governance and better social equity. Clearly, this opportunity was at the disposal of community forestry tenurial regime, but not the others. Hence, the community forestry regime has better governance than the other two regimes. This seems to have a major policy implication in that both Government forests and private forests need to follow the example of community forestry by promoting good governance practices if forests are to be managed better.

**BOX 1 ▌Example of good governance practice at local community level**

*Community Forest User Groups in the study site are found to*

- *hold regular assemblies and meetings to make collective decisions; encourage the participation of women, poor, and marginalized communities;*
- *prepare forest operational plans in consultation and revise them from time to time to reflect on the reality of the situation;*
- *exercise well-being ranking to identify the most marginalized and poor, and supports are beginning to be extended to them to ensure equity;*
- *make group financial records transparent in general assembly and public auditing a regular phenomenon, and resolve conflicts internally;*
- *thin, prune, and protect forests collectively and control forest fire; and stop grazing, illegal felling, and over harvesting.*

*As a result, the forest condition is improved and new forest is regenerated. Forest users generally have complied the local rules; punishment and rewards system are introduced. Users are made aware of the issues related to gender, equity, and social justice.*

*Despite this, there are many unfinished tasks that CFUGs have yet to complete. These include fully practicing equitable distribution of benefit; optimizing the benefits from sustainable management and utilization of forests through enterprise activities; and creating more green jobs and contributing to improving the livelihoods of user-members.*

## 3.4 Governance performance and tenure security from community perspective

### 3.4.1 Performance criteria

The international literature suggests that forest performance is related directly to full tenurial security and good governance systems at the local level. This is to say that higher the tenurial security in terms of all rights in a bundle, defined by Schlager and Ostrum 1992 and Meinzen-Dick 2006 (See Annex 1), and accompanied by good governance systems – the better will be the forest condition. The following assessment shows the scale of tenure security from fully to poorly secured and the scale of governance performance from poor to good, based on the rights exercised and enjoyed by local communities in government forests[5], community forests, and private forests.[6]

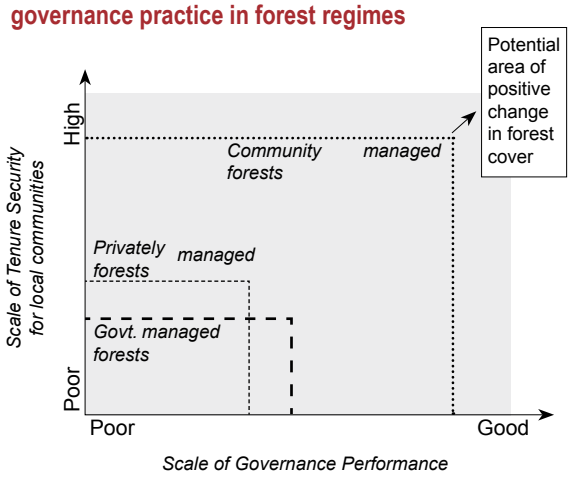
**TABLE 4 ▌Assessment of scale of tenure security and governance performance in three regimes**

| Type of forest tenure regime | Type of rights enjoyed by local communities | Ranking |
|---|---|---|
| Government-managed forests | In Shivapuri protected area: no access rights inside the area without permission; limited use rights for the collection of wasted fuel woods, fodders, timber and herbs; no management rights in terms of making rules; no voice for the identification of user to the protected area; and no right to take land on lease etc.<br>In govt. forests other than Shivapuri protected area: access rights to enter into the forests for recreation, some rights to collect dry wood, fodder and litter are allowed. However, no rights to make local rules to identify the user members and to take closely located forestland on lease.<br>Similarly based on the governance criteria (Pokharel and Niraula 2004; Pokharel et al. 2009; see Annex 2): bundles of rights offered to local communities are somehow limited as roles and responsibilities are not clear, decisions are not so transparent, public hearing are lacking, benefit sharing for revenues are not equitable, decisions are top down, limited efforts for community empowerment etc. | Partial tenure security to communities and partial good governance practice |
| Private Forests | Access rights to local communities to enter private forest, even for non-subtractive benefit, is restricted without permission. Private owners enjoy harvesting rights but with some governance restrictive regulations, no use rights to harvest timber and non-timber products and herbs. However, environmental benefits go to local communities; management rights in terms of defining the family members is with the private owner, no local communities other than family are allowed to transfer any rights to local communities; rights to sell and lease private forests and land is with land owner. Local communities have limited voice in making decision on the sale and type of land use.<br>Nevertheless, some private individuals who are also the members of local communities group benefit from private forests by minimizing the risk of over harvesting of community forests.<br>Private forests have short-term vision and are accountable only to the family, which sometimes goes for unsustainable harvesting for short-term commercial benefits. They are not transparent in decision making, participatory, democratic, equitable, or responsive to local communities. | Partial rights to local communities and weak governance |
| Community forests | Local communities have access rights to enter and use community forests for both subtractive and non-subtractive benefits; use rights for all kinds of timber, non- timber forest products; rights to make local rules on management, plantation, and harvesting. Local communities define boundary and user members in the constitution.<br>However, local communities do not have ownership or entitlement rights to transfer or lease the forestland. Local community groups translate good governance principles into practice. (See Box 1) Groups are often operated under rule of law, transparency is maintained through public meetings and public auditing, committees are accountable to the members, decisions are largely participatory, benefit sharing mechanisms are becoming equitable, and resources are conserved and managed in a relatively sustainable way. | Tenure partially secured (but above average) and good governance performance |

[5] Many currently government-managed forests in the hills, which are close to settlements, could become community forests in the near future.

[6] Although private forests are owned and managed by individuals, some environmental benefits from upstream forests such as soil and watershed conservation and aesthetic values are enjoyed by local communities; therefore some management rights and responsibilities tend to be shared by respective communities.

**FIGURE 10 ▌Illustration of tenure security and governance practice in forest regimes**




These situations can be represented graphically as follows.

### 3.4.2 Specific Qualifications

Specific forest patches under each tenure type may have specific qualifications. For example, not all government forests are equally poor in terms of allowing communities to exercise some rights. Some forest patches are locally controlled and managed through what has been called indigenous systems of forest management, despite the fact that those are under *de jure* control of the government. The forest policy (1986) in effect tends to encourage such systems by explicitly stating, "all forests in the hills may be handed over as community forests to the extent people are willing and capable of managing them". Local communities may have started some form of local control and use with a hope that the forests may be handed over to them as community forests in the near future.

Similarly, private forests may not necessarily have all secured rights in the bundle despite the fact that the *de jure* ownership explicitly lies with private households. Frequent infringements of private *de jure* rights by both the central and local governments level tend to curtail the actual private rights thus discourage the concerned households from taking adequate initiatives to manage and use the concerned resources.

Although community forests have better governance and a more secured bundle of rights, except ownership rights, there are always marked exceptions. There are some examples to suggest that government can, take back the forest resource if it feels that the specific community has grossly violated the stipulations in the agreed operational plans. Cases of exclusion, marginalization, and misuse of the forest resource and funds are not uncommon in CFUGs especially in areas with commercially harvested forests. These are indications of problematic community level governance.

### 3.4.3 Future potential

The current status of community forestry is most promising in terms of its contribution to positive forest cover, followed by private forests, and then government forests. The supremacy of community forestry over the other tenurial systems is attributable to relatively secured access, use, management and exclusion rights of local community groups, and a governance system for which the state pursues a purposeful intervention.

Looking at the future potential for forest cover change, existing government forests may have the most potential because if they are handed over with all bundles of rights to local communities that followed good local governance

practices, those forests might yield a maximum output compared to their current state. This is not to say that community forests and private forests have little to offer.

Community forests might definitely produce better forest regeneration with secured community tenure and better governance at least compared to the present situation by providing a secured bundle of rights of all kinds and good governance. Likewise, private forests may yield better results particularly if the government respects the rights of households to control and manage their resources independently.

It may thus be concluded that forests of all tenure types may be improved by giving more secured rights to local communities for forests that are close to the settlement and if communities are willing to manage tenure and better governance albeit with a variable extent. The future policy interventions must acknowledge this reality to ensure full tenurial security and the community governance system.

# 4 Concluding Remarks

The study presents the following points as its concluding statements. The findings are also presented in the diagram in Annex 3.

- Community forest regimes have done very well in terms of both creating new forest and in improving the quality of existing forest. For example, about 33% of community forest regimes have been created as new forest areas and 20% of these forest areas have shown improvement in forest quality.
- There are substantial areas of no change. The majority of government managed forest fall in this category. There has been no change in 56% of government forest in 20 years, whereas only 40% of private forests and 37% of Community forests are unchanged in terms of their quality.
- In all regimes, there are areas that are exposed to both 'deforestation' and 'degradation'. Private forest has more deforested area than other regimes. For example, about 5.9% private forests have been completely deforested but only 0.9% private forestland is degraded.

To conclude, community forestry has a higher tendency towards positive change in forest condition and is able to halt deforestation and degradation to extent better than any other regimes. This supports the painstaking endeavour local communities have been investing for decades in the management of their local forest.

So, if it is a debate on "Does tenure matter?" we observed that community based tenures score the best of all, while all regimes are heading towards that end.

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# Annex

## ANNEX 1 ▌Bundle of Rights

| Types of rights | Descriptions of rights |
|---|---|
| Access rights | The rights to enter a defined physical area and enjoy non-subtractive benefits, e.g. to camp or rest inside the area. |
| Use rights | The rights to obtain resource units or products of the resource system, e.g. extracting timber and non-timber forest products from the forest. |
| Management rights | The rights to regulate internal use patterns and transform the resources by making improvements, e.g. harvesting rules, planting seedling and thinning trees. |
| Exclusion rights | The rights to determine who will have access and withdrawal rights, and how that right is transferred. |
| Alienation rights | The rights to transfer, sell or lease, and all of the above-mentioned rights |

**Source:** Adapted from Schlager and Ostrom 1992, and Meinzen-Dick 2006

## ANNEX 2 ▌Characteristics, features, attributes, principles, and criteria of good forest governance

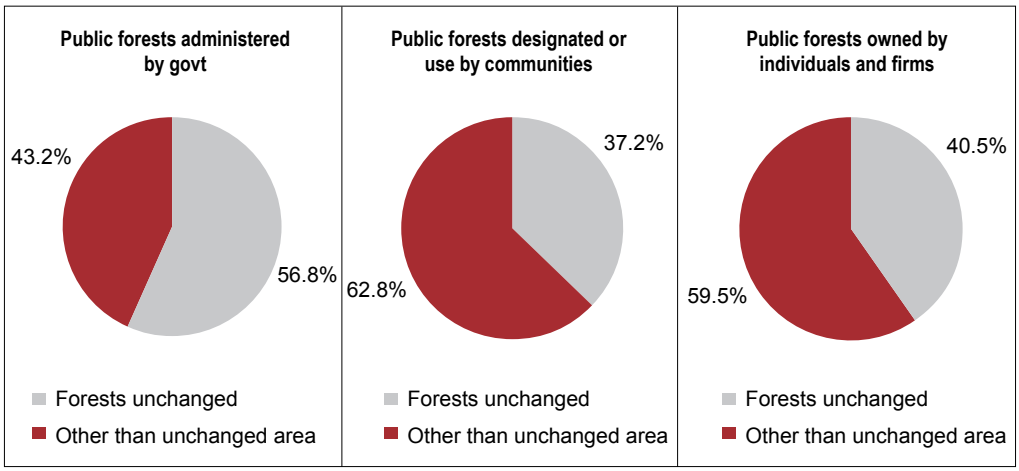
| Characteristics, features, attributes, principle of governace | Criteria |
|---|---|
| 1. Rule of law | • Coherent and enabling policy<br>• Strategic vision<br>• Clear role and responsibility<br>• Fair legal framework enforced impartially<br>• Legal arrangements guarantying rights of individuals and enterprises, and protect them from abuses of power on the basis of equality<br>• Competent and capable judiciary to implement the rules of law as perceived by the public |
| 2. Transparency | • Free access of information<br>• Transparent and equitable relationships<br>• Transparent decision making and benefit sharing mechanism |
| 3. Accountability | • Accountable to all affected person and institution<br>• Clear distribution of roles, responsibilities and duties among authorities, officials and other stakeholders including civil society and private sector<br>• Accountable to all affected person and institution, both internally and externally |
| 4. Participatory | • Participation of men, women and all stakeholders in planning, decision making and benefit sharing<br>• Participatory planning and decision-making<br>• Mediation of different interests<br>• Bottom-up planning and coordination<br>• Mediation of different interest<br>• Effective implementation<br>• Effective and sustainable management of resources<br>• Collection of revenues and taxation<br>• Equitable distribution of resources and materials primarily to the marginalized groups, and among actors |

| Characteristics/ feature/ attributes/ principles of governace | Criteria |
|---|---|
| 5. Responsive | • To the needs of people and service to all in time<br>• Adjustment in changing situation<br>• Easy access to information flow and open communication<br>• Bi-directional flow of information both horizontally and vertically at all levels among all actors through various means and media<br>• Self, participatory and transparent monitoring<br>• Culture of timely correction and improvement |
| 6. Inclusive and equitable | • Fair opportunity to all; gender balance<br>• Equitable relationships between stakeholders<br>• Inclusive following clear and fair criteria<br>• Inclusion on the basis of gender, class, caste, ethnicity and geographical coverage in participation, representation and benefit sharing |
| 7. Effective & efficient | • Effective delivery of services to needy people on time in a simple way<br>• Optimum use of resources<br>• Credibility, competence, capacity and integrity to respond primarily to the needs of poor and marginalized groups<br>• Efficient forest management<br>• Efficient resource management |
| 8. Consensus oriented | • Decisions are made not on the basis of majority and minority basis rather it is made on consensus<br>• Representatives and leadership positions are chosen by consensus |
| 9. Decentralisation and devolution | • Devolution of power to local level with the defined roles of the state, communities and private sector |
| 10. Empowerment | • Policy of positive discrimination to poor, women, disadvantaged caste and race |
| 11. Sustainable management of forest resources | • Long term strategy for the sustainable management of natural resources |

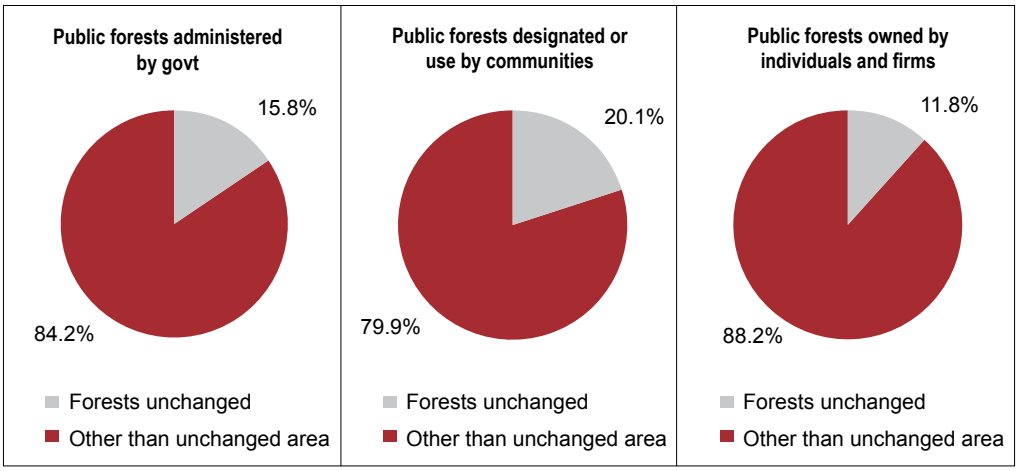
**Source:** Adapted from Pokharel and Niraula, 2004

## ANNEX 3 I Comparison of the contribution of various tenure regimes to change in forest cover

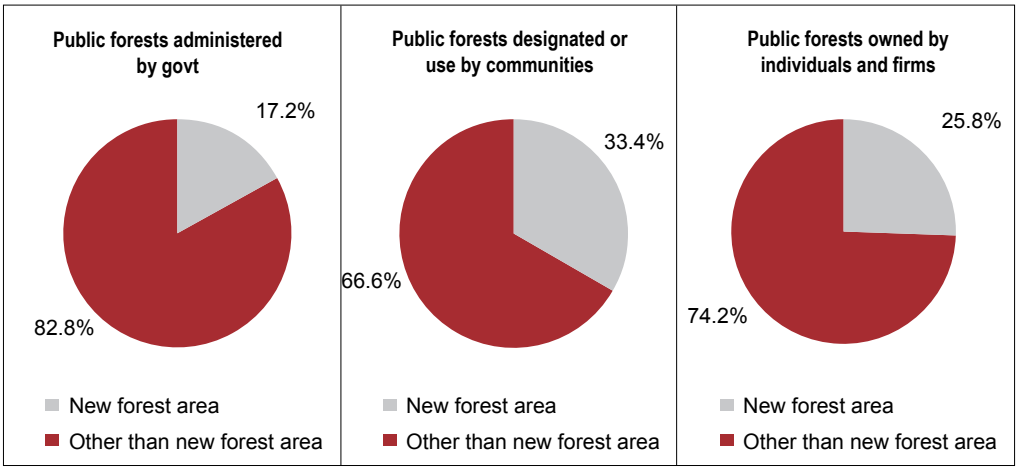
### a. Forests unchanged



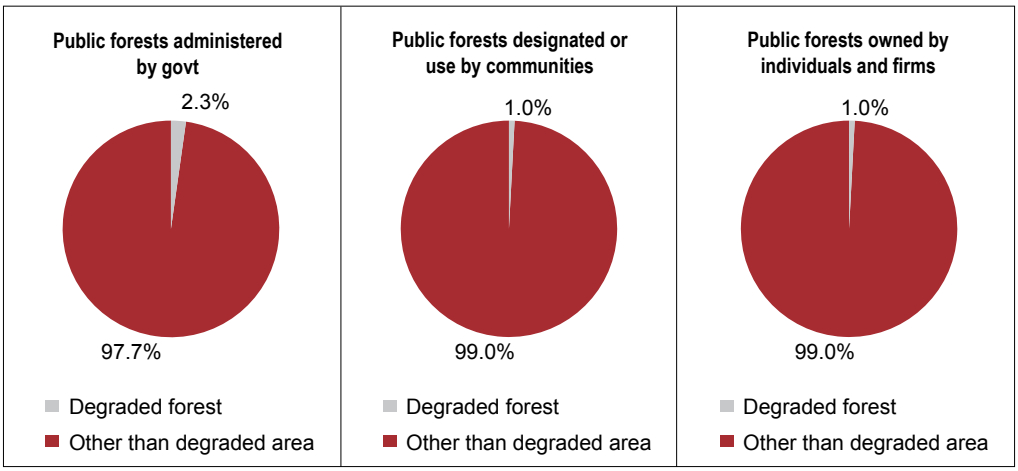
## b. Forests improved



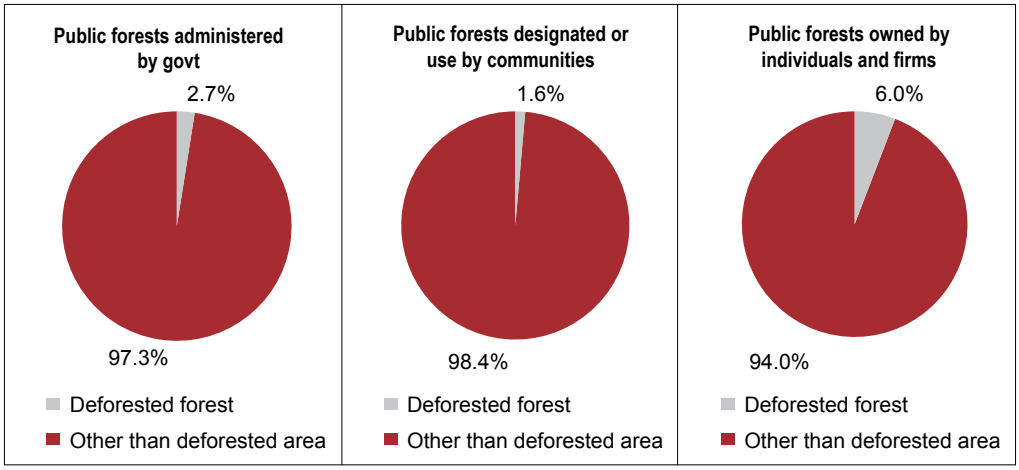

## c. Creation of new forest




## d. Forests degraded



### e. Area deforested




## ANNEX 4 | Rate of forest cover change in all forest tenure regimes

*Land cover class 1990*

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| TOTAL | | | | | |
| Sparse forest | 3,191.11 | 1,073.91 | | | |
| Non-forest | 9,019.923 | | 2,629.5 | | |
| Dense forest | 2,569.23 | | | 108.19 | |
| Forest | 5,760.35 | | | | 923.08 |
| Change (%) | | 33.65 | 29.15 | 4.21 | 16.02 |
| Rate of change (% per year) | | 1.68 | 1.46 | 0.21 | 0.80 |

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| Community Forest | | | | | |
| Sparse forest | 595.26 | 346.91 | | | |
| Non-forest | 546.99 | | 495.83 | | |
| Dense forest | 396.72 | | | 17.25 | |
| Forest | 991.98 | | | | 14.75 |
| Change (%) | | 58.28 | 90.65 | 4.35 | 1.49 |
| Rate of change (% per year) | | 2.91 | 4.53 | 0.22 | 0.07 |

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| Government Forest | | | | | |
| Sparse forest | 689.93 | 361.54 | | | |
| Non-forest | 501.73 | | 373.57 | | |
| Dense forest | 724.47 | | | 47.11 | |
| Forest | 1,414.40 | | | | 63.25 |
| Change (%) | | 52.40 | 74.46 | 6.50 | 4.47 |
| Rate of change (% per year) | | 2.62 | 3.72 | 0.33 | 0.22 |

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| Private Forest | | | | | |
| Sparse forest | 468.84 | 181.87 | | | |
| Non-forest | 625.49 | | 396.19 | | |
| Dense forest | 443.36 | | | 15.25 | |
| Forest | 912.20 | | | | 92.06 |
| Change (%) | | 38.79 | 63.34 | 3.44 | 10.09 |
| Rate of change (% per year) | | 1.94 | 3.17 | 0.17 | 0.50 |

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| Shivapuri National Park | | | | | |
| Sparse forest | 45.41 | 32.53 | | | |
| Non-forest | 62.56 | | 55.84 | | |
| Dense forest | 469.20 | | | 9.04 | |
| Forest | 514.61 | | | | 2.82 |
| Change (%) | | 71.63 | 89.27 | 1.93 | 0.55 |
| Rate of change (% per year) | | 3.58 | 4.46 | 0.10 | 0.03 |

| Land cover | Area (ha) | Improved forest | New forest area | Degraded forest | Deforested area |
|---|---|---|---|---|---|
| Leasehold Forest | | | | | |
| Sparse forest | 61.35 | 7.49 | | | |
| Non-forest | 162.15 | | 94.63 | | |
| Dense forest | 4.07 | | | 1.20 | |
| Forest | 65.42 | | | | 13.77 |
| Change (%) | | 12.21 | 58.36 | 29.43 | 21.04 |
| Rate of change (% per year) | | 0.61 | 2.92 | 1.47 | 1.05 |

## ANNEX 5 ▌Confusion matrix of Landcover classification 1990

| | Ground truth pixels | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Landcover | Water bodies | Sand | Barren land | Agriculture | Grass land | Sparse forest | Dense forest | Total | User Accuracy (%) |
| Water bodies | 40 | 0 | 0 | 0 | 0 | 0 | 0 | 40 | 100 |
| Sand | 0 | 47 | 0 | 0 | 0 | 0 | 0 | 47 | 100 |
| Barren land | 0 | 0 | 13 | 0 | 0 | 0 | 0 | 13 | 100 |
| Agriculture | 2 | 7 | 1 | 197 | 15 | 1 | 0 | 223 | 88.34 |
| Grass land | 0 | 0 | 0 | 6 | 75 | 0 | 0 | 81 | 92.59 |
| Sparse forest | 0 | 0 | 0 | 17 | 4 | 95 | 0 | 116 | 81.9 |
| Dense forest | 0 | 0 | 0 | 0 | 0 | 6 | 113 | 119 | 94.96 |
| Total | 42 | 54 | 14 | 220 | 94 | 102 | 113 | 639 | |
| Producer Accuracy (%) | 95.24 | 87 | 92.86 | 89.55 | 79.79 | 93.14 | 100 | | |
| Overall Accuracy (%) | 90.77 | | | | | | | | |

## ANNEX 6 ▌Confusion matrix of Landcover classification 2010

| | Ground truth pixels | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Landcover | Water bodies | Sand | Barren land | Agriculture | Grass land | Sparse forest | Dense forest | Total | User Accuracy (%) |
| Water bodies | 31 | 17 | 0 | 0 | 0 | 0 | 4 | 52 | 59.62 |
| Sand | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 5 | 100 |
| Barren land | 0 | 0 | 24 | 0 | 5 | 0 | 0 | 29 | 82.76 |
| Agriculture | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 9 | 100 |
| Grass land | 0 | 0 | 3 | 0 | 79 | 12 | 7 | 101 | 78.22 |
| Sparse forest | 0 | 0 | 0 | 0 | 5 | 332 | 50 | 387 | 85.79 |
| Dense forest | 0 | 0 | 19 | 18 | 19 | 4 | 656 | 716 | 91.62 |
| Total | 31 | 22 | 46 | 27 | 108 | 348 | 717 | 1299 | |
| Producer Accuracy (%) | 100 | 22.73 | 52.17 | 33.33 | 73.15 | 95.4 | 91.49 | | |
| Overall Accuracy (%) | 87.45 | | | | | | | | |

HELVETAS Swiss Intercooperation Nepal
Dhobighat-3, P. O. Box 688, Lalitpur, Nepal
Tel: +977 1 5524925, Fax: + 977 1 5531109
E-mail: po@helvetas.org.np
Web-site: www.helvetasnepal.org.np