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Final Report

Study on Drivers of Deforestation and Degradation of Forests in High Mountain Regions of Nepal

Volume I; Main Report

Submitted by:

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Table of Contents

Executive Summary

The study is about drivers of deforestation and forest degradation in the high Mountain region of Nepal. The major objective of the study was to identify the nature and extent of major drivers of deforestation and forest degradation in the High Mountain regions of Nepal. And the other specific objectives were to assess the current and future consumption of wood products (timber and fuel-wood) and non-wood products and project their future scenario and recommend strategic framework options to address the identified drivers of deforestation and degradation of Forests

The report is organized in seven chapters. Chapter I sets the stage with introduction including objective and detailed methodology. Chapter II briefly explains the general physical, ecological and socio-economic overview of forests in the High Mountain Chapter III is assigned for discussions and analysis of drivers of deforestation and forest degradation in the High Mountain forests. Chapter IV consists of existing demand and supply of forest products and future scenario of wood and non-wood forest products is designed for Chapter V. While chapter VI presents and analyses the existing policy, institutional and technical capacity of the forestry institutions required for the management of High Mountain forests. Finally, the ways forward and recommendations for the sustainable management of forests from REDD and climate change perspective is presented in chapter VII.

The information for the study was gathered from both primary and secondary sources. Stakeholder consultations and core group discussions at national and regional, districts and users levels following inclusive and participatory approach including household survey of more than households formed the major source. The Department of Survey TIP/DoF Ecological GIS Maps 2002 was used to generate landuse and forest types data for analysis.

Overall synopsis of the report

High altitude forests occur throughout the high hills, generally 2,000 meter to alpine pasture. They refer to all contagious forests ranging from lower oak forests (about 2,000 m) close to population to alpine meadows/ scrubs (up to 5,000 m) devoid of permanent human settlement. Mapping of land areas above 2,000 m shows that of total 75 districts 55 fall in the High Mountain region. For the purpose of the study and also from forest management point of view of the total 55 high mountain districts 25 districts having more than 50,000 ha of high altitude areas have been recommended as High Mountain regions.

The landuse and forest cover information presented by different agencies contradict with each other and are difficult to reconcile over the geographical areas. For the purpose of the study district wise land use data published in CBS 2009, MPFS 1988 and areas derived from Maps of Department survey and TIPs- GIS MAP 2002 were taken for analysis of landuse systems and forest cover changes. Based on these sources High Mountain region comprises a total of 5832510 ha of land, of which barren land comprises the maximum share (39.5%0 followed by forest (26.8%), grassland (16.6%) and shrubs (5.8%). Rest of the area is under other land uses mostly snow and rock and non-cultivated inclusion.

High Altitude areas are inhabited by different ethnic groups dominated by Tibeto-Burman ethnic groups such as Sherpa, Rai, Limbus, Tamang, Jirel, Gurung, Thakali, and Magar and speak a variety of languages and dialects. The total population of the high mountain region in 2011 was 4211900 which is about 16% of Nepal's population. High Mountain people depend for their livelihoods on a combination of animal husbandry and agriculture, that is, seasonal pastoralism (or upland livestock herding) and upland dry field farming. They also derive subsistence from many other natural resources, particularly from MAPs and ecotourism. There were 4833000 livestock in 2001 (livestock's from high altitude forest management perspective), which is about 27% of total livestock population of Nepal. Of the total population cattle capture the major share (40%) followed by goats (38%) buffalo (19%) and sheep (3%).

Forests in the High Mountains can be broadly grouped into four broad types: montane/Himalayan moist temperate forest, Himalayan dry temperate forest, sub-alpine forest, and alpine scrub. These forests are mainly dominated by broadleaved species (45%) followed by Conifers (31%) and Mixed

species (24%). The major forest types includes (Map 2.4): Alpine scrubs; Cyprus forests; Cedar forests; Fir Forest (Fir); Spruce Forests; Fir Hemlock Oak forests; Blue pine forests; Birch-Rhododendron Forest (B&R);Temperate Mountain Oak Forest (TMOF); Lower Temperate Oak Forest (LTOF); East Himalayan Oak-Laurel Forest (EHOF); Lithrocarpus forests and Larch forests

Information on growing stock of forests is old, inconsistent and not updated. Therefore information from MPFS (1988) and NFI (1998) was taken for analysis. Analysis of data from these sources has shown that total stem volume (over bark) of reachable forests of high mountain regions has reduced down from 537.2 cubic meter in 1978 to 388 million cubic meters in 1994 and the total biomass of stems, branches and leaves is 429 million tons (air dry) over the period from 1978 to 1994 . The Current Annual Increment (CAI) of the forests varies between 0.6 to 1.2 cubic meters per hectare, and the sustainable annual wood supply from forest in the High Himal and High Mountain, is 2.4 and 3.0 MT respectively.

However, examples from recent forest inventory in Sindphalchowk and Panchthar districts show that there is drastic decline in the per ha standing volume of high altitude forest as compared to MPFS and NFI. The average weighted per ha volume of high altitude forests in the Sindhupalchowk is 97.47 m3 and 76.46 m3/ha in Panchthar. Similarly the mean annual growth also varies between 0.61 m^3 (Birch Rhododendron forests) to 1.7 5 m3 (Fir Forest) while MAI of high altitude forests in Panchathar varies between 0.7 m3 (Lithrocarpus Forests) to 1.4 m3 (Fir forests).

Forests and Shrubland are under the jurisdictions of two public land management agencies: Department of Forests (DoF) and Department of National Parks and Wildlife Conservation (DNPWC), under the Ministry of Forests and Soil Conservation (MFSC). Of total forests and shrub land about 78% of total areas of forests is under the DFO jurisdiction known as the national forests. Of the remaining 25% of forests 10 % falls in the National parks and rest in the conservation areas (12.5%) and Buffer zones (2.4%). Government managed forests (GMF), community forests, and leasehold forest are the three major modes of forest management under the DFO jurisdiction, By July 2011, 384808 ha of national forests (including, shrubland, grassland and barren land within forests areas) has already been handed over to 4910 Community Forests Users Groups. Similarly, there are 859 Leasehold Forest Users Groups with an area of 10470 ha of degraded or barren forest land,

Similarly, under the protected areas management systems a total of 696900 ha of forests has been handed over to 191 Buffer zone Community Forests Users Groups (BzCFUG) . The Rara National Park and Khaptad National Park do not have any community forests.

Database on forest cover are old, conflicting and inconsistent. Comparing the landuse data of 1985/86 (MPFS) to that of landuse data generated from Department of Survey, TIPs/DOF and GIS Maps 2002 the stdy found that a significant decline in the area of cultivated land (58.2%), forest (18.74%) and grassland (32.48%) at an annual rate of 3.6, 3.3 and 4.08 respectively over the period. And the area covered by shrubland and barren land or NCI had been drastically increased at an annual rate of 37.4 and 25.7 respectively. However, from the review of site specific forest cover change studies carried out by various agencies in three high mountain districts of central development region the study has attempted to conclude that change in land use patterns and pathways of conversion of forests into other forest sub-categories (shrubland, and grassland) and agriculture and vice versa largely depends on the management regimes of forests resources. The rate of decline of natural forests under government management regimes was between 32 to 59% between 1978-1992 while shrubland and grassland increased up to 204 % and 214% respectively over the same period. Whereas there was an overall increase in forest area (1.1 to 1.96% per year) and forest quality (1.13% to 1.39% per year) between 1990 and 2010.

Both the proximate and underlying causes of drivers of deforestation and forest degradation in the high mountain regions have been identified and discussed in detail. Out of 6 proximate causes of deforestation and forest degradation in the High mountain region (Forest fire, Over grazing, Indiscriminate product extraction, Illegal trades, Infrastructure expansion, Development of new economic frontiers and Others) forest fire, open grazing and indiscriminate product extraction were perceived as the most critical factors. And among the underlying causes contributing for the

deforestation and forest degradation identified and perceived by the respondent were Demographic factors, Policy and institutional factors, Governance factors, Economic factors, Cultural factors and the Lack of research and development.

Forests, particularly those under government management regimes in the lower temperate region and sub alpine and alpine areas are under extreme pressure for fodder and firewood showing higher level of degradation in quality, species diversity and density. They have been converting into shrublands and pasture, while pasture in temperate and lower temperate regions where transhumance grazing is abandoned is slowly and gradually converting into shrubland of invasive species. The Alpine Junipers scrubs and Cuppresseus and Juniper forest in the Sub-alpine zone are heavily cut for firewood by the transhumance graziers, trekkers and labour of the expedition team. In many localities, they have been threatened if not exterminated (discussed in detail in the next section) .To the contrary, except a few cases majority of high altitude forests managed by local communities have shown various positive impacts on restoration of forest cover, improving forest quality and wanton exploitation of trees for wood and fodder.

The major forest products that were harvested from the high mountain forests included timber, firewood, fodder/forage, leaf litter or bedding materials, medicinal and aromatic plants (MAPs), Bamboo/nigalo and other NTFPs. There was a big gap of data/information on the per capita consumption of forest products and their supply. Assessment of demand and supply of forestry products, therefore, was mainly based on secondary information that includes DFOs Periodic forest management plan, DoF forest products database and MPFS's estimation of growing stock and annual sustainable yield, other literature on demands and supply of forest products. Personal experience of the research team was also used where appropriate. Finally future demands and supply of forest products by sources based on alternative option scenario are projected for both consumptive and commercial purposes.

The report has also reviewed the major forestry and legal framework along with other sectoral polices and legal provisions relevant to High Mountain forests resources. Major gaps in these police and legal frameworks had been assessed and lesson learned from the implementation documented. Various formal and informal institution prevailed in the high mountain regions have been identified and their Institutional and technical capacity assessed.

Institutional vacuum, policy mismatching, weak governance at multiple levels were identified the core problems of DD in the high Mountain regions. Similarly, uplifting the socio-political status of high mountain communities and raise their voices and influence in the national political decision makings, and bring changes in the attitude, perception, knowledge and values among major stakeholders/actors and developing a forest policies and legal framework that acknowledged the unique features high mountain areas while managing the forest resources in a participatory way were the major challenges of addressing DD.

The suggested strategies include adaptation of a holistic approach comprising of all the four dimensions of subjectivity and objectivity the development of more holistic. The quadrivia perspective need to be acknowledged, understood and dealt in a holistic way at the every level from micro to macro level in the changed context of global trend and concerns of climate change.

Based on the above conceptual framework of quadrivia perspectives the following way forwards in four broad headings are suggested in order to address the issues and challenges of forest resource management in the high mountain region of Nepal. They are:

1. Redefinition in attitude, mindset, values and ethical consideration by all actors.
2. Knowledge and capacity development and management of resources.
3. Developing collective vision, common understanding and strengthening of coordination.
4. Reforming policy and institutional arrangements.

Abbreviation

AEC	Agriculture Enterprises centre
ANSAB	Asian Network for Small-scale Agriculture and Bioresources
APP	Agriculture Perspective Plan
asl	Above Sea Level
BCF	Biodiversity Conservation Facility
BISEP-ST	Biodiversity Sector Programme for Siwaliks and Tarai
BS	Bikram Samvat
BZ	Buffer Zone
CAI	Current Annual Increment
CBD	Convention on Biological Diversity
CBOs	Community Based Organisations
CDM	Clean Development Mechanism
CF	Community Forest/ry
CFM	Collaborative Forest Management
CFUG/s	Community Forest User Group/s
CIFOR	Central for International Forestry Research
CITES	Convention on International Trade on Endangered Species
COMFORTC	Community Forestry Research and Training Centre
cu. ft.	cubic feet
cu. m	cubic meter
DADO	District Agriculture Development Office(s)
DD	Deforestation and Forest Degradation
DDC	District Development Committee
DFCC	District Forestry Coordination Committee
DFO	District Forest Office/er
DFRS	Department of Forest Research and Survey
DLSO	District Livestock Service Office
DNPWC	Department of National Parks and Wildlife Conservation

DOA	Department of Agriculture
DoF	Department of Forests
DoLS	Department of Livestock Services
DPR	Department of Plan Resources
DPRO	District Plant Resources Office
DSCO	District Soil Conservation Office/Officer
DSCWM	Department of Soil Conservation and Watershed Management
dbh	Diameter at Breast Height
EIA	Environmental Impact Assessment
United Nations	
FAO	Food and Agriculture organisation of the United Nations
FECOFUN	Federation of Community Forest Users Nepal
FSCC	Forestry Sector Coordination Committee
FUGCs	Forest User Group Committees
FUGCs	Forest User Group Committees
FUGs	Forest User Groups
GDP	Gross Domestic Product
GHG	Green House Gas
GMF	Government Managed Forests
GoN	Government of Nepal
ha	hectare
HH	Household
HLFFDP	Hills Leasehold Forestry and Forage Development Project
HPPCL	Herbs Production and Processing Company Limited
HRD	Human Resource Development
HRM	Human Resource Management
ICIMOD	International Centre for Integrated Mountain Development
IEE	Initial Environmental Examination
IFAD	International Fund for Agriculture Development

IGA	Income Generating Activities
INGO/s	International Non-Governmental Organization/s
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
IUCN	World Conservation Union
KAFCOL	Kathmandu Forestry College
kg	Kilograms
km	Kilometers
LF/LHF	Leasehold Forests/Leasehold forestry
LF/LHF	Leasehold Forests
LFP	Livelihood Forestry Program
LFUGs	Leasehold Forest User Groups
LIBIRD	Local Initiatives for Biodiversity Research and Development
LIP	Livelihood Improvement Plan
LRMP	Land Resource Mapping Project
LRMP	Land Resource Mapping project
LSGA	Local Self Governance Act
m	meter
MAI	Mean Annual Increment
M&E	Monitoring and Evaluation
MAPs	Medicinal and Aromatic Plants
MoAC	Ministry of Agriculture and Cooperatives
MoE	Ministry of Environment
MoF	Ministry of Finance
MoFSC	Ministry of Forests and Soil Conservation
MPFS	Master Plan for the Forestry Sector
MT	Metric Tonne
NACRMLP	The Nepal Australia Community Resource Management and Livelihoods Project
NAPA	National Adaptation Program of Action
NBS	Nepal Biodiversity Strategy
NBSIP	Nepal biodiversity Implementation Plan

NBU	National biodiversity Unit
NCS	National Conservation Strategy
NEFEJ	Nepal Forum for Environment Journalists
NEFUG	Federation of Natural Resource Management Group
NEPAP	Nepal Environmental Policy and Action Plan
NFA	Nepal Forester's Association
NGO/s	Non-Governmental Organization/s
No.	Number
NPC	National Planning Commission
NSCFP	Nepal-Swiss Community Forestry Programme
NTFP	Non Timber Forest Products
PA/s	Protected Area/s
PES	Payment for Environmental Services
PF	Private Forestry
PPP	Prioritized Productivity Package
PRSP	Poverty Alleviation Strategy Paper
R&D	Research and Development
RAN	Rangers' Association of Nepal
REDD	Reducing Emission from Deforestation and Forest Degradation
RF	Religious Forests
Rs	Nepalese Rupees
SHL	Sacred Himalayan Landscape
sq km	square kilometers
TAL	Tarai Arc Landscape
TCN	Timber Corporation of Nepal
TCP	Technical Cooperation Programme
TL	Team leader
UNDP	United Nation's Development Programme
UNFCCC	U.N. Framework Convention on Climate Change
VDC/s	Village Development Committee/s
WECS	Water and Energy Commission Secretariat
WWF	World Wildlife Fund for Nature

Chapter 1. Introduction

1.1 Background and rationale

Deforestation and forest degradation account for 20 percent of annual total greenhouse gas (GHG) emissions. The vast majority of these forestry emissions come from deforestation in developing countries (IPCC, 2003). Reducing Emissions from Deforestation and Forest Degradation (REDD) is evolving as a means to reduce forest sector carbon emissions through appropriate forest management practices and enhanced forest governance both in the forestry sector and related sectors. Several other initiatives are active such as the Forest Carbon Partnership Facility (FCPF) to develop capacities of developing countries for REDD. Developing and applying strategies and programs to address the drivers of deforestation and degradation of forests are the key activities during the REDD readiness phase. The quick assessment of land use, forest policy and governance carried out during REDD preparedness plan (RPP) preparation has identified nine major drivers of deforestation and forest degradation in Nepal. Since the extent and speed of drivers is different in different physiographic regions, there is a need for clear understanding on different drivers in different regions to develop future national REDD strategic framework.

RPP has identified forest fire, illegal logging and grazing as critical drivers of deforestation and degradation in High Mountain forests. This region is an important habitat for many endemic key stone species. For this reason, some eco-regions in high mountain landscapes are recognized as biodiversity hotspot areas of global significance. The inaccessibility and low population density in this region have contributed to remain many forests intact and in good condition, even outside the protected area systems. These forests have high carbon density and also possess very high conservation values due to undisturbed old growth natural conifer forests. Loss of these forests may impose huge costs to REDD-plus implementation and other ecosystem services including Biodiversity conservation in future. Therefore, there is a need of clear understanding on direct and underlying drivers of deforestation and degradation in High Mountain forests so that appropriate actions can be taken.

The analysis of supply and demand trend in this region - in terms of commodities, seasonality and magnitude in both spatial and temporal context- shall contribute in understanding the extent of additional demand required to meet administrative, institutional and financial costs in future. The REDD Forestry and Climate Change Cell of the Ministry of Forests and Soil Conservation has commissioned this study in order to provide guidance for policy makers concerning the effective allocation of possible REDD incentives, and help develop REDD strategy framework for Nepal.

1.2 Objective of the Study

The objective of the study is to identify the nature and extent of major drivers of deforestation and forest degradation in the High Mountain regions of Nepal. More specifically,

1. To identify the critical drivers (including both direct and underlying) of deforestation and degradation of forests and assess the change contributed by each drivers with reference to major forest types;

2. To estimate the magnitude of current and future consumption of wood products (timber and fuel-wood) and non-wood products in High Mountain areas of Nepal for next twenty years and provide critical comments on the data challenges in such estimation;

3. To estimate the magnitude of current and projected future supply potential of different forest management regimes for next twenty years to produce wood products (timber and fuel-wood) and non-wood products from High Mountain forests and provide critical comments on the data challenges in such estimation;

4. To develop scenario of future demand and supply of wood products and non-wood products in High-Mountain forests of Nepal under changing social, political and economic environment including but not limited to price, food security, economic growth, political restructuring, remittance, internal migration and infrastructure development.

5. Provide proposed strategic framework options to address the identified drivers of deforestation and degradation of Forests (with reference to objective number one) in High Mountains.

1.3 Limitations of the Study

The study has been carried out under the following assumptions:

- The report is primarily based on the information derived from the review of existing available relevant secondary sources; however efforts are made to validate and fill the information gaps through participatory appraisal techniques and household survey.

- Forest owners, managers, forest users and stakeholders are well aware about the drivers of deforestation and degradation as they experiences of dealing with causes and effects of deforestation and degradation in the context of climate change;

- Stakeholder involvement is critical – local knowledge and memory of forest degradation and deforestation and climate changes over time can help identify potential measures to halt deforestation and degradation contributing reducing emission; and also building stakeholder ownership on the report;

- Findings of the study could be considered as baseline information or checklists and indicators of divers of forest deforestation and degradation, trends for wood and non-wood products and their future demands required for designing and developing the way forward for national REDD strategy;

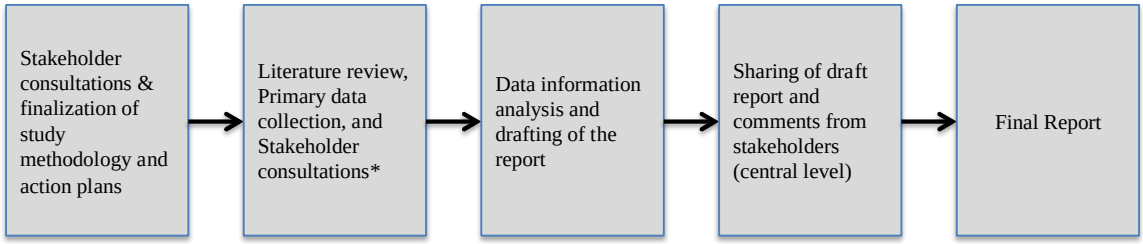
1.4 Structure of the Report

The report is organized in seven chapters. Chapter I sets the stage with introduction including objective and detailed methodology. Chapter II briefly explains the general physical, ecological and socio-economic overview of forests in the High Mountain Chapter III is assigned for discussions and analysis of drivers of deforestation and forest degradation in the High Mountain forests. Chapter IV consists of existing demand and supply of forest products and future scenario of wood and non-wood forest products is designed for Chapter V. While chapter VI presents and analyses the existing policy, institutional and technical capacity of the forestry institutions required for the management of High Mountain forests. Finally, the ways forward and recommendations for the sustainable management of forests from REDD and climate change perspective is presented in chapter VII.

1.5 Methodology

The study followed various methods and processes mentioned in the study ToR (Annex I) that include review of secondary information, consultations and meetings, primary data collection and data analysis. Figure 1.1 presents the process of study and report preparation.

Figure 1.1:Study process/methodology



Note:* Includes Key Informant discussions, Focus Group Discussions, and Household Surveys

1.5.1 Review of the secondary information

A number of literatures (study reports, project documents, forest management plans, district profile, annual reports etc) related to High altitude forests, climate change and livelihoods, published and unpublished by various government, projects, organizations and international agencies were collected and reviewed. Similarly, climate change policy, forestry sector policies, strategies, Acts, Regulations of the forestry sector and other sectoral Guidelines were also reviewed. Finally, data required for the preparation of the report were visualized and data gaps were identified.

1.5.2 Consultations and meetings with concerned stakeholders

A number of consultations and meetings were organized with the concerned stakeholders. The objectives and process of study were shared and their opinions, expectations were obtained to refine the methodologies. The consultations at micro and meso level were focused on understanding their perception about the drivers of degradation and deforestation

and strategic interference. A total of over 250 stakeholders and users were consulted during the entire process of the study (Annex II).

I. Meetings and presentation at REDD Forestry and Climate Change Cell

Altogether three meetings were held at the centre with concerned Officials from REDD Forestry and Climate Change Cell of MFSC. The first two meetings were focused on sharing and refining study methodologies and field planning. The comments and suggestions received during the consultations were incorporated and a revised methodology and work plan were prepared. In the third meeting, findings of field work (district and Ilaka planning workshops and forest inventory) were presented and discussed. The draft report was presented in the fourth meeting for final comments and suggestions.

II. Consultations with Regional Directorate of Forests and District Stakeholders

A total of four meetings with Regional directorate of Forest (FWDR, WDR CDR and EDR) and 10 meetings were held with the district stakeholders of the study districts. The objectives of these meetings were to introduce the study team and orient the stakeholders at the regional and district levels including sectoral line agencies, FECOFUN, HIMWANTI, and other relevant NGOs to share and discuss in depth the study methodology, process and obtain their comments and suggestions.

During the process of the study a series of interaction meetings were also conducted with the officials of DFO, DSCOs, DLSOs, and Protected areas management systems in and around the sample study districts to explore their programmatic inputs and roles at High altitude areas and also to identify potential community based institutions for the sustainable management of forests in these areas.

1.5.3 Primary Data/Information Collection

Various PRA Tools were used to validate the data/information collected from the secondary sources as discussed earlier, and also to fill the data/information gaps.

I. Focus Group Discussions

Altogether 20 FGDs, two in each sample study districts, were organized. VDCs within each range posts were stratified into three ecological regions and FGDs were conducted among diverse groups representing gender and caste/ethnicity composition and wellbeing. Representatives of the local community groups, village leaders, social workers, and representatives from NGOs/CBOs working in the study districts were invited for FGDs. A separate checklist outlining the major issues to be discussed in the FGDs was prepared (Annex III) and was moderated by the trained research assistants at each sample sites.

II. Key Informants Survey (KIS)

A total of 50 Key Informants in the sample district representing GOs, NGOs, CBOs, and Local bodies (Indigenous and Local communities) were identified and interviewed. To

facilitate the interview, a separate checklist of semi-structured questionnaire was developed and used (Annex IV**).**

III. Household Survey/Interview

Household Interview cum Survey was carried out to fill information gaps on drivers of deforestation, demand and supply of forest forests and also to assess privileges, access and control over forest and its products from the gender and social inclusion and geographical (upstream and down streams, physical distance) perspectives. Altogether 242 households representing High Mountain lifestyles (dry land farmers and transhumance glaziers), tourism centres and growing urban centres with proportionate distribution of households from each economic and social strata, Gender –Male/Female, Ethnicity-*Janajatis*, *Dalits*, *Brahmins/Chhetris* and others) were taken purposively for the household survey (see Annex IV for the questionnaire used)

IV. Forest stocking, yield, and demand and supply of forest products

Secondary information from periodic district forest management and Community Forests operational plans were taken to assess the status of the forests in terms of their productivity, pathways of deforestation and forest degradation, annual yield of wood and nonwood and their demand and supply. Overall stocking of High Mountain forests and other data were obtained from the District Periodic Forest management Plans while site specific information/data were taken from three operational plan of the district representing the High Mountain forest types in the district. In addition, both quantitative and qualitative information/data on forest conditions, increase or decrease in species richness, and density, status of forest encroachment or loss of forests from other landuse and demands and supply of forest products and their sources were collected. The compiled and collected information/data were also refined and validated to the extent possible during the transect walk of the sites in the sample districts

V. Assessing the Drivers of Deforestation and Forest Degradation

Both secondary and primary sources discussed earlier were used to identify the underlying and proximate causes of DD. Special checklists and questionnaires were developed for this purpose to facilitate the discussion and interview in line with the issues. Extent of damages and their severity and trends (pathways) of DD (forests, shrubland and pasture) and impacts on forests resources and local livelihoods along with efforts made to combat the problem were explored. The success and failure stories of rehabilitation and restoration of forests were noted, documented and directly observed**.**

V. Assessing the institutional and technical capacity of the forestry institutions

The capacity assessment of various forestry institutions were made through (i) Stakeholders analysis (ii) PRA with specially designed checklists and questionnaires. Various individuals and institutions engaged in the different aspects of High Mountain forests were identified as: DFO, DSCO, DLSO, FECFUN, and CFUGs, Transhumance glaziers, NGOs, traders and

forest based entrepreneurs at the district level and Forest users groups, transhumance glaziers, farmers, school teacher and local CBOs. Strengths, gaps (weakness) and potential opportunities of these stakeholders were identified during the questionnaire survey.

V. Participatory mapping

Participatory maps showing status of forests in the past and present (without interventions and before and after intervention) were prepared for the better understanding of the extent and severity of DD and the changes made by the interventions (Annex V)

VI. Transect walk and direct field observation/visits

To verify the data collected from various sources including FGD and KIs, a number of field visits with representation of major forests types, a field observation /transect walk were made. These visits were focused on assessing and acquiring hands on knowledge on the extent of damages from the factors of DD and their impacts on forests/pasture and local livelihoods, trees on farm lands, use of wood and non-wood.

VII. Mapping

To understand the High Altitude areas and their biophysical features, a number of maps (landuse, forest type, slope maps, and forest management regime) were prepared using a number of computer softwares.

Software: Geographical Information System (GIS) technology was adopted for preparing number of resource maps, spatial data handling and management, Landsat Imageries (ETM+) was used as a RS data for spatial data management and topographic digital data sets and RS data in GIS platform.

Spatial Data Handling and Management: Available topographic digital data sets were simply processed & edited. Furthermore, processing and editing task had been carried out according to the requirements of study. These digital data were processed by ArcView 3.2a software using geo-processing and other necessary tools and functions. All necessary GIS application had been carried out after these processing and editing tasks.

Landsat ETM+ image (Path 141; row 041-Feb, 2001): Landsat ETM+ image was used as a background map to separate high mountain areas (area above 2000-2200 m asl) by climate zones.

Preparation of Landuse and Forest Types Maps: Land use and Forest type maps were generated using topographic digital data sets through GIS application. At first, high altitude areas above 2000-2200 m asl were delineated and mapped and then areas under standard landuse types (forests, cultivated land, shrub, pasture, Non cultivated inclusions/barren land, water bodies, rock and snow etc) were calculated. Similarly, area of forest types in each climate zone of the High altitude areas was delineated and a forest map showing the major forest types, shrubland and pastureland was prepared.

Preparation of Slope maps

To assess the inaccessibility and other natural barriers of forest management and explore potential opportunities of sustainable forest resource management including pasture, areas of high altitude were also delineated into four-slope categories (area below 15 degree, 15-30 degree, 30-45 degree and above 45 degree). Finally a slope map showing all these features was prepared.

Preparation of Forest management Regime Maps

Forest management maps in terms of their management regime or institutional arrangement such as protected areas management systems, government managed forests, community based forestry were prepared for better understanding of the drivers of deforestation and forest degradation and efficiency of various institutions trusted for the sustainable management of High altitude forest resources.

1.5.4 Data Analysis

All the data and information collected from KIs, FGDs and household surveys were compiled, processed, analyzed and interpreted using a computer program Statistical Package for the Social Sciences (SPSS). Area of forests by types was calculated based on the Topographical Maps 2001 produced by the Department of Survey and the TIP/DoF, GIS Ecological Maps of 2002. Growing stock (regeneration, poles and trees) according to the forest types was calculated by compiling, computing the data derived from secondary and primary sources as discussed earlier. Similarly, to assess per household demand of forest products data collected from group interview were aggregated by the number of respondents. Finally, the analyzed and interpreted data is presented using simple statistical tools, diagrams and charts.

Chapter II: High Mountain Regions and the State of Forests and Forestry

2.1 High Mountain Regions

2.1.1 Definition and characteristics

There is no official or legal definition of High Mountains/altitude and High altitude forests. However, review of contemporary literature reveals that there is lack of consensus on definition of High altitude forests or areas, with some using the broad definition of an altitudinal range from 2000 m up to alpine pasture (Acharya, 2003). Generally, the Mid-hills people call these areas as *lekh*, whereas the High Mountain people call *kharka* (winter pasture-temperate zone) and also *Sidhi Kharka*-summer pasture-alpine area (Baral, 2005).

High altitude forests occur throughout the high hills, generally 2,000 meter to alpine pasture. They refer to all contagious forests ranging from lower oak forests (about 2,000 m) close to population to alpine meadows/ scrubs (up to 5,000 m) devoid of permanent human settlement, combining all or some of the characteristics listed in the box 1 below. This is also the definition adopted by two forestry projects Nepal Australia Community Natural Resource Management and Livelihoods Project (NACRMLP, 2006) and Livelihoods & Forestry Programmes. This definition also correlates with the local use perspective, broad forest policy envisioned by the MPFS 1988, and also with Sub-alpine high mountain zone boundaries standards for Nepal set by LRMP, 1986. For this study too, the High Altitude" is defined as area between 2,000 m and 5,000 m, with all or some characteristics listed in the box 1. Similarly, the word "High Altitude" and "High Mountain" are interchangeably used.

Box 1: Characteristics of High Altitude Areas

Inaccessibility

- Mostly the forests are large, contagious located in remote and are inaccessible for daily use;
- The terrain of the area is often steep;
- There are no permanent settlements in between of these forests;
- Severe cold climatic condition, majority of the area is covered with snow for 5-6 months

A unique set of Natural resources

- High altitude areas are generally associated with distinct species or forest types of particular combinations. They are generally characterized by:
  - Broad leaved trees species (e.g. oak, rhododendron) confers (Hemlock, Fir , Spruce, Cedar) , mixed forests, and associated trees and shrubs many of which are not found in the Mid-hills
  - High forest, high value NTFPs and alpine pasture land
  - Greater number and diversity of wildlife species as compared to Mid-hills;
- Rich in aesthetic places and glacier lake

Livelihoods and Indigenous Natural Resource Management and Utilization

- Transhumance pastoralism;
- Agriculture is largely absent, more dependent of livestock husbandry (yak, sheep and mountain goat) and NTFPs ;
- Seasonal users and seasonal availability of resources
- Resource utilization focused largely on single- purpose and single –product based

(Source: Messerschmidt and Rayamajhi, 1996; Acharya, 2003; and Baral, 2005)

The High Altitude areas encompass the northernmost part of Nepal on the border with Tibet and falls north of the Mid-Hills. For administrative purposes, the DoF, CFDP has categorized 16 district of Nepal as High Mountain districts. According to MPFS (1988) High altitude

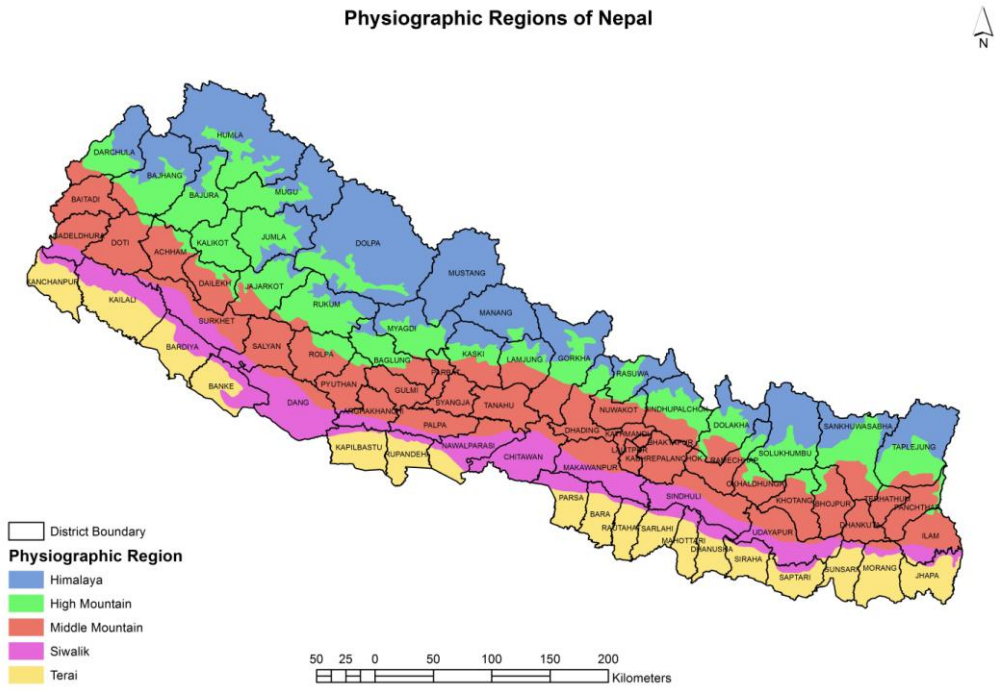
(Himal and High Mountain) areas constitute 42% of total landmass of Nepal out of which 23% belong to the High Himal (Map 2.1). Similarly, of6.3 million ha of total land area of High Altitude, forests and shrublands together compromises about 1.8 million ha(30.8%) about 33.61% of total forests of Nepal (Table 2.1). Whereas, mapping of land areas above 2,000 m reveals 55 districts out of 75 consisting of the High Mountain/altitude region (Map 2.2 and Table 2.2).

Table 2.1: Landuse in High Mountain Regions (Area in '000' ha)

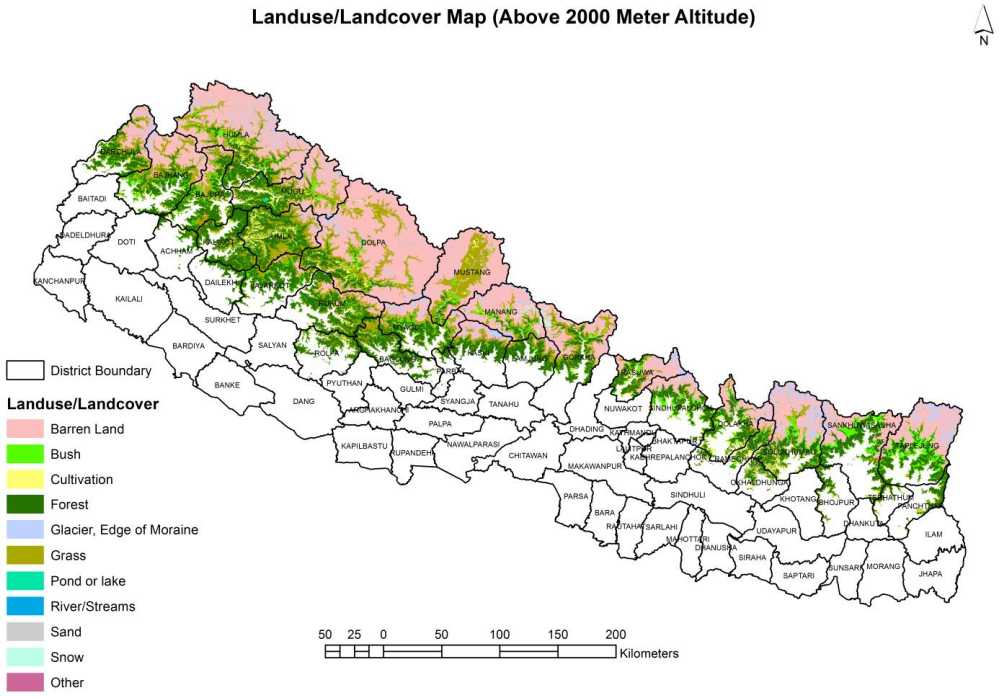
Landuse Category	High Mountain		High Himal		High Mountain Region	
	Area	%	Area	%	Area	%
Forests and Plantation	1639	55.4	155	4.6	1794	28.4
Cultivated land	244	8.2	8	0.2	252	4.0
Non-cultivated Inclusion	148	5.0	1	0.0	149	2.4
Shrubland	176	5.9	67	2.0	243	3.9
Grassland	508	17.2	885	26.4	1393	22.1
Other lands (snow, ice rock etc)	245	8.3	2234	66.7	2479	39.3
Total	**2960**	**100**	**3350**	**100**	**6310**	**100**
% of total	46.9		53.1		100.0	

Source: MPFS, 1988

Map2.1: Physiographic Regions of Nepal



Map 2.2: Landuse map of Nepal showing area above 2000 meter altitude



2.2: Distribution of land areas above 2000 m altitude (Area in ha)

Area Category	No of District	Land Area	% of total HA area
>100,000 ha	22	5,558,579	89.67
50-99,000 ha	3	210,259	3.39
25-49,000 ha	7	234,804	3.79
5-24,000 ha	10	138,812	2.24
1-4,000 ha	8	54,802	0.88
<1,000 ha	5	1,331	0.02
	55	6,198,587	100

Source: Department of Survey 2001 and TIP 2002 GIS Maps

From the management perspective of High Mountain forests of the total districts of Nepal, 25 districts having more than 50,000 ha of high altitude areas have been recommended as High Mountain districts or districts containing High Mountain regions of Nepal. Distribution of districts and landuse status calculated using the above criteria is depicted in Table 2.3and 2.4.

Table 2.3: High Mountain regions of Nepal in five development regions

Region	District with more 50,000 ha of land area		% of total area
	No of district	Area in '000' ha	
EDR	3	840	14
CDR	4	502	9
WDR	8	1,334	23
MWDR	7	2,505	43
FWDR	3	652	11
Total	25	5,833	100

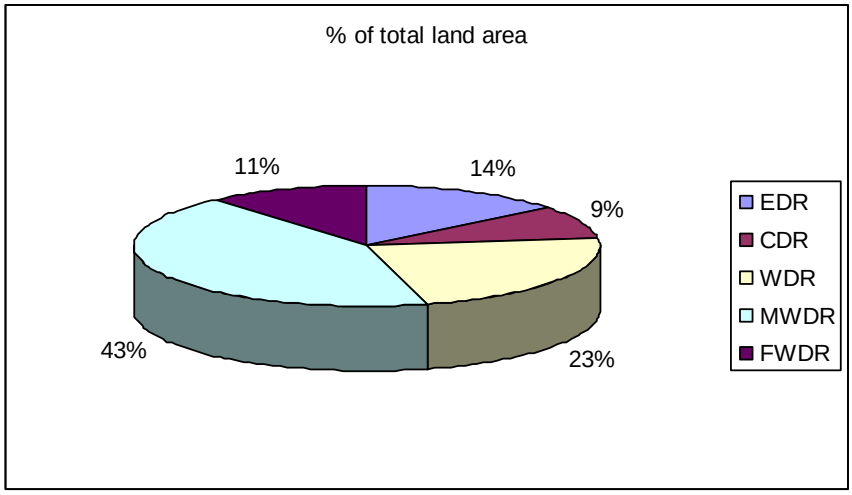
Source: Department of Survey 2001 and TIP 2002 GIS Maps

The figure in the table shows that the High Mountain region comprises a total of 5832510 ha of land, of which 43% falls in the MWDR (Figure 2.1) .Whereas the WDR comprises 23% of total land area followed by EDR (14%), FWDR (11%) and CDR (9%). See Annex VI for district-wise details.

Table 2.4; Landuse in 25 High Mountain districts

LANDCOVER	HIGH HIMAL	HIGH MOUNTAIN	TOTAL	PERCENT AREA
Agriculture	13.89	285.88	**299.77**	**5.14**
Forest	178.2	1383.37	**1561.57**	**26.77**
Shrubland	102.41	236.54	**338.95**	**5.81**
Grass	642.78	326.70	**969.48**	**16.62**
Barren Land	2226.52	80.04	**2306.56**	**39.55**
River/Streams and Water bodies	120.51	15.05	**135.56**	**2.32**
Glaciers & Snow	218.02	0.73	**218.75**	**3.75**
Rock outcrops and others	1	0.87	**1.87**	**0.03**
TOTAL	3506.2	2326.31	**5832.51**	**100.00**
PERCENT AREA	**60.1**	**39.9**	**100.0**	

Figure 2.1:. Percentage distribution of land areas across the development regions



2.1.2 Landuse

The landuse and forest cover information presented by different agencies contradict with each other and are difficult to reconcile over the geographical areas. The Central Bureau of Statistics (CBS) provides information on three ecological zones of Nepal. On the other hand, Land Resources Mapping Project (1978), and the Master Plan for the Forestry Sector (MPFS, 1988) provide land use and forest information based on five physiographic regions. The Department of Forests (DoF has taken the 16 districts as Mountain region as identified by the CBS/GoN for maintaining basic database on forest products and community forestry.

Map 2.3: Landuse Map of High Mountain Region

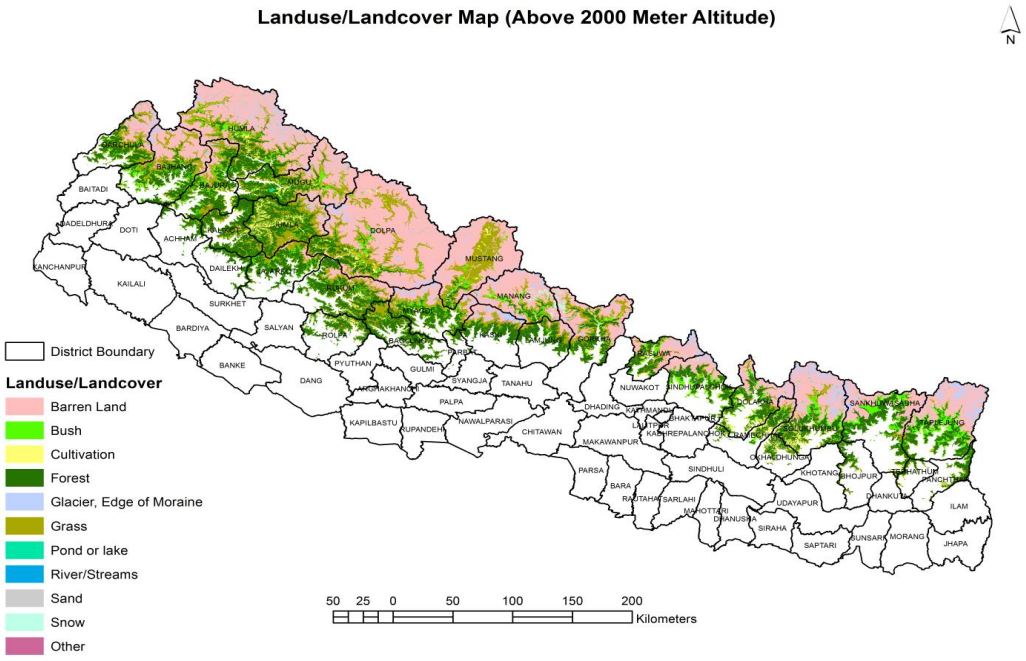


Table 2.5: Landuse of 25 High Mountain districts of Nepal (Area in '000'ha)

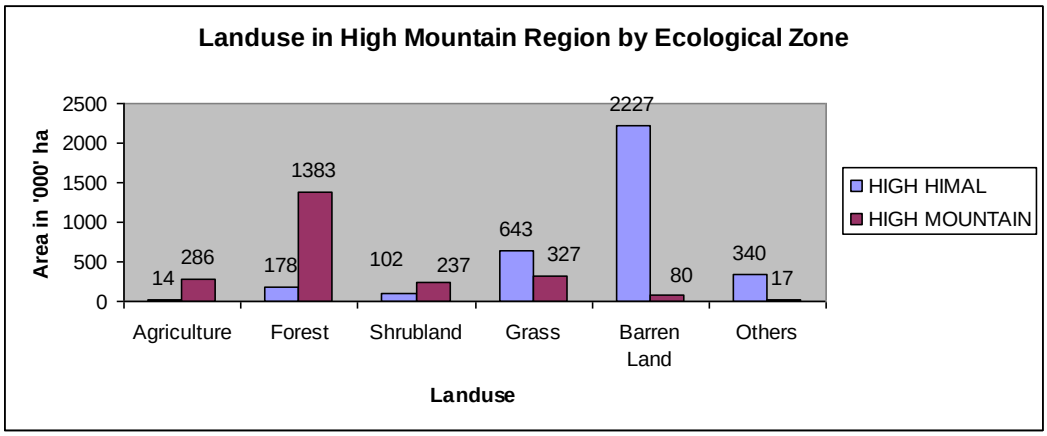
Development Region	Agriculture	Forest	Shrubs	Grass	Barren Land	Water Body	Glaciers and snow	Others	Total
EDR	36.7	224.4	97.4	31.9	358.6	6.1	75.9	0.2	831.1
CDR	42.4	171.6	42.8	38.3	177.2	2.2	21.0	0.8	496.1
WDR	61.7	317.7	55.3	278.7	549.5	20.2	66.4	0.3	1349.7
MWDR	135.5	629.0	92.1	474.7	1043.3	93.1	42.1	0.4	2510.1
FWDR	23.6	219.0	51.4	145.9	177.9	14.0	13.4	0.2	645.4
Total	**299.8**	**1561.6**	**339.0**	**969.5**	**2306.6**	**135.6**	**218.8**	**1.9**	**5832.5**
% of total area	**5.1**	**26.8**	**5.8**	**16.6**	**39.5**	**2.3**	**3.8**	**0.03**	**100**

Source: Department of Survey, TIPS/DoF, Ecological Map 2002
**Rivers, ponds/lakes/sand/embankment cutting
** Rock Outcrop and Others

Actually speaking, data and information on High Mountain landuse is limited, scattered, site specific, contradictory, disorganized and outdated,. Thus, reconciling the data of CBS, LRMP/MPFS and DoF over geographical areas is difficult. Therefore, for the purpose of this study district wise land use data published in CBS 2009, MPFS 1988 and areas derived from Maps of Department survey and TIPs GiS MAP 2002 has been taken for analysis of landuse systems and forest cover changes. Data generated from these sources has been depicted in the Table 2.5, Map 2.3 and Figure 2.2. The figure in the table shows that of 5832 area of land barren land comprises the maximum share (39.5%0 followed by forest (26.8%), grassland (16.6%) and shrubs (5.8%). Rest of the area is under other land uses mostly snow and rock and non-cultivated inclusion. These figures closely resembles with the land use area used in

MPFS, 1988 and DFRS, 1999 (discussed in the next section under forest cover change heading).

Figure 2.2: Landuse in 25 High Mountain Districts



2.1.3 People, lifestyle, livelihoods and culture

High Altitude areas are inhabited by different ethnic groups dominated by Tibeto-Burman ethnic groups such as S*herpa, Rai, Limbus, Tamang, Jirel, Gurung, Thakali, and Magar* and speak a variety of languages and dialects. The total population of the high mountain region in 2011 was 4211900 which is about 16%of Nepal's population (Table 2.6; Annex VII). Annual growth varies across the districts the highest being the urban and developing district such as Kaski, Baglung is between 1.5 to 2.56 while majority of districts have minus growth rate (see annex for more details). Similarly the average population density is about 51 persons per square km and also varies between 3 person/sq km-Manang to 243 persons/sq km-Kaski (CBS 2011)

Table 2.6: Population in High Mountain districts of Nepal

Development Region	**Population in '000'**		**Decadal Change**	**Annual growth rate**	**Average HH Size**	**Population Density**
	2001	2011				
EDR	401.6	419.2	-4.9	-0.2	4.4	37.7
CDR	780.2	726.8	-4.7	-0.5	4.3	90.3
WDR	1253.8	1333.0	-3.2	-0.5	4.0	89.4
NWDR	1067.6	1267.7	21.8	2.0	5.3	66.8
FWDR	397.8	465.2	9.0	1.6	5.4	58.7
Total	**3901.0**	**4211.9**	**4.5**	**0.6**	**3.8**	**50.5**
Nepal	23151.42	26620.81				
% of Nepal	**16.85**	**15.82**				

Source: CBS, 2011

The diversity of ethnic groups and agro-pastoralist groups in many High altitude areas is associated with a variety of different cultures, lifestyles and livelihoods practices, making it difficult to generalize. People in each areas or locations are unique in the way they combine

local environmental knowledge, household landuse decisions, and community resource management institutions into adaptive responses to environmental changes (Acharya, 2003)

High Mountain people depend for their livelihoods on a combination of animal husbandry and agriculture, that is, seasonal pastoralism (or upland livestock herding) and upland dry field farming. They also derive subsistence from many other natural resources, particularly from MAPs and ecotourism (ANSAB, 2006, Baral 1996, 2006, 2007, Acharya 2003).

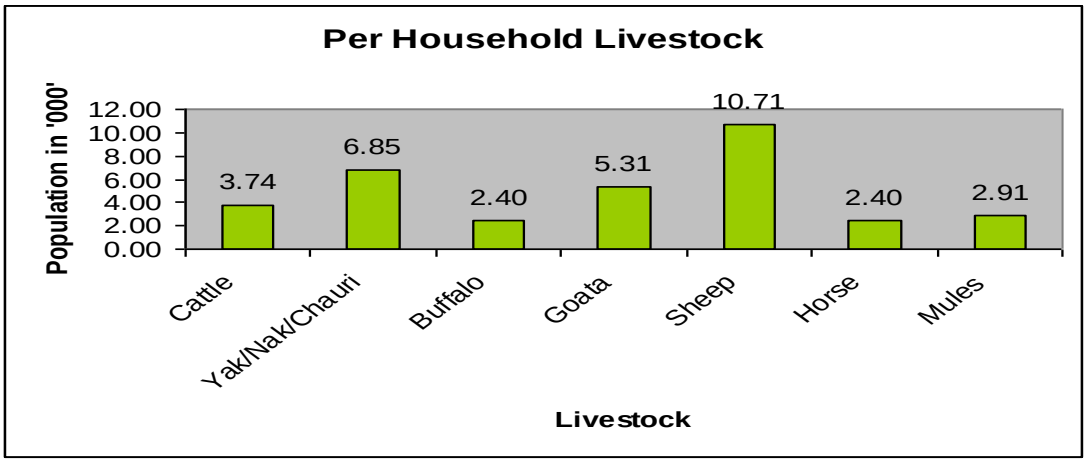
Livestock population in the 25 High mountain districts is given in the Table 2.7 and Annex **VIII**. According to CBS, 2009, there were 4833000 livestock in 2001(livestock's from high altitude forest management perspective), which is about 27% of total livestock population of Nepal. Of the total population cattle capture the major share (40%) followed by goats (38%) buffalo (19%) and sheep (3%). Although the 25 districts comprise about 80% of yak/chauri/Nak population of Nepal, they represent simply one percent of total livestock population of the region. Similarly percentage of population of sheep is 3% while percentage of horses and mules is in decimal.

Table 2.7: Livestock Population in 25 High Mountain districts of Nepal

Development Region	Cattle	Yak/Nak /Chauri	Buffalo	Goats	Sheep	Horse	Mules
EDR	342.96	17.00	97.70	276.76	32.78	0.05	0.00
CDR	275.17	9.09	182.81	426.27	24.27	0.60	0.02
WDR	345.18	20.66	333.60	450.14	43.44	5.50	2.84
MWDR	597.31	29.60	163.25	419.14	198.57	9.41	1.91
FWDR	296.81	0.35	83.66	136.86	8.88	0.24	0.18
High Mountain	1,857.44	76.71	861.02	1,709.17	307.93	15.80	4.95
Nepal	**7,215.16**	**95.45**	**3,477.73**	**6,932.94**	**471.16**	**20.08**	**5.99**
% of Nepal	**25.74**	**80.37**	**24.76**	**24.65**	**65.36**	**78.67**	**82.66**

Source: CBS, 2009

Figure 2.3: Per Household Livestock Holding in 25 high mountain districts



The figure 2.3 provides per household livestock holding scenario in the high mountain region. Animal husbandry differs across the lifestyles of the high mountain communities, cattle are generally raised by dry land farmers while those adopting transhumance lifestyles largely keep yak/chauri and sheep. Similarly, holding of horses and mules is largely

concentrated in Trans-himalayan region and number of households rearing these animals is in highly decreasing trend (see annex VIII for more district-wise details)

2.2 Forests Resources

High altitude areas are rich in forests resources. There are 399 endemic flowering plants in Nepal out of which about 63% are from the High Mountains (MPFS, 1988; NBSP, 2003). Forests in the High Mountains can be broadly grouped into four broad types: montane/Himalayan moist temperate forest, Himalayan dry temperate forest, sub-alpine forest, and alpine scrub. These forests are mainly dominated by broadleaved species (45%) followed by Conifers (31%) and Mixed species (24%). The major forest types includes (Map 2.4): Alpine scrubs; Cyprus forests; Cedar forests; Fir Forest (Fir); Spruce Forests; Fir Hemlock Oak forests; Blue pine forests; Birch-Rhododendron Forest (B&R);Temperate Mountain Oak Forest (TMOF); Lower Temperate Oak Forest (LTOF); East Himalayan Oak-Laurel Forest (EHOF); Lithrocarpus forests and Larch forests (TISC, 2002). District-wise area of each forest types is given in Annex IX and a summary of forest types and their distribution across the ecological zones is given in the Table 2.8.

Map 2.4: Vegetation Map of 25 High Mountain districts of Nepal

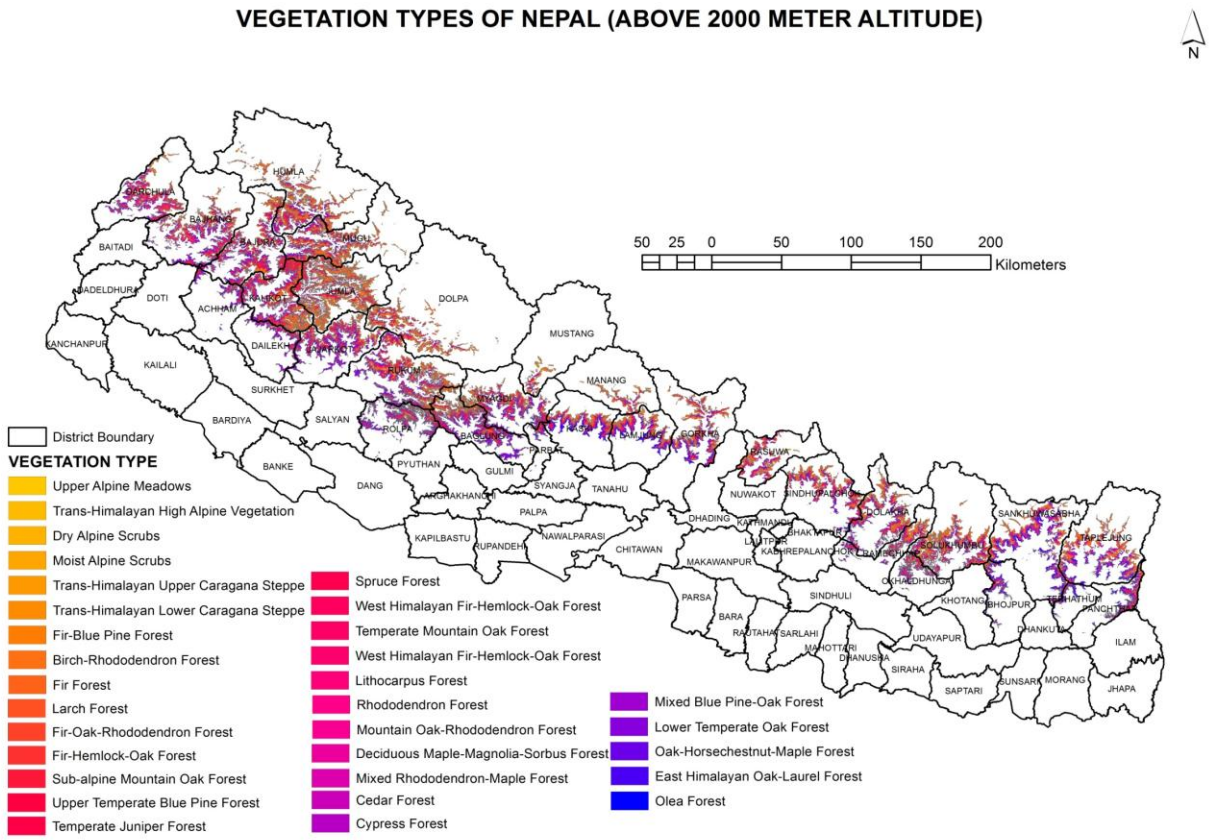


Table 2.8: Distribution of Forest types by Ecological Zone

Ecological Zone	No of Forest types	Area
Alpine Zone	3	3.798
Trans-Himalayan Zone	3	4.148
Sub-alpine Zone	7	606.97
Temperate Zone	17	904.743
Total	**30**	**1519.659**

Source: Department of Survey, TIPS/DoF, Ecological Map 2002

2.3 Forests growing stock and productivity

Information on growing stock of forests is old, inconsistent[1]and not updated. Therefore are based on MPFS (1988) and NFI (1998). However, to give the status of high altitude forest recent information on growing stock of high mountain forests of two districts Sindhupalchowk and Panchthar is presented to provide the trend of growing stock and productivity of forests in the high mountain regions of Nepal

Total growing stock figures of forests along with high mountain regions of Nepal are presented in the Table 2.9. Total stem volume (over bark) of reachable forests of Nepal has reduced down from 537.2 cubic meter in 1978 to 388 million cubic meters in 1994 and the total biomass of stems, branches and leaves is 429 million tons (air dry)over the period from 1978 to 1994(MPFS, 1988; DFRS, 1999). According to NFI, the mean stem volume (over bark) of Nepal is 178 m^3/ha, the mean stem volume up to 10 cm top is 131 cubic meter/ha and the average number of stems per hectare is 408 (DFRS, 1999).

In terms of distribution of volume, the high mountain has the highest mean stem volume (155 cubic metre/ha)and mid-mountain has the lowest (59m^3 /ha).The high mountain region comprises 30 per cent of total forest area and have about 48 per cent of total growing stock while the Tarai has simply 8 percent are under forests accounting nine percent of the total standing timber(MPFS, 1988, DFRS, 1999).

Similarly, Hardwood comprises 45% of total volume followed while the conifers and mixed forest have 31 percent and 24 percent of total standing volume respectively *Sal (Shorea robusta), fir (Abies spp)* , Chir pine (*Pinus roxburgh*ii) the oaks (*Quercus spp*) and blue pine (*Pinus wallichina*) in that order are the most significant species, accounting for 46% of the total standing volume (MPFS, 1988, DFRS, 1999).

The Current Annual Increment (CAI) of the forests in Nepal is estimated as 0.6 to 1.2 cubic meters per hectare, which is well below the theoretical potential (DFRS, 1999, Kafle, 2000; Kanel, 2000.) According to MPFS (1988) sustainable annual wood supply from forest in the High Himal, High Mountain, Mid-hills, Siwaliks and Tarai is 2.4, 3.0, 2.3, 4.1 and 6.5 MT respectively. Similarly, annual TDN supply from High Himal, High Mountain, Mid-hills, Siwaliks and Tarai forests is 434, 818, 853, 481, and 208 thousand tonne/ year. All forests in

[1] MPFS provides development region and physiographic region wise data while NFI/DFRS data/information is limited to development region

are not accessible in terms of harvesting forest products. The MPFS (1988) has assumed recovery factors of 70% for the High Himal and High Mountains, 80% for the Mid-hills, and 90% for the Siwaliks and Tarai (MPFS, 1988)

Table 2.9: Natural forest standing timber (stem volume in cubic meter up to 10 cm diameter) by Development and Physiographic Regions

Development Region	**Year and Volume**					
	1978	**% of Vol**	**1986 (MPFS)**	**% of Vol**	**1994 (NFI)**	**% of Vol**
FWDR	103	19.2	102.0	19.7	71.9	18.6
MWDR	206.9	38.5	204.0	39.3	71.1	18.3
WDR	67.9	12.6	64.0	12.3	43.8	11.3
CDR	91.5	17.0	85.0	16.4	89.8	23.2
EDR	67.9	12.6	64.0	12.3	110.9	28.6
Total	**537.2**	**100.0**	**519.0**	**100.0**	**387.5**	**100.0**
Physiographic regions						
High Himal	NA	NA	24	5	NA	NA
High Mountains	NA	NA	225	43	NA	NA
Mid Mountains	NA	NA	104	20	NA	NA
Siwaliks	NA	NA	118	23	NA	NA
Tarai	NA	NA	48	9	NA	NA
Total			**519**	**100**		

Source: MPFS, 1988; DFRS, 1999; WECS, 1988

2.4 Status of High altitude forests in two Mountain districts

The Leasehold Forests and Livestock Development Programme (LFLP) in support from FAO has prepared recently (2011) District Forestry sector Plan of two mountain and hills districts Panchthar. The growing stock of high mountain forests in these two districts have been presented in the Table 2.10 and 2.11 for better understanding of the existing scenario of productivity of high mountain forests in Nepal

2.4.1 Stand density and Species Composition

Quality of forests in terms of stand density of principle and other commercial species is not satisfactory. High altitude forests are over aged (with an average age of more than 125 years) thereby dominated by over-matured trees (between 50-94/ha with average dbh more than 50 cm). Regeneration (saplings) seems satisfactory but their rate of conversion to higher diameter classes is very poor. Of the total regeneration 2.4 to 7.2% regeneration in the high altitude forests in Sindhupalchowk has grown into poles and 17.4 to 38.2% poles are converted to trees. While in mid-hills most of the poles being originated from plantation and no thinning were done timely 16.9 % to 19.7 % of poles have been grown to trees (Table 2.10).

High alpine and sub-alpine forests (B&R and Juniper and Cupresseus) are heavily exploited by transhumance grazers for firewood, therefore, composition of principle species such as

Birch Rhododendron and junipers and *Cupressus* is badly altered, the space created from over exploitation of mature trees is taken by Rhododendron and invasive shrub species such as *Viburnum* and *Cotoneaster*. Similarly, because of heavy biotic pressure (lopping for fodder) the lower temperate Oak forests (khasru) are badly degraded.

Table 2.10: Status of Regeneration, Poles and Trees (per ha) in Sindhupalchowk

SN	Type of forest	Saplings	Poles (10 cm-30 cm dbh)				Trees (>30 cm dbh)		Total pole/tree
			10-20 cm		20-30 cm				
			No	% of 1	No	% of 2	No	% of 4	
		1	2	3	4	5	6	7	8
1	Birch Rhododendron Forest	2000	135	6.8	76	56.3	51	67.1	262
2	Fir Forest	2000	129	6.5	110	85.3	55	50.0	294
3	Temperate Mountain Oak Forest	3100	125	4.0	92	73.6	72	77.7	289
4	East Himalayan Oak Laurel Forest	1690	105	6.2	85	81.0	53	62.4	243
5	Lower Temperate Oak Forest	2162	106	4.9	68	64.2	39	57.4	213
6	Chirpine Broad Leaved Forest	12	283	2358.3	300	106.0	115	38.3	698
7	Schima Castonopsis Forest	250	375	150	476	126.9	144	30.3	995
8	Hill Sal Forest	10467	340	8.302283	140	106.9	41	37.8	521

Source: COMFORTC Field Survey, 2010/11

Similarly conifers are replacing broadleaved species in Temperate Mountain forests and other bread leaved forests of the high altitude areas. Oaks are heavily lopped and high commercial values species such as hill Chanp (*Michelia deltopsa*), *Acer* spp, and Aarupate (*Prunus nepalensis*) and Banseth (*Quercus lamellosa*) are mostly exploited.

The situation of high altitude forests in Panchthar district is also not different from taht of Sindhupalchowk (table) . From the above discussion it can be concluded that forests in the Mid-hills are largely under community forests managements providing the local communities the incentives to protect and manage their forest in a sustainable way, while majority of forests in the high mountain regions are under government management Regimes, absence of proper institutions and adequate incentive packages forests in these areas closely resembles the free rider problems of an open access regimes thereby resulting in over exploitation, mismanagement and degradation of natural forests.

2.4.2 Growing Stock and Productivity

The figures in the Table 2.10 and 2.11 shows that there is drastic decline in per ha standing volume of high altitude as compared to MPFS and NFI. The average weighted per ha volume of high altitude forests in the Sindhupalchowk is 97.47 m^3 and 76.46 m^3/ha in Panchthar. Similarly the mean annual growth also varies between 0.61 m3 9 Birch Rhododendron forests) to 1.7 5 m^3 (Fir Forest) while MAI of high altitude forests in Panchthar varies

between 0.7 m^3 (Lithrocarpus Forests0 to 1.4 m^3 (Fir forests). In both the districts conifers dominates the volume while volumes of typical high altitude broadleaved species such as *Betula alnoides, Michelia deltopsa, and Prunus nepalensis*, is less than one percent of the total standing volume.

Table 2.11: Growing Stock of Different Forest in Panchthar District

Forest type	Volume m^3/ha						Mean Annual Growth m^3/ha
	Poles			Trees	Grand Total		
	10-20 cm DBH	20-30 cm DBH	Total		Volume	%	
Lithocarpus Forest	1.993	9	11	40	51	8	0.7
Pinus wallichiana and Fir Forest	1.483	7	8	95	103	15	1.4
Mixed Rhododendron Maple Forest	4.973	13	18	64	82	12	1.2
Temperate Mountain Oak Forest	4.991	9	14	79	93	14	1.3
East Himalayan Oak Laurel Forest	5.044	8	13	40	53	8	1.1
Chirpine Broad Leaved Forest	7.020	18	25	48	73	11	2.6
Schima Castanopsis Forest	2.619	13	16	51	67	10	2.0
Hill Sal Forest	13.295	22	35	121	156	23	6.2

Source: COMFORTC Field Survey, 2011

2.5 Forest Ownership

Forests and Shrubland are under the jurisdictions of two public land management agencies: Department of Forests (DoF) and Department of National Parks and Wildlife Conservation (DNPWC), under the Ministry of Forests and Soil Conservation (MFSC).The forests and shrubland under DoF are collectively known as the National Forests, whereas those under DNPWC are known Protected Areas (PAs). Table2.12 presents the total area of major land category of high mountain regions in terms of ownership.

The figures in the table show that about 78% of total areas of forests is under the DFO jurisdiction or the national forests. Of the remaining 25% of forests 10 % falls in the National parks and rest in the conservation areas (12.5%) and Buffer zones (2.4%).

The National Forests under DoF are categorised into five types based on the management rights assigned to different entities. Of them two community based management regimes: Community Forestry (CF) and Leasehold Forestry (LF) are the major ones, while forests outside these management regimes are known as government managed forests. By July 2011, 384808 ha of forests areas (forests/shrublands including grassland and barren land) has already been handed over to 4910 Community Forests Users Groups (DoF 2012). This is about 28% of total CFs of Nepal and 20.25 % of total national forest (forests and shrubland) of the high mountain regions. Similarly, there are 859 Leasehold Forest Users Groups with an area of 10470 ha of degraded or barren forest land (Table 2.13 and Annex X). This is 30.14 % of total area of leasehold forestry of Nepal and 0.55% of national forests (forest & shrubland) of high mountain regions (CFD/DoF, 2012, LFLP/DoF, 2012).

Table 2.12: Distribution of Land Area by Management Regime (in '000' ha)

Land Cover	High Mountain	NF		NP		CA		Buffer Zone[2]	
		Area	% of HM	Area	% of HM	Area	% of HM		% of HM
Agriculture	299.8	258.3	89.4	10.6	3.5	21.1	7	9.8	3.3
Forest	1561.6	1172.1	77.5	156.7	10	195.1	12.5	37.7	2.4
Shrubs	339	217.0	67.2	49.3	14.6	62	18.3	10.7	3.2
Grass	969.5	605.7	64.4	131	13.5	214	22.1	18.8	1.9
Barren Land	2306.6	1069.3	49.1	536.8	23.3	637.2	27.6	63.3	2.7

Source: Department of Survey, TIPs/DoF Ecological GIS Maps 2002

Table 2.13: Forest area under different ownership arrangement

Category	**Sub Category**	**Unit**	**Area**	**% of total forest area**
Nepal	Forests and shrubland	000 ha	5830	100
High Mountain	Forests and shrubland	'000'ha	1900.6	32.60
National Forest	Government-managed forest	'000'ha	993.8	52.29
	Community Forest	'000'ha	384.8	20.25
	Leasehold Forest	'000'ha	10.47	0.55
Protected Areas	Forests and shrubland		511.6	26.92
National Parks	Buffer Zone Community Forests	000'ha	69.69	13.62
Conservation Areas	Community Forests	000'ha	309.3	

CFD/DoF, 2012; LFLP/DoF, 2012, DNPWC, 2011,

Similarly, a total of 696900 ha of forests has been handed over to 191 Buffer zone Community Forests Users Groups (BzCFUG) . The Rara National Park and Khaptad National Park do not have any community forests. Conservation protected areas system also comprises substantial number of community forests; however, except Kachanjangha conservation areas information about community forests could not be available. According to the KCA annual report about 309305.77 ha of forests have been handed over to 25 CFUGs (KCA, 2066) . See Annex X for district and management regime wise detail information.

2.3 Forest cover change and transition path

2.3.1 Forest cover change

As discussed earlier database on forest cover are old, conflicting and inconsistent. MPFS (1988) provides district-wise landuse data on both development and physiographic level, whereas NFI of DFRS provides overall data on development region level. Similarly, the government authorized agency Central Bureau of Statistics (CBS, 2008) citing sources again

[2]No detail information except total area is available for buffer zones. therefore the figure were derived from weighted land cover by each landuse types of the corresponding districts and assuming 15% of total buffer zone area is above 2000m

from Department of Forests (Information System Development Project for the Management of Tropical Forest, Activity Report of wide Area and Tropical forest Resource Survey, March 2001) publishes district wise landuse data but combines the distinct separate land category the grassland with agriculture. Therefore, the study team observed serious problems to compare forest (forest, shrub, barren land within forests and grassland) cover changes and its dynamics or the pathways.

Review of several inventory and study reports and publications reveals significant changes in both forests and shrub areas in the High Mountain regions over the past three decades. Overall conclusion of these reports is that conversion of forests to shrubland and shrubland to grassland is conspicuous, nonetheless, extent of forest cover changes varies among the literatures and publications. As no high altitude areas (area above 2000m) focused landuse studies have been carried out so far at national level, the district wise land use data provided by MPFS has been taken the baseline information to compare forest cover changes in the proposed high mountain 25 districts with that of NFI (1998) and landuse data derived from Department of Survey, TIPs, GIS Map 2002. Table 2.14 presents the status of major landuse in different periods of time. See Annex XI for district-wise details.

Table 2.14: Landuse change between 1985/96 and 2001/2002 in 25 High Mountain districts of Nepal

Landuse	MPFS(1985/86)	2001/2002	Difference	Change %	Change/year
Cultivated land	566	236	-329	-58.2	-3.6
Forests	2061	969	-1092	-53.0	-3.3
Shrubland	331	2307	1976	597.9	37.4
Grassland	1452	339	-1113	-76.7	-4.8
Barren land/NCI	306	1562	1256	410.7	25.7
Others	2503	1782	-721	-28.8	-1.8
Total	7218	7195	-23	-0.3	-.02

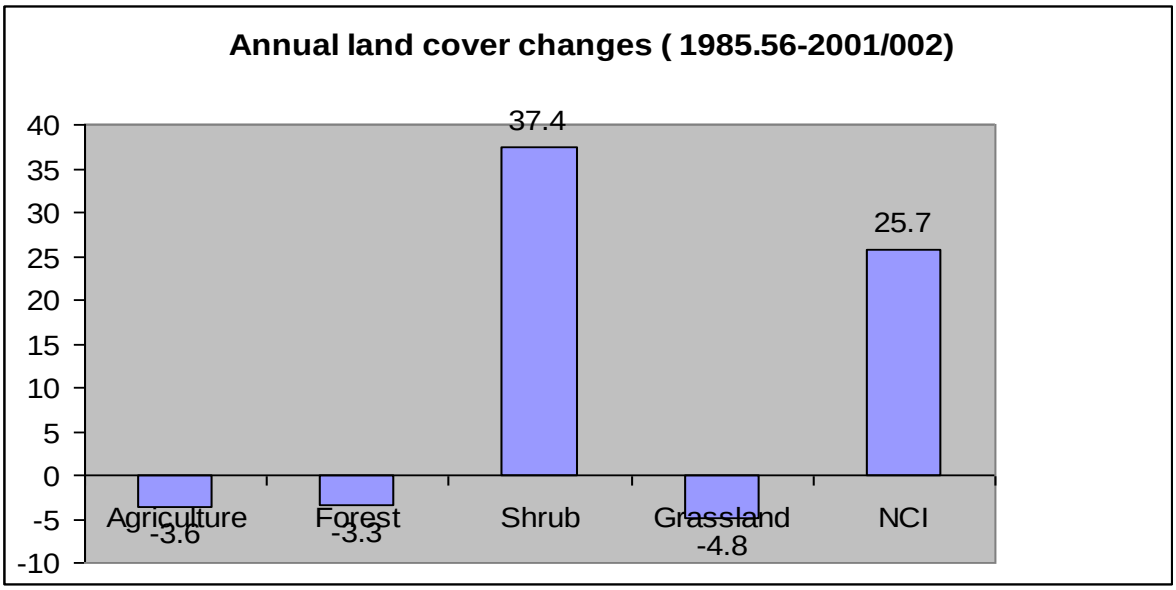
Source: MPFS, 1988, Department of Survey, TIP/GIS Maps 2002.

The figures in the table show that there is significant decline in the area of cultivated land (58.2%), forest (18.74%) and grassland (32.48%) between 1985/86 and 2001/002 with an annual rate of 3.6, 3.3 and 4.08 respectively. And the area covered by shrubland and barren land or NCI has drastically increased at an annual rate of 37.4 and 25.7 respectively. Most interestingly, the figure in the table also shows that there is decline in the total area of land mass by 0.3% (2300 ha) between 1985 and 2001. This could have been the methods of survey, area calculation, landuse classification criteria and other technical errors. Whatever be the case, there is serious problem of reliability of data set and confidence level of landuse survey and forest inventory in Nepal.

There is no doubt that there are significant changes in the landuse patterns. Agricultural land have been left fallow and abandoned thus contributing to barren land or NCI, forests are

slowly and gradually converting into shrubland. During the 1980s and early 1990 significant area of barren land and grassland[3] has also been converted into plantation forests.

Figure 2.4: Annual land cover changes between 1985/86 and 2001/2002



The national trends as presented by Kanel *et al*(2009) also shows that natural forests are declining at -2.2% (0.22 % rate/year)between 1991-2001, while shrubland and cultivated land are increasing at 21.8% (2.18 % rate/year) and 1.4% (0.14%/year) over the same period (Table 2.15). From this it can be concluded that forests areas are being converted into shrubs and agriculture land

Table 2.15: Landuse Changes over times in High Mountain Regions (1991/92-2001/02)

Land Use Types	1991/92	2001/02	Difference	% of Change	Change Rate/Yr
Cultivated land	207761	210635	2874	1.4	0.14
Non-cultivated land	494998	517309	22311	4.5	0.45
Forest	233346	228100	-5246	-2.2	-0.22
Shrubland	137800	167800	30000	21.8	2.18
Grass land	132644	137644	5000	3.8	0.38
Other	796618	946212	149594	18.8	1.88
Grand Total	**2003168**	**2207700**	**204532**	**10.2**	1.02

Source: Kanel et al 2009

Similarly, MFSC (2009)in its the Future of Nepal 's Forests Outlook for 2020 also reports that the annual rate of forest cover change between 1994-2005 was -5.22% while shrubland increased by 2.79%/year during the same period (Table 2.16).

[3] Significant area of pastureland/grassland in the lower temperate region of Sindhupalchowk and Dolkha districts were heavily planted by Swiss and Australian projects between the period 1970-1990; at present these plantations have been developed into forests (Personal experiences).

Table 2.16: Forest Cover change in different time series

	Period			
Cover Type	**1978/1986**	**1986/1994**	**1978-1994**	**1994/2005**
Forest Cover Change	-112.8	-1236.0	-1348.8	-632.0
Shrub land change	16.1	854.0	870.1	337.0
Total	-96.7	-382.0	-478.7	-295.0
Change /year	-12.1	-47.8	-29.9	-26.8
Forest	-14.10	-154.50	-84.30	-57.45
Shrubland	2.01	106.75	54.38	30.64
Change/year %				
Forest	-1.76	-19.31	-5.27	-5.22
Shrubland	0.25	13.34	3.40	2.79

Source: MFSC, 2009

A number of location specific studies also suggest a significant loss of forest area and their quality. The following section presents three site specific studies carried out by Nepal Australian Community Resource management Project (NACRMP) and Swiss Development Corporation (SDC), Nepal. The first one was carried out by NACRMP in 1995 in the Mabahrat lekh of Kavrepalanchowk and Himalayan lekh of Sindhupalchowk. And the other two studies were recently carried out by SDC in Dolkha and Melamchi watershed areas of Sindhupalchowk. The first one typically represent the high mountain forests with little government interventions showing open access regimes. Of the two studies carried out by SDC, the first largely covers high mountain forests managed by community forests users groups with intensive inputs from the government and SDC from 1970s while the study area in the Melamchi watersheds typically represents the Mid-hills dominated by community forestry.

(i) The case of Mahabhrat Lekh and Himalayan Lekh, NACRMP

A study carried out by Tamrakar (1996) and Jackson et al (1998) in the4 VDCs of the Himalayan Lekh of Sindhupalchowk and in 12 VDCs of the Mahabhrat Lekh of Kavrepalanchowk for NACRMP shows an alarming decline of mixed and broad leaved forests similar trend of land use change. The rate of decline of mixed forest and broadleaved forests are 59% and 6% in the VDCs Kavrepalanchok and 32% and 22% in the VDCs of Sindhupalchowk. Similarly, the shrubland has increased by 205% in Sindhupalchowk, although it was stable in Kavrepalanchok. The grassland has also increased in both locations in the fourteen years period. In Kavrepalanchok the increase of grass land is found by 85%,whereas in Sindhupalchowk the increase is remarkably high by 214%. (Table 2.17). This shows that the forests are degrading into shrubland while grasslands are gradually colonizing as shrublands and vice versa.

Table 2.17: Landuse Change from 1978-1992 in the high altitude in Mahabhrat Lekh of Kavrepalanchowk and Himalayan Lekh of Sindhupalchowk (areas in hectares)

Landuse Category	Kavrepalanchowk			Sindhupalchowk		
	1978	**1992**	**% change**	**1978**	**1992**	**% change**
A. Forests and Shrubs						
Mixed Forest	4010	1639	-59.1	3764	2553	-32.2
Broadleaved	6106	5744	-5.9	3068	2403	-21.7
Coniferous	126	1194	847.6	1609	1442	-10.4
Plantation	131	600	358.0	0	11	0.0
Shrubland	3983	3974	-0.2	636	1938	204.7
Sub-total	**14356**	**13151**	**-8.5**	**9077**	**8347**	**-8.0**
B. Agriculture, grassland and Other Lands						
Agriculture	6771	5661	-16.4	457	371	-18.8
Grassland	2046	3784	84.9	296	929	213.9
Riverine	116	147	26.7	0	0	0.0
Urban	30	31	3.3	0	0	0.0
Erosion Areas	900	1453	61.4	0	184	0.0
Sub-total	**9863**	**11076**	**12.3**	**753**	**1484**	**97.1**
Total Sample Area	**24219**	**24227**		**9830**	**9831**	

Figure 2.5: Landuse Change (1978-1992) in the High Mountain regions of Kavrepalanchok (adopted from Messerschmidt and Rayamajhi (1996) and Jackson et al (1998)

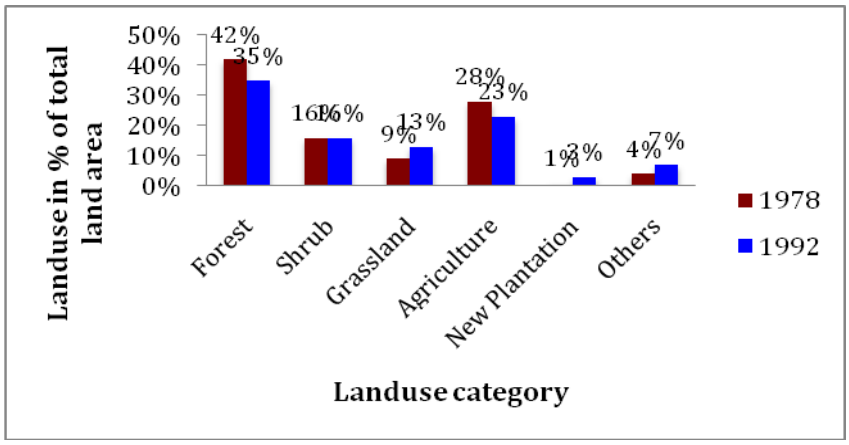
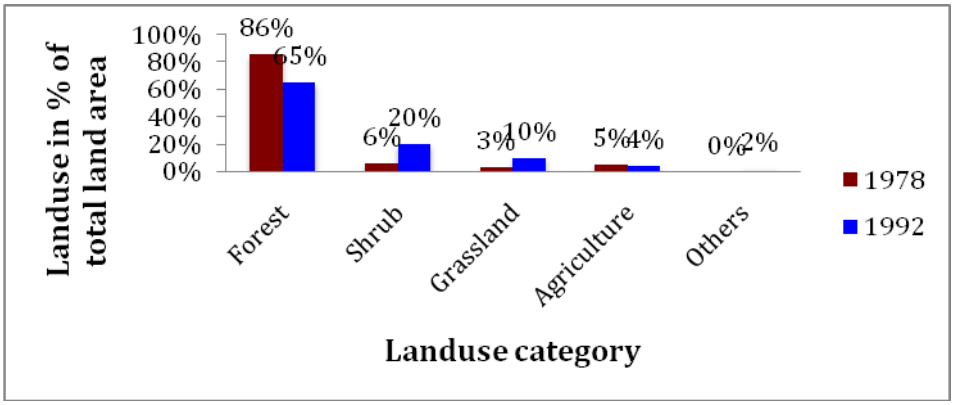


Figure 2.6: Landuse Change (1978-1992) in the High Mountain regions of Sindhupalchowk (adopted from Messerschmidt and Rayamajhi (1996) and Jackson et al (1998)



Change in Forest quality

Forests in High Mountain areas, not only the cover but also in terms of maturity, crown density and productivity are also degrading. An analysis of four major forest types of High Mountain areas: Broadleaved, Confers, Mixed and Shrubland in the Bhirab Kunda sub-watershed of Sindhupalchowk by Tamrakar (1995) and Tamrakar (1996) found that the mature to over mature forests were vanishing at a rate of 0.86% per year in between 1978 and 1992. The study also found that area of mature to over mature forests declined from 58% to 46%% in Sindhupalchok and from 22% to 12% in Kavreplanchok. However, there was some increase in immature forests and shrublands in both locations (Table 2.18).

Table 2.18: Proportional Change (in percentage) in Forest Maturity Classes in Mahabharat and Himalyan Lekh (1978-1992)

Maturity Class	**Mahabharat, Kavrepalanchowk**				**Himalyan Lekh Sindhupalchowk**			
	1978	1992	Change	Annual	1978	1992	Change	**Annual (+/-)**
1. Mature to over mature (trees at saw timber size)	22	12.00	-10.00	-0.71	58.00	46.00	-12.00	-0.86
2. Immature (small saw timber dominated by pole sized trees)	19	47.00	28.00	2.00	35.00	31.00	-4.00	-0.29
3. Regeneration	0.8	9.00	8.20	0.59	0.00	0.00	0.00	0.00
4 Shrub	28	32.00	4.00	0.29	7.00	23.00	16.00	1.14
Total Forest Area	14225	12542	-1683	-120.21	9076	8335	-741	-52.93

Source: Tamrakar (1995 and 1996) as cited in Messerschmidt and Rayamajhi (1996)

Similarly, area under natural forest with 50 to 70% crown cover has significantly decreased in both lekhs from 21% to 13% in the Mahabhrat Lekh and from 62% to 11% in the Himalayan Lekh between the same periods (Table 2.19).

While the area of immature forests increased by 15.8. Of them most area have been turned down to a small area were converted about 3% with stocked with poles and small trees have been converted into immature forests

Table 2.19: Proportional Change (in percentage) in Forest Density Classes in the Mahabharat and Himalyan Lekh (1978-1992)

Crown Class	**Mahabharat, Kavrepalanchowk**				**Himalyan Lekh Sindhupalchowk**			
	1978	1992	Change	Annual	1978	1992	Change	**Annual (+/-)**
1. Sparse (10-30% crown cover)	23	27.00	4.00	0.29	29.00	23.00	-6.00	-0.43
2. Moderate (30-50% crown cover)	24	27.00	3.00	0.21	0.00	0.00	0.00	0.00
3. Moderately dens (50-70% crown cover30-50% crown cover)	21	12.00	-9.00	-0.64	62.00	11.00	-51.00	-3.64
4. Dense (> 70% crown cover	3	1.00	-2.00	-0.14	2.00	0.00	-2.00	-0.14
5. Shrub	28	32.00	4.00	0.29	7.00	23.00	16.00	1.14
Total Forested Area	14225	12542	-1683.00	-120.21	9076	8335	-741	-52.93

(ii) The case of Accessible High Mountain forests largely on communal management regimes supported by DoF and donors

The study was carried out by Niraula and Maharjan (2011) fro SDC using the Landsat TM imageries of 1990 and 2010 on three cluster (Bhimeshwor, Singati and Thulopatal) of Dolakha district covering a total area of 27,902.03 ha in 10 VDCs. The study has shown that there is an increase in forest cover and density. The study shows that the forest density has improved in all three studied clusters between 1990 and 2010. The rate of conversion of sparse forest into dense forest has been found between 1.13 to 3.39% per year. Similarly, the rate of conversion of non-forest area into forest has been found between 1.11 to 1.96% per year. Further, the study reveals that the rate of conversion of non-forest areas into forests in the community managed forests is higher than that in the government forests and the private forests

(iii) **A typical Mid-hills dominated largely by community based forestry with strong linkages with high mountain forests.**

The study was carried out by HELVETAS, Nepal in 2011 to assess the forest cover change between 1990 and 2010 under three broad forest management regimes (Government based forestry, Community based Forestry and Privately owned forestry) in eight VDCs of Malachi watershed of Sindhupalchowk. The study with primary data justifies that there is an overall increase in forest area and forest quality, with a significant increase in dense forests (Table 2.20 and Figure 2.7). However, the study suggests variations within a particular management regime. The study further explains that deforestation exist in all types of regime, but a lesser degree in community based forestry and more in privately owned forestry, and most interestingly, no change was found in forests under government management regime. Overall conclusion of the study is that tenure rights over the forest resources is critical factor protecting the forests from human induced deforestation and forest degradation (HELVETAS, 2011)

Table 2.20: Status of Land cover in 1990 and 2010 in Eight VDCs of Melamchi Watershed of Sindhuplachowk

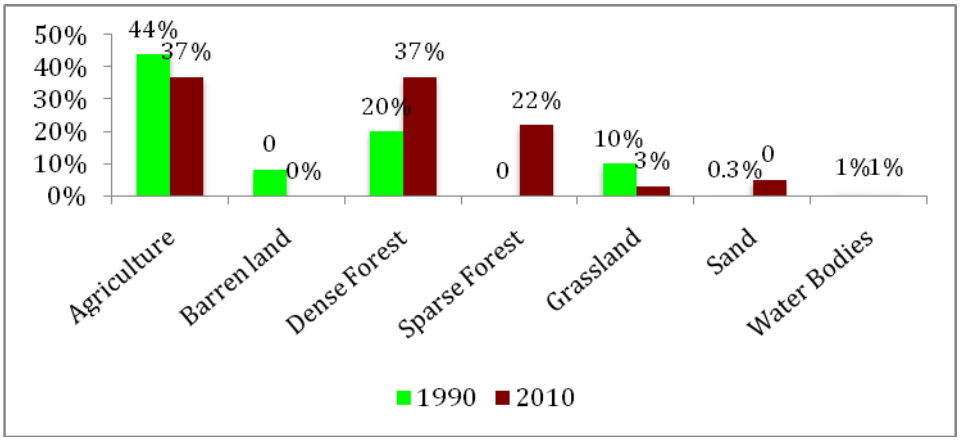
Land cover	1990		2010		Change (+/-)	
	Area (in ha)	%	Area (in ha)	%	Area	%
Agriculture	5580.82	43.63	4812.86	37.50	-767.96	-6.00
Barren land	10.4	0.08	34.58	0.27	24.18	0.19
Dense Forest	2569.23	20.09	4718.86	36.76	2149.63	16.81
Sparse Forest	3191.11	24.95	2794.04	21.77	-397.07	-3.10
Grassland	1314.58	10.28	395.94	3.08	-918.64	-7.18
Sand	33.94	0.27	6.5	0.05	-27.44	-0.21
Water Bodies	90.19	0.71	72.5	0.56	-17.69	-0.14
Total	12790.27	100	12835.28	100.00	45.01	0.35

Source: HELVETAS, 2011

The study also reports that the forests have improved in all tenure regimes. Community forestry did the best by increasing the new forest areas by almost 33% and improving forest quality by 20%. In comparison, forests in the government managed regime increased by 17% and the quality of forest improved 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 11% of newly created forest is on private land (HELVETAS, 2011).

Figure 2.7: Comparison of land cover change between 1990 and 2010 in Melamchi watershed area



Change in Forest Quality

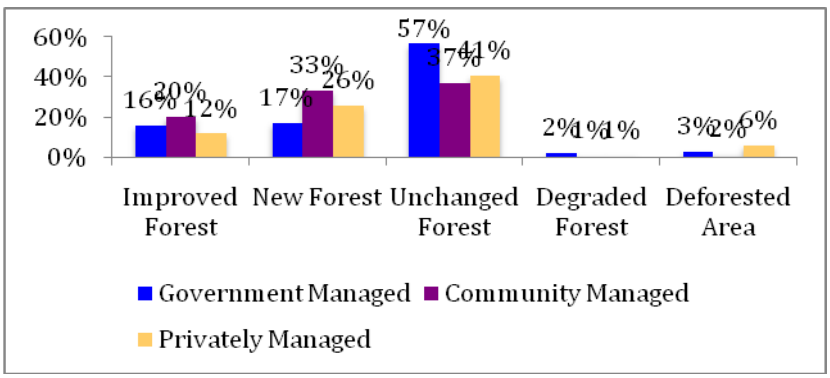
The HELVETAS study (2011) has also shown that community forest regimes have done extremely well in terms of both creating new forest and improving forest quality as compared to that of government managed forests. About 33% of community forest has been created as new forest as compared to 17% of the forest under government control (Table 22 and Figure 2.8) between 1990 and 2010. Similarly, improvement on forest quality in community forestry is also higher (about 20%) than that of government managed forest (about 16%) over the same period of time (HELVETAS, 2011).

Table 2.21: Forest cover change by Management Regime in Melamchi Watershed area from 1990 to 2010 (%)

	Improved Forest	New Forest	Unchanged Forest	Degraded Forest	Deforested Area
Government Managed	15.81	17.22	56.75	2.25	2.65
Community Managed	20.06	33.43	37.23	1.04	1.61
Privately Managed	11.83	25.77	40.52	0.99	5.99

Source: HELVETAS, 2011

Figure 2.7: Forest cover change by Management Regime in Melamchi watershed area from 1990 to 2010



Overall Assessment

It was observed in the field visit and transect survey and participatory mapping of forest visited (Annex) in the sample districts that the less accessible and more remote High altitude forests, which are mostly under government managed regime or protected areas systems are more dense, and mature than those closer to the human settlements. In contrast community forests or forest managed by local community are dominated by immature and young tress, with a few scattered mature and over mature trees. The human pressure for long time before community forestry handover can be evident in these forests. Nevertheless, these forests in and around the settlements or the forests managed by the local communities are significantly in better condition in density and species composition.

Increase in road networks and development of market centers are seen exerting pressure to nearby forests and shrublands. Removal of forests cover for both commercial and subsistence needs around market centers and areas accessed by road network is seen quite extensive.

The areas between 2000 m to 2500 m are under extreme pressure of grazing as the lower winter yak/chauri pastures and high summer water buffalo-common cattle pasture overlap. In areas where the forests that include yak/chauri winter pasture are handed over as CF the nearby government forests are much degraded. This is because the grazing pressure shifted to nearby government forests as CF imposed restrictions in their areas. These areas are found highly degraded due to over grazing and lopping of khashru trees, and also by clearing for pasture expansion. Trampling by grazing animals has made these areas highly prone to soil erosion.

Pressure for fodder, firewood and timber in lower temperate region and firewood in the sub-alpine and alpine areas during the summer season is heavy.

Forest in these areas are highly degraded due to over cutting of trees such as Junipers, Cuppressus (thulo dhupi) , Birch, Sunpati (*Rhododendron spp*). Harvesting of these species is mainly for firewood, *goth* (cattle shed) construction and also for trade. Lopping and branch cutting of Sunpati and Cupressus and Junipers are done to sale as NTFPs and incense. Indiscriminate lopping and branch cutting has made a change in species composition bringing the change in the highly sensitive ecotype of the region. Over harvesting of valuable species (both broadleaved and conifers) and thus opening up has made least valuable species such as Rhododendron, Cotoneaster (Bhangaru), Lyonia (Angeri), Eurya (Jhingan) and conifers to mushroom.

Regeneration density was found to be better in forests with a large opening created by forest fire and removal of trees, particularly in temperate region dominated by Fir and Bluepine. While the regeneration of preferred broad leaved species such as Khashru, Banseth, Champ andArupate (in Mixed forests of temperate and lower temperate region) and conifer species such as Abies, Tsuga, Cuppressus and Junipers are poor and are invaded by less preferred and non-valuable species such as Rhododendron, Symplocos (kholme), Lyonia, Eurya, and shrub and weed species such Contoneaster, Berberis, and Viburnum. .

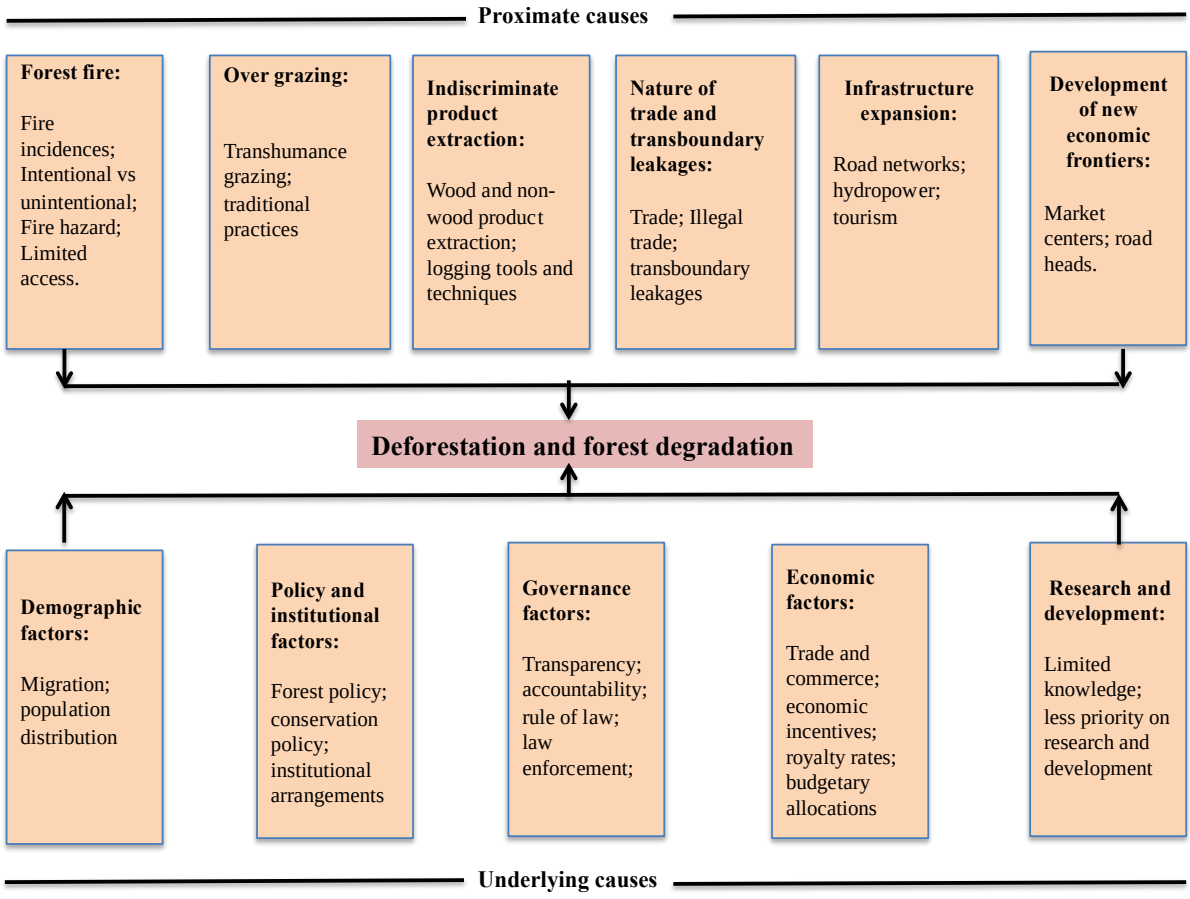
In conclusion, forests, particularly those under government management regimes in the lower temperate region and sub alpine and alpine areas are under extreme pressure for fodder and firewood showing higher level of degradation in quality, species diversity and density. They have been converting into shrublands and pasture, while pasture in temperate and lower temperate regions where transhumance grazing is abandoned is slowly and gradually converting into shrubland of invasive species. The Alpine Junipers scrubs and Cupressus and Juniper forest in the Sub-alpine zone are heavily cut for firewood by the transhumance graziers, trekkers and labour of the expedition team. In many localities, they have been threatened if not exterminated (discussed in detail in the next section).

To the contrary, except a few cases majority of high altitude forests managed by local communities have shown various positive impacts on restoration of forest cover, improving forest quality and wanton exploitation of trees for wood and fodder. The three case studies presented earlier justifies that unless a special local indigenous knowledge based and community friendly institutional arrangement is made, the lower temperate oak forests, and highly decorative and commercial broad leaved species and Junipers and Cupressus forests, there degradation and finally extermination is inevitable.

Chapter III: Drivers of Deforestation and Forest Degradation

Deforestation and forest degradation is caused by multiple drivers and pressures. Some of these causes are proximate[4], which are more immediate human activity at local level and some are, underlying factors, which are more fundamental in nature such as policy, institutional and social processes. These drivers are closely linked and interact in a complex way. An assessment is made through field observation, interaction and household survey to identify and assess the extent of these drivers for the deforestation and forest degradation of High Mountain forests. The proximate causes are found to be Forest fire, Over grazing, Indiscriminate product extraction, Nature of trade and transboundary leakages, Infrastructure expansion, and Development of new economic frontiers. Similarly, the underlying causes are identified as: Shift in demographic profile, Policy and institutional arrangement, Governance, and Lack of research and development.

Figure 3.1: Proximate and Underlying Causes of Deforestation and Degradation in the High Mountain Region of Nepal



[4] Geist and Lambin (2002) and Kanel (2004) have illustrated proximate causes as immediate human activities which are operational at the local level underlying causes as the fundamental social processes.

3.1 Proximate causes

Out of 6 proximate causes of deforestation and forest degradation in the High mountain region forest fire, open grazing and indiscriminate product extraction are perceived as the most critical factors. 73% of respondents out of 242 stakeholders and local community members consulted in 10 districts perceive that the forest fire is the most important factor. The second important factor is perceived as over grazing and third important as the indiscriminate product extraction (see table 3.1). All categories of respondent- users, traders, civil society members and government consider the forest fire as the important factors of deforestation and forest degradation. The priority of the factors given by the respondents is presented in table 3.1.

Table 3.1: Perception of stakeholders and community members on the proximate causes of degradation and deforestation

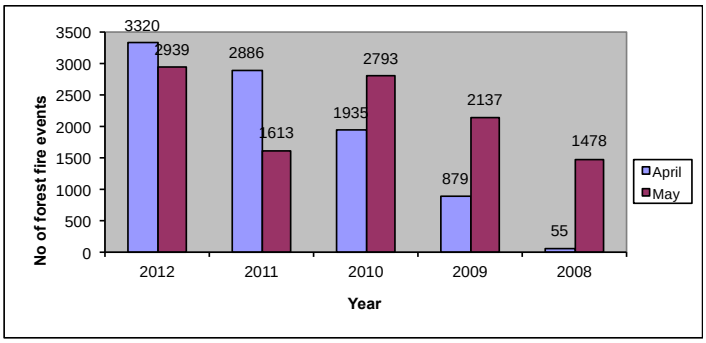
	Users		Traders		Civil Society		Government		Total	
Forest fire	118	84%	21	75%	27	54%	10	43%	176	73%
Over grazing	79	56%	14	50%	22	44%	6	26%	121	50%
Indiscriminate product extraction	60	43%	11	39%	17	34%	7	30%	95	39%
Illegal trades	24	17%	3	11%	5	10%	3	13%	35	14%
Infrastructure expansion	16	11%	3	11%	0	0%	1	4%	20	8%
Development of new economic frontiers	3	2%	1	4%	2	4%	2	9%	8	3%
Others	4	3%	0	0%	0	0%	0	0%	4	2%
	N=141		N=28		N=50		N=23		N=242	

COMFORTC Field Survey 2012

3.1.1 Forest fire

An analysis of fire incidents in the last four years (Figure 3.2) shows that about 10-15% of total forest fire events in the country occurred in the High altitude districts and they lasted on an average at least three -four days. High altitude forests are highly vulnerable to forest fire as huge quantity of leaf litter, debris and highly inflammable biomass is deposited on and underneath the forest floor (ICIMOD, 2012).

Figure 3.2: Forest fire incidents in Nepal in two peak fire season of April and May from 2008-2012



Source: www.icimod.org, 2012

Moreover, the presence of conifer trees with stems cut for torches, thick layer of lichens and mosses covering all parts of the trees make these forests highly sensitive and vulnerable to fire. Thus, once a fire is set or enters into the forests it become almost impossible to extinguish. Both crown fire as well as underground fire occurs particularly in southern and western aspects dominated by conifer trees.

Unlike Mid-hills forests, the High altitude forests are not fire resistant. Even a small fire can badly damage the regeneration of preferred species inviting non-preferred species to grow. The topography, climate condition, remoteness and low population make it almost impossible to take necessary steps of controlling once the fire is noticed.

79% of respondents believe that the forest fire is the major cause of deforestation and forest degradation (see table 3.2). High altitude forests receive a substantial number of fire incidences in the dry season of the year- April and May. In the year 2010, 2011 and 2012 about 170-180 fire incidents are recorded (see figure 3.3).

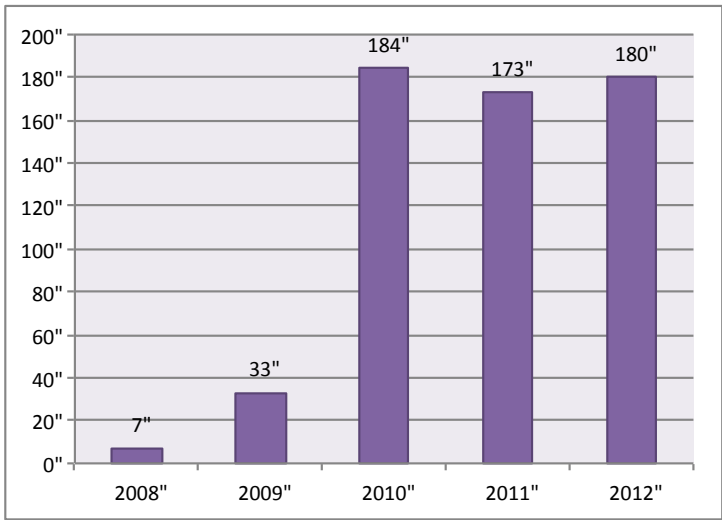
Table 3.2: Respondents' perception about forest fire as the major cause of DD

Statement	Highly Agreed		Agreed		Neutral		Disagree		Highly Disagree		Don't Know	
	N	%	N	%	N	%	N	%	N	%	N	%
Forest fire is the cause of DD	167	69%	23	10%	15	6%	1	0%	0	0%	36	15%

Statement	Yes		No		Don't Know	
	N	%	N	%	N	%
Forest fire is the major cause of DD	190	79%	16	6%	36	15%

COMFORTC Field Survey, 2012

Figure 3.3: Forest fire incidents in High altitude forest in April from 2008-2012



Source: After www.icimod.org

Data and information about forest fire are limited. ICOMOD has launched a system of forest fire detection and monitoring for Nepal. The system is based on the Moderate Resolution Imaging Spectroradiometer (MODIS) sensors on board NASA's Terra and Aqua satellites that facilitate data acquisition, processing, and reporting on fire location information in an automated manner. According to ICIMOD, 70 district forest officers and 75 focal persons of the Federation of Community Forestry Users Nepal (FECOFUN) have already subscribed to the system. However, the utility of the system is not reported yet.

Many of the High altitude forests in distant location from human settlements are large and contagious, dense and relatively least disturbed. In this regard they closely resemble the core areas of forests of protected area system in terms of area, density and number of fire incidences. Considering the fire hazard deposited in the High altitude forests and comparing the extent of losses of forests (area totally burned, areas semi burned, and area with minor surface fire) to that of Chitwan National Park[5]).

Causes of Forest Fire

Most of the fire incidence in the High altitude areas is intentional except in some parts of the transhimalayan region such as Dolpa. Unintentional fires are either escaped from the adjoining Mid-hills, from the farmland or enter from the boarder of Tibet. There are incidences where such fires lasted for several weeks. The crown and pit fires of 1969 and 1992 were the major forests in Kalinchok region of Dolakha district, which were the fires escaped from Tibet[6]. These fires caught many High Mountain forests of all development region from Taplejung to Darchula and remained for several months.

Intentional fire for new grasses in not practiced in High Altitude areas:

As in the lower temperate and sub-tropical regions, graziers at alpine and sub-alpine regions do not set fire for new grasses. When summer starts, snow in the Subalpine areas starts melting from the month of Falgun (early March) and in Alpine from Mid Chaitra (end of March). It takes two-three months to come new flushes of grasses in these areas. Once the grasses are fully-grown and the temperature in the Temperate region rises, chauri/yak herders also shift their herds from temperate to Sub-alpine and to Alpine zone. As the temperature become too cold after the Mid of Bhadra (early September), the herds descend down gradually reaching lower temperate region on December/January. The Sub-alpine and Alpine pastures are intensively used for 2.5 months to 3.5 months a year and in the rest of the month the herds remain in the Temperate and lower region. Thus, setting fire for new grasses is not a practice in these regions. It is not wise to blame the transhumance graziers that they set fire on forest for new grasses though it is a tool used by foresters, ecologists and local communities of the tropics. (Based on the FGD and the personal experience of Nav Raj Baral).

[5] Chitwan National park is taken as a reference because ICIMOD has published data on the loss of forests from fire in this park.

[6]High altitude forests adjoining to Suspa Deurali Community Forests in the Kalinchowk regions faced two major crown and pit fires. The fire remained for a week and extinguished after the onset of heavy rain. More than 75% conifer trees were burnt and dead. The open spaces created by fire were later invaded by Nigalo, Symplocos, and Berberis while a few scattered openings are densely regenerated with Tsuga and Abies. Two women gone for grass cutting were trapped in the fire and were dead. More than 250 local people including personnel from district head quarter were involved in fire fighting however, all efforts failed because of crown fire and pit fire (Personal Observation of Navraj Baral, as a DFO of the district) .

Unlike the ecological characteristics of the Mid-hills and the Tarai, fire is not a tool of managing grassland and pastureland, with exception at lower altitude area of Transhimalyan region. The pasture and grassland of High altitude areas are not evolved or adopted from forest fire either. The transhumance graziers do not set fire on forests for new grasses.

Fire database of ICIMOD provides basic information on the forest fire such as number of fire occurred, its size and types along with satellite images. This information is enough to take necessary prevention and precautionary measures for further expansion of forest fire and information for the long term fire management planning. It does not provide the extent of loss and actual area damaged. The concerned authorities (DFOs and Wardens) are supposed to assess the effect/impacts of forest fire on forest, wildlife and local livelihoods. But, such assessments are seldom done. They are not equipped with neither any tools nor techniques or with any budgetary provisions. In most cases, news in national media becomes the source of arousal of government agencies. As a result no assessment, information or database does exist in the district about the forest fire, area of damage, and the impacts.

Detailed data on forest fire about their size, types, coverage and effects /impacts or the loss of forests, lives and private propriety and its impacts on forests ecosystem in High Mountain areas have not been studied, therefore there is a big information gaps on forest fire.

During the field visit, evidence of both ground and high intensity forest fire were noted. Ground fire is typically set by dry land farmers for removing the ground cover to stimulate grass growth. High intensity fire are sometimes deliberately set to expand pasture and grazing areas, and sometimes are caused accidentally when ground fire get out of control. Hunters and wildlife poachers also deliberately set fires to drive wild animals from the thick woods and make opening in the forests to make easier trap of wild animals.

For the last few years the frequency and the size of forest fire in Nepal is in increasing trend. Mature trees are burned and remaining trees are harvested in sub-tropical region, however, this is not the practice in the High altitude region[7]. But, no study findings are available about the fire practice in the High altitude areas.

High altitude areas do have human-wild animal conflict as in other parts of the country. Damage to livestock and field crops are the regular phenomenon to local communities. National park's restriction on removal of forest products makes local people difficulty in one hand. In other hand, local people have an incentive to clear the forests illegally or set fire deliberately and drive wild animals away from the vicinity of villages and agriculture fields[8].

[7]Most interestingly, high altitude communities rarely use dead or wind/snow blown trees for timber and firewood. They highly prefer live trees. According to them, it is very difficult and labour intensive to process the dead wood and extract timber, shingles and firewood. Moreover, firewood from live tree is considered more effective than that from dead trees.

[8] Crop damaged by monkeys is one of the major problem in Thadi of Lambagar VDC Dolkha (a village situated in the edge of Lower temperate region where the hill wheat, barley and maize is the major crop). Despite their great effort they could not stop monkeys from entering their farmlands. The villagers then decided to set fire for

3.1.2 Overgrazing

Stakeholders and communities in sample districts believe that overgrazing is the second major cause of DD after forest fire in the High Mountain regions (see table 3.1 above). 69% of respondents believe that the grazing is the cause of DD in the High altitude areas (see table 3.3)

The extent of grazing in the High altitude region is associated with the number of herders, size of herders and the dynamics of transhumance grazing pattern. Data about total number of transhumance herders and livestock are not available at the national level. However, review of existing literatures show two trends regarding livestock herding and their impacts on High Mountain forests resources and their environment. In some districts, livestock herding is on increase, in others it is decreased or even abandoned. The population of transhumance herders and number of livestock varies across the region, district and within the district itself.

Table 3.3: Perception of stakeholders and users about the grazing as the cause of DD

Statement	Highly Agreed		Agreed		Neutral		Disagree		Highly Disagree		Don't Know	
	N	%	N	%	N	%	N	%	N	%	N	%
Grazing is the cause of DD	70	29%	97	40%	19	8%	10	4%	8	3%	38	16%

Source: COMFORTC Field Survey, 2012

Decrease in the size of and number of herders in some district such as Okhaldhunga, Rasuwa, Karnali Zone and Solukhumbhu is associated with changing economic incentives and new economic frontiers such as increased road network, new market centers, expanding tourism business, establishment of hydropower, and out migration of youths. The other factors contributing to decrease are institutional and policies such as absence of institutional structure of the government in High mountain areas, deteriorating and diminishing indigenous NRM systems, handing over of Community Forests without acknowledging the traditional life styles of the transhumance herders, and closure of Tibetan pasture and lack of government support in the management of forest and pasture, change in grazing system replacing long distance, long term transhumance grazing system by light and temporary grazing system, increased stall feeding or intensification of stall feeding among the dry land farmers and virtual abandonment of the traditional semi-transhumance system based on short distance and short term forest grazing system among the dry land farmers.

While a decline in pursuit of change in lifestyles, emerging economic frontiers, and change in grazing system is decreasing in some parts of the country, in others it has seen a dramatic increase. Reason behind sudden increase of the population of herders and livestock are new expanded market for animals by products, which are becoming one of the most attractive income generating enterprises. Moreover, the ban on chauri/yak farming in Sikkim, India, has

driving the monkeys awy from their areas. Unfortunately, the fire became out of control of the areas and expanded to large areas covering the territories of neighboring VDCs of Orang to Bigu-Alampu.

suddenly increased the number of herders and livestock in the far eastern districts of Nepal such as Taplejung, Ilam and Panchthar, where a few years ago, chauri/yak husbandry was almost absent. The average number of yak/chauri herd in Kalinchowk and Bhairabkund lekhs of Dolkha and Sindhupalchowk using a two-three kilometer radius at present is 30-125 respectively. While the number of herds in Cho-Cho and Yangrima lekhs ranges from 0 to six goths-with an average size of herds per goth ranging from 10-40 (Messerschmidt and Rayamajhi 1996).

Expansion of herds and pasture tends affect the forest in three ways Firstly more trees will be cut for firewood, making temporary sheds and fences. Secondly, more livestock means over grazing and over lopping of fodder trees (which are in fact already in dead condition) reducing reproductive capacity of the vegetation and acceleration soil erosion. Thirdly, to meet the growing demands, more and more forest area will be cleared for pasture

The decrease in herd size or abandoned of transhumance has also ecological impacts on the typical high mountain forest ecosystem, particularly to those of ecotype that are evolved through grazing. Low intensity grazing abandoned transhumance grazing pasture is invaded by weeds and unpalatable shrub species and gregarious tree species such as Rhododendron or Abies Blue pine or Tsuga. The area of most affected are the sub alpine region and transitional region where the lower altitude water buffalo, common cattle pasture and summer transhumance pasture overlaps/intersects.

The other factors associated with the expansion of herds and pasture is relates with institutional and policy aspects. The local institutional arrangements to control the access to pasture do affect the growth of herds. Management of pastureland falls under the reasonability of two departments Department of Forests and Department of Livestock; however, there is poor understanding of pasture management as a result of no coordination between these two departments. A big institutional gap does exist to manage the access and use of the pastureland.

3.1.3 Indiscriminate product extraction

Forest products that are harvested from forests of the High altitude areas include timber, firewood, shingles for roofs, leaf fodder, bedding materials, nigalo, MAPs and other NTFPs (Baral, 1996 and Acharya, 2003). A substantial quantity of these products are harvested and used for both domestic and commercial purposes. Detailed information on per capita consumption and forest products trade is discussed in detail in chapter 5, in this section the extent of unmanaged product harvesting contributing to deforestation and forest degradation is discussed.

Stakeholders and community members consider unmanaged product harvesting as the third major cause of DD in the High Mountain areas (see table 3.1 above). Table 3.4 shows the perception of respondents about the indiscriminate product extraction as the cause of DD. As compared to forest fire and grazing, a higher percentage of respondents (29%) consider its

contribution to DD is neutral (see table 3.2, table 3.3 and table 3.4). However, the field observation and secondary information provide ample evidences of indiscriminate and concentrated wood and non-wood product extractions contributing to DD.

Table 3.4: Perception of stakeholders and users about the unmanaged product harvesting as the cause of DD

Statement	Highly Agreed		Agreed		Neutral		Disagree		Highly Disagree		Don't Know	
	N	%	N	%	N	%	N	%	N	%	N	%
Indiscriminate product extraction is the cause of DD	27	11%	71	29%	71	29%	11	5%	5	2%	57	24%

COMFORTC Field Survey, 2012

Wood products harvesting

The highest pressure on the forests in the High altitude region exists from the firewood need of the local people, hotels& lodges, and trekking/expedition laborers (Messerschmidt and Rayamajhi 1996, Joshi, 2000, Steven 2003, Byers, 2005). Firewood is the only source of energy for cooking and heating. A large quantity of firewood is also used by transhumance herders for boiling milk, making *churpi* (dry cheese) and heating their temporary sheds. Firewood is cut and stored in huge piles in all villages during the winter and spring before the onset of rainy season. Pile of firewood has cultural and social values among Sherpa communities. The stocks of firewood and the herd size of yak and their age are considered as the signs of well-being and prosperity. The cheese factories also use large quantities of firewood, and the numbers of cheese factories are growing in recent years (Baral 1996, 2003, 2005).

The methods employed to collect firewood causes substantial damage to the forests. Despite a huge quantity of dead and fallen trees, only preferred species and selected live trees are chosen for firewood. The most preferred species are Oaks, Rhododendron, Angeri and Cuppressus and Junipers in the Sub-alpine and Alpine areas. A visible deforestation and degradation can be seen of these species.

Timber harvesting

The use of timber in making roof shingles, beams and planks for house construction occur throughout the high mountain regions. Evidences of selective feelings of specific or optimal-size tree and concentrated felling are the common phenomenon of timber harvesting (Messerschmidt and Rayamajhi, 1995). These are the one of the major causes of the decline in the area and quality of conifer forests. The main high altitude species used for timber are Fir, Hemlock, Blue pine, Deodar, Spruce among the conifers and Birch, Champ, Oak species other than Kharsu and Bangh, Aarupate (Prunus nepalensis), and Walnut among broad-leaved species (Baral 2005). In addition, there is huge demand of Junipers and Cuppressus wood in Kathmandu for both religious and commercial purposes. Timber is also harvested for supply

to lower villages markets, and even to Tibetan boarder where it fetches good price. Increased road networks and growing towns and market centers has created a huge market for timber making it more lucrative business in recent years.

For local consumption, trees are frequently cut beyond actual needs or demand. Large and over matured trees are always avoided and relatively smaller sized trees are chosen for timber harvesting. The methods of harvesting of timber are destructive, wasteful, inappropriate and inefficient. Traditional tools such as the axes are the major tools of timber harvesting in many parts of the High altitude areas. Hand saws have been more recently introduced in areas accessible to roads (Baral 1996).

Splitting of standing conifers for torches

Traditional methods of extracting pine splits from standing trees for lighting the house, locally known as Diyalo, is still in use in remote and inaccessible areas of the High altitude. Blue pines, fir and Tsuga are used to extract splits for lighting. On an average a household of five members requires 50 kg of Diyalo per household/year. For this 5-10 matured to over matured trees is required. Diyalo is generally extracted from matured to over matured trees at breast height using a small axe specially designed for it. Extracting splits continues for more than 3-4 years[9]until the cut penetrates pith of the stem, sometimes leaving just one-third of the stem making prone to be easily blown by wind or snow (Field Observation).

Felling of trees for making roof shingles

Trees in the high altitude area are also cut for making shingle for roofs. This is the most destructive factors of forest degradation. Trees of Abies, Blue pine and Tsuga of pole size are selected for making shingles. Review of existing literatures revel that per capita consumption of shingles is 0.34 m^3/hh/year, which is one third of the per capita consumption of firewood. Baral (1996) estimated a requirement of 19-22 pole sized trees of Abies, Blue pine and Tsuga for a common house, which can be obtained from a single tree of relatively matured tree if improved technology is used.

A small portion (2-4 logs of a meter length) is used for shingles and rest of the wood is left to rot. Many dead and fallen, malformed and diseased trees are ignored, while growing young trees are selected for making shingles (Schimdt-vogt, 1988; Baral, 2005). One of the most interesting points to note in case of shingles is that selection of sites or trees for cutting shingles is not influenced by territorial limits or use rights of other villagers (Schmidt-Vogt 1988), otherwise in many location local people often restrict outsiders for cutting trees for other purposes from their forests.

[9] Reason for selecting the same tree for longer timeis that such trees exudes more resin giving vigourous burning and giving more lighting power.

Harvesting of flag poles

The other social-cultural factor associated with degradation of forest is the use of flags poles. Hundreds of immature poles of confers with clear bole are cut for flagpoles. In many instances a large number of immature trees are sacrificed while selecting the best ones (Messerschmmidt and Rayamajhi, 1996, Baral, 1996).

Timber for agricultural implements and home decoration

Although consumption of timber for manufacturing of agricultural implements and furniture's particularly for religious purposes or decoration is very small as compared to other uses. But the choice of species and their limited habitats and over harvesting make them more vulnerable to extinction. Use of selected oak species such as Quercus glauca and Q. lemellosa for making plough sets; Michelia deltopsa, Juglans regia (walnut), and Prunus nepalenesis for furnishing houses and making wooden box and Junipers and Cuppressus for making racks for keeping religious books and epics have threatened these species from many areas of high mountain forests (Baral 2005). Moreover, the construction of large number of Buddhist monks in High Mountain and Cities such as Kathmandu and Pokhara in recent years has created huge demands of Jumpers and Cuppressus wood.

Debarking of Conifers

Significant numbers of trees are killed from debarking. The bark of conifer (other than Junipers and Cypressus) is commonly used in shading of g*oth* and making special beds to young calves to keep them warm. Pieces of bark, generally, 1-1.5 m long and 20-30 cm wide are peeled off from the standing trees, left in the sun for a few days to dry and then fixed on to a wooden frame designed for keeping young claves (Baral 1996). Similarly, the herders also make their temporary shades from conifer barks.

Logging tools and techniques

Other important factor of forest degradation in the High altitude areas is the logging methods. Creation of transport chutes for moving logs and timbers down to steep slopes, thus encouraging more timber felling in higher and distant forests or isolated areas and damaging fragile slopes also contributes for the degradation of forests in many parts of the High mountain areas (Messerschmmidt and Rayamajhi, 1996, Baral, 1996) .

Improved feeling and logging methods not only reduces waste but also maintains good health and vigour of the forest. Use of improved tools and logging methods were not observed and are not generally practiced in the high mountain forests. Dissemination of improved harvesting technology, and the monitoring is almost absent in the areas.

The harvesting methods also disregard the natural flowering and seed producing cycles, thus retarding regeneration (Messerschmmidt and Rayamajhi, 1996). Even in areas where regeneration does occur, the young seedlings are easily browsed by livestock or are badly damaged by indiscriminate grass cutters (Baral 2005).

Non-wood products harvesting:

Fodder collection

Lopping of fodder trees, especially kharsu (*Quercus semicarpifolia*) is a distinctive feature of high mountain areas. Kharsu trees are one of the highest strained broad-leaved species close to settlements and herders camp. Although the fodder collection is an all-round activity for transhumance herders, most fodder collection in villages is a seasonal activity. The highest pressure on the resource is during the winter, when the naturally grown green grasses for grazing or cutting close to home or fields are at their lowest point and poorest quality.

Lopping intensity decreases with increasing altitude and distance from the villages. The collection of fodder takes place up to the highest altitudinal limit of Kharsu at approximately 3000 m in altitude. Kahrsu trees are often seen like an electric pole devoid of any small braches sprouting directly from the main stem. The other factor associated is the feeding habit. Kharsu is fed to the yak/chauri directly in the forests, where branches up to 10-15 cm girth are cut, the chauri and yak by their nature do not eat all the foliage leaving more than 43% waste (Baral 1996)

MAPs and NTFP harvesting:

The market of MAPs and NTFPs are tightly controlled by the traders, processors and middle men who have a very little concern about the collection methods and the management of resources (Acharya, 2003). The collection methods are competitive among collectors, who less considers the life cycle of regeneration. The haphazard method of collection and the lack of supervision and monitoring have contributed to the depletion of the resources.

3.1.4 Nature of trade and transboundary leakages

The nature of trade of wood and non-wood products across the High Mountain region is changing at a fast speed. In one hand, the expansion road networks have increased the trade access and expansion of infrastructure has increased the demand of wood products especially the timber and firewood. In other hand, rise in demand in China boarder has made a significant influence in the extent and pattern of the trade.

Trade relationship of Nepal with Tibet is as ancient as the history of Nepal. Traditionally, High mountain people bordering to Tibet used sell (barter) food grains mainly barley, mustard oil, spices (hot chili, ginger and turmeric etc); wood items such as wooden bowls, beam, and planks and animals (mainly horses and mules) and their products. For many year till mid 70s salt was the major item of trade in most part of the hills and mountains. The whole trade system was based on barter system, equivalent ratio of each exchange items were developed and improved through mutual understanding. This system is still in practice in many trade centers[10]. However, after the insurgency of Khampas in the 70s, and war between

[10] A mature nine-foot log fetches around 25 kilos of wheat flour at Taklakot (Tibet border) .Timber demand is increasing in Tibet but the price is fluctuating and the Tibetan traders dictate the price. A yak-load of timber

India and China in the 60s and increased road linkage of Mid-hills of Nepal with India, regular trade with Tibet disrupted and gradually trade items reduced and replaced by Indian goods limiting the traditional trade to the northern border. Moreover, recent development in Tibet and increased infrastructures such as roads and market close to the Northern border of Nepal and construction of Kodari highway, the magnitude and nature of trade through traditional routes and market centers have been drastically changed. Now the Nepalese mountain people exchange wood, high value MAPs and dairy products not for cloths and salt but largely for food grains and cash. As the high mountain communities do not have other means of living, they have adopted a lifestyles based on the existing natural resources. The only viable solution for living available to them remained the export of wood products and MAPs to Tibet.

Information and data about change in magnitude and nature of trade to Tibet through traditional routes is missing. A few site specific studies, carried out 20 years ago, are available, which have given explored the socio-economic issues of some villages in Humla, Dolpa and Musatng. Similarly, some news media and institutions working on the area of environment such as Nepal Forum for Environmental Journalists have tried to draw the attention of the decision makers about the importance of the issues and its consequences to the forests of high mountain regions. So, the extent of impacts of wood trade to Tibet on the High mountain is difficult to explain due to the limited evidence based knowledge and information.

However, the field survey in Chepuwa VDC of Sankhuwashabha identified 441 household (more than 80% of total household) are found to be involved in wood trading. Villagers have changed their transhumance life styles of keeping yak or sheep herd and have started keeping at least two jopkoie (a cross breed of yak/chauri serve as a drought animals) to transport sawn timber from Chepuwa to Tibetan border. It was also reported that the trade continues for two and half months and a household at least sells or exchange 36 beams and 9 dozens of planks per season (a jopkoie can make three trips and carry six beam (4 m*30cm*15 cm) or more than two and half dozen planks (2-3 m* 20-30 cm* 5 cm) per trip (COMFORTC Field Survey 2012).

Chepuwa VDC presents the general situation of wood trade in the high mountain regions. It is well known that this kind of wood trade is increasing in many traditional trade routes to Tibet, particularly in Solukhumbu, Rasuwa, Gorkha, Dolpa and Humla and Mugu districts. Such kind of transboundary leakage has a tremendous impact in the forests of High mountain region. To address such issue the livelihood options of people living in this area also need to integrated.

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fetches around 50 yuan to 70 yuan (750 NRs) (nepalitimes.com/issue/2000/11/17 cited in REDD Forestry and Climate Change Cell, 2011)).

4.1.5 Infrastructural expansion

Infrastructure development in simple terms includes, roads, electricity, drinking water and irrigation schemes, construction of new building for social services such as schools/ college, hospital/ health centers and other socio economic physical structures or facilities From the perspective of management of high mountain forest, three major infrastructures: road networks, hydropower projects and transmission line and tourism infrastructure have greater significance**.**

A. Road networks

Pressure to forests would be uniformly distributed, and more high altitude forest could be brought under intensive management if roads networks are developed in the High Mountain region in a planned, integrated and environmentally friendly way. However, the current practice of road planning, methods of construction, and post construction maintenance and monitoring in the rural hill areas are not only poor but also very haphazard and destructive. Many of such roads constructed in the past few years are seen causing severe landslides, soil erosion posing irreversible damage to the forest resources.

A review of plans and programme of the District Development Committee of 25 High Mountain districts and literature on rural roads of Nepal reveals a total of 11,082km of roads already constructed and about 14000 km have been planned and proposed for construction (see Annex XII for detail). Taking into account the size of these roads and the use of heavy machines (dozers, and excavators) the loss of forests and impact on the hill environment is quite severe. If the current haphazard practice of rural roads construction is not improved and adequate measures are not taken the impact to the degradation and deforestation could be irreversible.

B. Hydropower projects

Although hydropower is considered a green energy sector having intense environmental values, it has positive as well as adverse socio-economic and ecological consequences. The country has an estimated potential of 83,000 megawatts (MW) of hydroelectricity with 43,000 MW as economically feasible. Currently the country is generating only 689 MW, less than 1.0% of its total potential. Assuming 2,000 persons for 750 MW can get employment, if Nepal could harness 10,000 MW hydropower every year, 132,000 people (13,000 persons on construction phase and 32,000 in operation phase will be employed in hydropower sector (NEA 2010). The construction of hydropower project contributes not only to the economy of the country but also provides the local people access to roads, schools, health center, jobs and trade opportunities.

However, these benefits are not free from costs. The permanent loss of the forest due the construction seems to be small in areas but its implication on the remaining forests in and around the hydropower project is quite significant. Ecological foot prints of hydropower project (transmission line, access roads, supply of natural resources and developing market

and social services at road heads etc) is extensive and wide spread. With the increased access, markets and other infrastructures, population of the area is seen to be increased exponentially. Moreover, review of EIA report of major hydropower project (Kali Gandaki, Bhotekoshi, and Khimti) has shown that 10-20% of the labour involved in the project will also settle down locally (MoEST, 2005, 2007, 2009), which will increase the pressure to the nearby forests. Demands for wood have been increased by many folds around the hydropower projects encouraging concentration felling of tress. At the same time with limited private land for the expansion of social service centers and market, and private building pressure to forest land also increases. Thus, the balance between socio-economic and ecological or environmental needs get disturbed resulting into many adverse impacts on forests and local environment.

Review of Nepal hydropower scenario and proposed hydropower projects shows that if adequate measure is not taken in advance, a big loss of forests is inevitable in the near future. To date a small percentage of hydropower has been exploited. But, more than 500 hydropower projects with total capacity of over 2700 MW have been identified. Out of which, four projects of total capacity 506 MW are under construction, and eight of total capacity 1422 MW are planned (NEA, 2011). Similarly thousand kilometers of transmission lines will be constructed to join the electricity generated from these projects into the national grid. Most of these transmission lines will likely to through forest areas. As majority of these major hydropower projects are in the vicinity of High Mountain areas, which will exert more pressures on forest resources therein resulting in imbalance between socio-economic and ecological or environmental systems of the area.

C. Tourism infrastructure

Nepal in general and high mountain of Nepal is the destination of thousands of tourists, trekkers and mountain expeditions. More than one million tourists from all over the world visit Nepal each year. Their favored destinations in high mountain region include Annapurna Conservation Area, Sagarmatha National Park and Lang tang National Park.

Increased tourists leading to increased number of inns, lodges and hotels in and around National park and conservation area has placed a substantial pressure in and also in the adjoining forests outside the national parks and conservation areas. No detailed study covering all aspects of impacts of expansion of protected areas systems and increasing tourist has been conducted at national level. However, a number of park specific studies focusing on the impacts of tourism on forests in and outside park have been conducted by a number of scholars, ecologists and social scientist (Bauer and Paudel, 1995; Bjonness, 1980, 1983, Brower, 1991, Brower and Dennis 1998, Byers 1987, 1997, Hardie et al, 1987 Steven 1993, 1997, 2001, 2002 and 2003). Of them the study of Tourism and deforestation in the Mt Everest region of Nepal by Stevens (2003) best illustrates the extent of adverse impacts from tourism business in and outside national parks of Nepal.

Assessing the tourism impacts of the regional forests and alpine vegetation between 1950 and 2002 in the Khumbu region of Sagarmatha National Park , Stevens (2003) found that use of firewood has been increased from 6 ton /hh/year to 8 ton/hh/year and that of timber from 18 M3 /structure(inn) to 24 m3/inn between 1979 and 2002. Similarly the numbers of inns have increased from 62 to 169 in Khumbu region and from 34 to 110 in Pahrak between 1986 to 2002.

Stevens (2003) furthers reports that a total quantity of 1,500 m^3 of round wood was annually exported from Pharak (a place outside Park) to Khumbhu. And the demands for round wood in Khumbu region has increased many fold amounting 3,000 m^3/year (Ledgard 2002 cited in Steven 2003). Over harvesting of wood is not limited to the periphery of Sagarmatha National Park, it has now expanded to Ramechhap (Gumdel ridge) and Dolkha (Chordhum ridge) to meet the growing demands of timber. New wood timber traders have emerged in the Khumbu region that use helicopters to transport timber from mountain districts such as Ramechap and Dolkha. During the peak insurgency period (2055-2060) the Jiri Airport of Dolkha was heavily used for transporting sawn timber (hand saw) from Jiri to Khmubu region (Baral 2005).

Box 2: Deforestation in Sagarmatha National Park

....this mecca is fast becoming an environmental mess. The success of the Park over the past two decades brought more people (over 5000 a year) and with the masses has come the scourge of deforestation because of excessive cutting of forests for firewood . . ...deforestation is a general malaise in the Nepalese Himalayas, but it is particularly acute in the Park.
Sagarmatha has suffered more deforestation during the past two decades than in the preceding 200 years. Visitors to the Park are confronted with stark and denuded slopes in many areas, especially around Namche Bazar (Nauje). Twenty years ago, foreign visitors described the area as rich in forest cover with lush stands of juniper. Today, these forests have been levelled, leaving only isolated clumps of scrub juniper.
Source: Hinrichsen et al.1983, 2003 and 2004

As a result of this, forests in much location of high mountain areas of these districts are heavily thinned and degraded. Species composition of many forest types is changed (see box 2). The juniper forest and shrub in the sub-alpine and alpine areas are heavily degraded from many places to meet the requirements of timber and firewood of the inns/hotels and herders, labour of trekking and expedition groups. Despite strict park rules and regulation, the park authority has totally failed to control and monitor the extraction of firewood and timber from park and outside the park (Steven 2003). This raises the question of governance of park in one hand. In other hand the expansion of protected area system can just shift the problem to other areas making them further vulnerable.

3.1.6 Development of new economic frontiers

In all ten-sample districts the emergence of new market centers are visible. For examples Galkot bazar of Baglung, Godepani and Sikha of Myagdi, Singati bazar and Gogar of Dolkha, and Shivalaya, of Ramechap. In all these centers, the population has increased by many folds. About 15 years ago, there were hardly 5-7 hotels and Lodges at Ghodepani, which is now expanded to above 50 ha area with 20-30 hotels and lodges (COMFORTC, Field Survey, 2012).

3.2 Underlying causes

Apart from above direct causes, a number of underlying causes are contributing for the deforestation and forest degradation. The critical factors are: Demographic factors, Policy and institutional factors, Governance factors, Economic factors, Cultural factors and the Lack of research and development.

3.2.1 Demographic factors

In general, three types of lifestyles are visible among the people of the High altitude region. They are: Transhumance graziers, dryland farmers and business persons. Population of dryland farmers and transhumance graziers in remote and inaccessible areas has remained almost constant, while the population of business persons is in increasing trends. Similarly, the transhumance graziers in Karnali zone, Sagarmatha National Park, Lambagar Gaurishankar Ridges, Solukhumbu and in Sankhuwashaba has decreased while the yak/chauri population have increased in Ramechap, Dolkha Jiri, Kalinchowk, Panchthar and Taplejung. The increase in Dolkha and Ramechhap is associated with the establishment of Cheese factory and the good market of butter and cheese in Khasa and Kathmandu.

The change in lifestyle from transhumance grazier to hotel/tourism business is noticed in the vicinity of Sagartmatha. The change in lifestyle and out migration is also noticed. The decrease in herders in Karnali and other parts is associated with the closures of grazing in CF and also the heavy grazing tax imposed by the CFUGs.

The increased accessibility by road networks, expansion of protected areas system and promotion of tourism, in recent years, have made new market centers, towns and tourist centers to emerge. There is a significant rise in population (on an average about 25% per year) in these newly emerged centers (Annex XIII). People from far away remote areas and also from Mid-hills are migrating to these road heads and market centers. Such a rise in population and population concentration has two distinct implications to the existing forests. The first is there is under utilization of forests in faraway distances but over utilization or over harvesting of forests near the market centers. The pressure in nearby forests of these centers has increased for timber, firewood, and land for housing and schools, health posts and for other social service centers.

3.2.2 Policy and institutional factors

A number of policy and legal documents exist for forest management and conservation, and for the collection, production, handling, use and trade of wood and non-wood products. However, the unique characteristics of the forests, pasture and NTFPs of the High Mountain region are less addressed by these policy and legal framework. A summary major policies and legal frameworks from the perspective of High altitude forests is discussed in chapter 6.

Master Plan for Forestry Sector, 1989 and periodic plans like 5-year plans, Interim and three years perspective plans provide a policy framework for the government managed,

community, leasehold and private forestry. These policy documents are backed by legal provisions of the Forest Act 1993 and Forest Regulation 1995.

Other policy documents that relates to the High Mountain regions are (a) National Conservation Strategy (NCS) 1988, (b) Nepal Environmental Policy and Action Plan (NEPAP) 1993, (c) Agriculture Perspective Plan (APP) 1995 (d) Nepal Biodiversity Strategy 2002, (e) Herbs and NTFP Development Policy 2004, (f) Sacred Himalayan Landscape Strategy 2006 – 2016, (g) National Adaptation Programme of Action (NAPA) to Climate Change, 2010, and a cross cutting strategy of Gender and Social Inclusion Strategy in the Forestry Sector 2004 – 2019.

Similarly, other legislations that relates to the High altitude areas include (a) National Parks and Wildlife Protection Act 1973 and its Regulation 1974, (b) Soil and Watershed Conservation Act 1982 and its Regulation 1985, (c) EIA Guidelines for Forestry Sector 1995, (d) Buffer Zone Protection Regulations 1996, (e) Environment Protection Act 1996 and its Regulation 1997 and (f) Nepal Trust for Nature Conservation Act 1991.

Although these policies relates with the High mountain forests, they do not provide a holistic frame to address the unique issues of the High Mountain region. The policies influenced by the issues of Mid-hills and Tarai do not provide appropriate solutions to the address the issues of high altitude areas. The absence of supporting legislations and institutional arrangements made many of these policies are only on paper. The pasturelands at the high mountain areas are ignored by both agricultural and forest policies (Yonzon, 1998). These lands belong to the jurisdiction of the department of forests but utilization of the pastureland resources is associated with the department of agriculture and the department of livestock development. Yonzon (1998) stresses a need of developing pastureland policy jointly by the MoFSC and MoA in consultation with local communities and other stakeholders.

The high altitude areas greatly lack the formal institutional arrangements though many of the informal institutions are active. The government institutions that have authority and responsibility of high altitude resource management are basically absent from these areas. For example: Department of Forests (DoF), National Parks and Wildlife Conservation (DNPWC), Department of Soil Conservation and Watershed Management (DSCWM), Department of Plant Resources (DPR), and the Department of Livestock Services (DLS).

Nevertheless, many traditional informal institutions provide a strong basis for the management and utilization of the resources. Experiences from community forestry and protected areas management systems have shown that the institutional framework build upon traditional or indigenous systems is one of the best ways to develop successful local institutions to meet the local as well as national objectives of resource management.

Review of annual plans and programmes of the concerned District Forest Offices revel that the community forestry is the major programmes and the role of forests in the high mountain region has been limited to extraction of MAPs and other NTFPs. The priority provision of

community forestry has undermined the value, importance and specificities (inaccessibility, remoteness, fragility, marginality and ecological niche) of the high mountain regions. Similar is the situation in protected areas management systems. Majority of work has been focused on extension and awareness, protecting wildlife, and inducing formalized local institutions and raising fund for tourism giving low priority to minimize the underlying causes of loss of wildlife, biodiversity loss and degradation of park resources.

Government agencies working in the forestry and livestock sector have very limited experiences in high mountain forests and their environs. The two departments DoF and DNPWC are under-staffed and under budgeted for taking on any major new initiatives without considerable assistance. DoF has given low priority for the management of high mountain forests while DNPWC is without much of the prior experience in user group mobilisation and management necessary to carry out new buffer zone developments (Messerschmidt and Rayamajhi 1996, Baral 2006). As majority of forests is legally owned by the state but not effective institutional arrangements are in place to regulate the use, protect the forest, and exclude the non-users. Hence, they have become the de-facto open access resources (Kanel *et al*, 2009).

3.2.3 Governance

Governance factors generally include rule of law, legal enforcement, equity and incentives, quality of service delivery, transparency, and accountability. Nepal is ranked weak in maintaining the major characteristics of governance. According to the Human Development Report of UNDP (2009) Nepal is weak in general in terms of legitimacy and effectiveness, transparency, freedom, and doing in business. Table 3.5 provides the recent ranking index for Nepal. The political scenario of the country after May 28, 2012 would further lower the rank.

Table 3.5: Governance Ranking of Nepal

Governance Rating Index	**International Ranking**	**Nepal Ranking**
Fragility Index (2008)	0 to 25; 25 Most Fragile	14
Corruption Perception Index (2009)	1 to 10; 1 Most Corrupt	2.3
Freedom House Index (2009)	1 to 7; 1 free, 7 not free	4
World Bank Doing Business Ranking (2009) ▪ Ease of doing business ▪ Employing workers ▪ Paying taxes ▪ Trading across borders ▪ Enforcing contracts	1 to 183; 1 the best	 ▪ 123 ▪ 149 ▪ 124 ▪ 161 ▪ 122

UNDP (2009) as cited in Kanel et al, 2009

Governance at micro and meso level

The governance ranking as indicated by the Human Development Report can be observed at micro and meso level with a decreasing trend of social capital. Decision making at micro level are largely dominated the local elites and with very little or no participation of poor, women and dalits (Kanel *et al* 2009). Misuse of funds in community organizations can be observed in many local organizations including community forestry user groups (Baral, 2005, Niraula and Maharjan 2011).

Misuse of power and bad governance in local forestry institutions has become national issues as topic of discussions in various national and international workshops in the last ten years. In the last few years, media coverage of misuse fund and authority in forestry institutions has been very extensive. Most of these issues are from Mid-hills or Tarai, however, the high altitude districts cannot be the exceptions. Handing over of thousands hectares of large contagious high altitude forests to a limited forest users mainly the dry-land farmers and upper Mid-hills communities raises a question of equity and transparency[11]. The efforts to improve the governance of these institutions are insignificant.

Political fragileness and law enforcement

Political fragileness has further deteriorated the governance at the central level. Staff transfer has becoming a lucrative business to the politicians and high-level officials of the forestry sector. According to Kanel *et al* (2009), uncertainties in staff mobilization and retention associated with unpredictable change of decision makers hamper trust, reciprocity and reputation among the key actors of forest management. Frequent changes of policy makers and staff at higher and middle level de-motivate field and front line staff, and also reduce the institutional memory of decision making and field execution, ultimately leading to more deforestation and degradation.

The governing credibility of the forestry institutions have become so weak and fragile that authorities are unable enforce the laws effectively in a more transparent and democratic way. Despite a huge human resources and armed forces in various districts the overall performance is very low. Cases of smuggling of timber, and over harvesting, wild life poaching and forest encroachment is increasing at an alarming rate. Despite strong provision in the Forest Act (1993) and Forest Regulations (1995) they are under implemented. The existing Environmental Policy and its Acts and Regulations and the forestry sector Environmental Impact Assessment (EIA) guidelines/manuals have made Environmental Impact Assessment obligatory for any kind of development activities that have significant impacts on the forests and the environment. Thousands of hectares of forestlands are cleared for road construction, for hydropower and transmission line. Major road project and Hydropower agencies do conduct EIA but there is no mechanism in place for environmental monitoring and auditing.

[11] Review of Annual reports of DNPWC 2010 and KCA reveals that most of the community forests in Sagarmatha National Park Buffer Zone and KCA more than 10000 ha of high altitude forests have been handed over to less than 40 households

Most interestingly, majority of rural roads are constructed without any design and EIA/IEE, but there is no agency in the district to monitor and control it. The forestry institutions or the personnel who want to regulate or manage in a less destructive and environment friendly alternatives are often isolated and do not get appropriate support from the department or the ministry.

Governance factors as perceived by the respondents:

Respondents in 10 sample districts perceived that the governance of FUGs level makes the highest influence in the deforestation and forest degradation as compared to governance of district level, central level and other governance factors (see table 3.6)

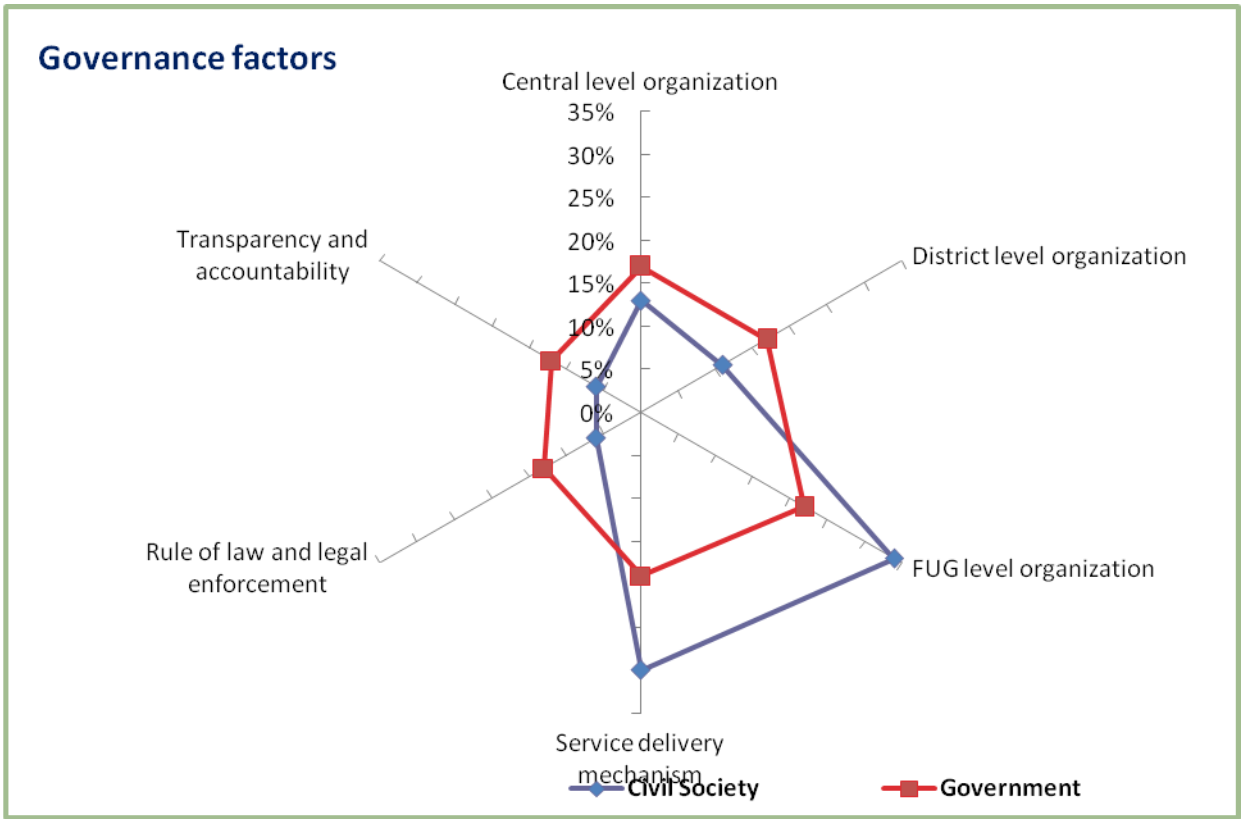
Table 3.6: Effect of governance factors on the DD as perceived by the respondents

	Users		Traders		Civil Society		Government		Total	
Governance of FUGs level organisation	88	20%	13	18%	33	27%	16	34%	150	22%
Service delivery mechanism and their quality	70	16%	14	20%	30	24%	14	30%	128	19%
Governance of central level organisation	78	18%	14	20%	15	12%	6	13%	113	17%
Governance of district level organisation	76	18%	13	18%	18	15%	5	11%	112	17%
Rule of law and legal enforcement	65	15%	9	13%	14	11%	3	6%	91	13%
Transparency and Accountability	56	13%	8	11%	14	11%	3	6%	81	12%
Total	433	100%	71	100%	124	100%	47	100%	675	100%

COMFORTC Field Survey 2012

The ‘governance of FUG level organization’ and the ‘service delivery mechanism and their quality’ are considered more important by civil society members than by government staff. Whereas other governance factors such as ‘governance of central level organisation’, ‘governance of district level organization, rule of law and legal enforcement’, and ‘transparency and accountability’ are considered more important by government respondents than by civil society respondents (see figure 3.4).

Figure 3.4: Effect of governance factors on the DD as perceived by civil society members and the government staff



3.2.4 Economic factors

High mountain forest resources have national as well as global values and concerns. They are the large watershed of big river systems of Nepal, and the home of majority of endemic flora and fauna. The High Himalaya has not only beautiful scenic values but also a significant global climate change concerns. Therefore, the economic equity and incentives must address these issues, and the cost and benefit sharing mechanism be developed accordingly.

The protected areas systems have established economic incentive of sharing revenue or benefits to the local communities. However, no such arrangement does exist in other sector such as hydropower, irrigation system and urban drinking water schemes. The Local Governance Acts and its regulation have a provision of 10% royalty from Hydropower Company or Nepal Electricity Authority and also from the sale of forest products in the district. However, there are very limited cases where these resources are allocated for the management and conservation. As an exception, Makawanpur DDC has launched special programmes on Pay for Environment Services, where DDC has allocated at least 50% (as provisioned by the Local Governance Act) of total income derived from forestry to manage the forests and improve the livelihoods of high mountain communities. Sindhupalchowk DDC makes an over 60% of annual income (more than 300 coror) from forest products (mainly from sand, gravel and stone) and hydropower but not a single rupee has been

allocated for the forest management or watershed conservation (COMFORTC/FAO/LFLP, 2011).

Forestry sector is the least priority area of the government, so there are disparities in fund allocations by the government. Most of the forestry programs are implemented through foreign aid. According to DoF (2006) the Forestry Sector is facing a severe financial constraint since 1999 and the estimated financial gap is about US $ 23 million per year. The situation has not been improved even after the restoration of democratic government in the country. The forestry sector receives about 3% of total development budget of Nepal (Kanel *et al* 2009b; Baral 2012). Review of five years forest management plans of the various districts show that there are no specific plans for the high mountain and there is a very little or no budget allocated for the high mountain forests.

Equity and economic incentive has to be developed as per the socio-economic features and resource use patterns in the high altitude areas. There is a variation among the transhumant graziers. Rich and elites generally have large and young herds while the poor herders remain satisfied with minimum herd size of about 15 mostly dominated by older chauri/yaks. Similarly, transhumance graziers mostly collect NTFPs from high altitude forests whereas selected dry land farmers, mostly the elite, are involved in NTFPs trade. Therefore both intra group and inter group (including down streams and national) equity must be taken into considerations while developing economic incentive packages and benefit sharing in high mountain forest managements (Baral ,2008).

The other significant problem lies in the way forest products are sold and marketed. Government fixes royalty rates for the sale of forest products, which does not match with the market price. The whole chain of forest product marketing is so opaque that 'invisible' hand operates in the supply and demand of these forest products. A series of regulatory hurdles in terms of various permit regimes (harvest, transport, multiple checks in route by various state and non-states agencies and individuals) operate in the trade and marketing of forest products. In fact, the forest regulations of 1995 on forest products sale and distribution is the same as the one under the old forest Act of 1961 (Kanel *et al* 2009).

3.2.5 Lack of research and development

Research and development is one of the least concerned programmes in the forestry sector of Nepal. The role of forestry in recent years has been changed from production of timber and firewood to maintaining the flow of environmental services. There are uncertainties and risks associated with the management of forest resources. A systematic study on the functions of forestry resources in supplying productive resources to the welfare of human kind and flow of environmental goods and services to maintain a healthy natural environment in a sustainable way must go simultaneously.

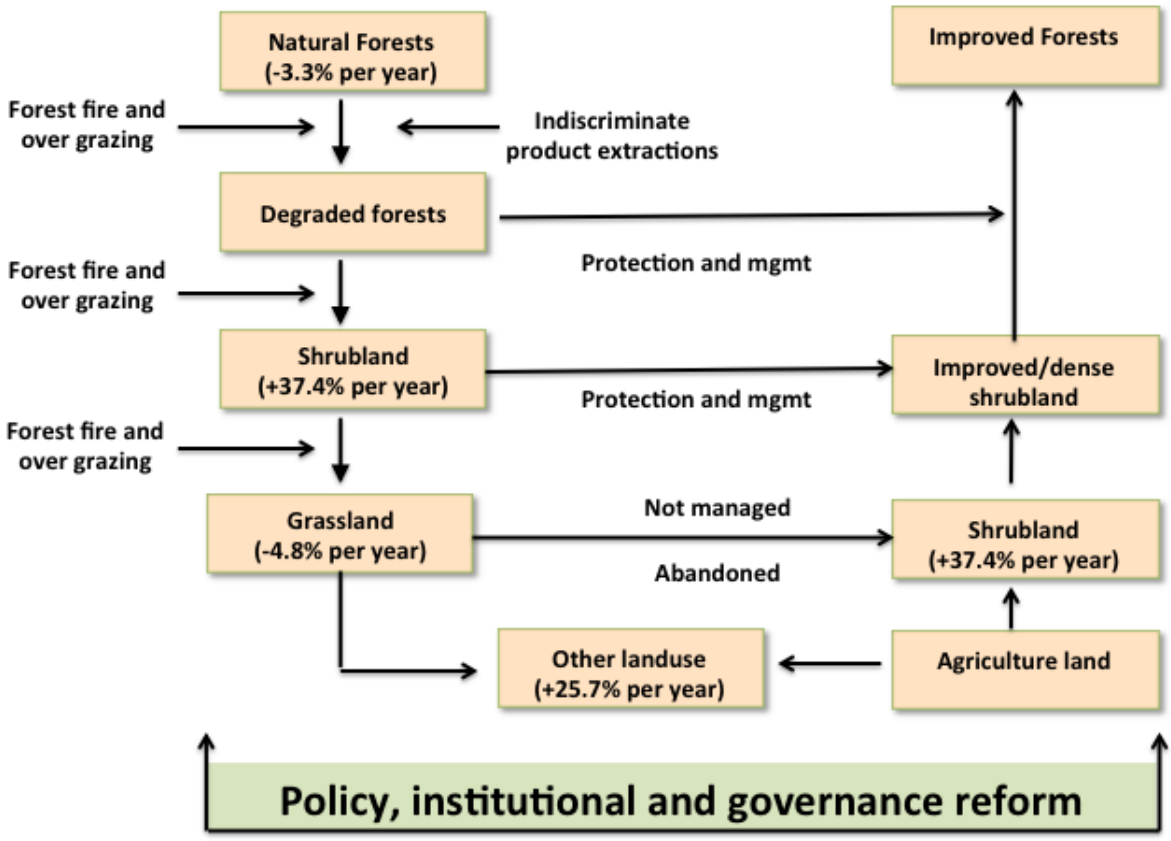
Applied research and resource data collection is a pre-requisite for any kind of natural resource management. Survey of forest areas has not been done for the last 15 years. Similarly, cultivation and domestication practices, development of processing technology, and quality control are main constraints in managing many plant species.

There are a very few studies and research particularly in the high mountain region. This makes many policy decisions and programme formulations to be based on the knowledge and technology developed at Mid-hills, the Tarai and elsewhere. As discussed earlier, the high mountain region is characterized by specific characteristics, the lack of research and development makes further difficult in identifying appropriate solutions to address the causes of deforestation and forest degradation.

3.3 Forest landuse transition path and its reversal

This section summarizes the transition path of the forest landuse of high mountain areas and explores the possibility of reversal path. Figure 3.5 depicts the transitional path of forest landuse as influenced by the major drivers of forest fire, over grazing and indiscriminate product extraction. The forestland transits to degraded forests to shrubland and to grassland. However, with appropriate policy, institutional and governance reform the degradation and deforestation can be halted and reversed. The kinds of such reforms are discussed in chapter 6.

Figure 3.6: Pathway of forest landuse change in high altitude areas (based on field observation, Jackson et al 1999, and MPFS, 1988, Department of Survey, TIP/GIS Maps 2002)



Chapter IV: Demand and Supply scenario of wood and Non-wood products

The major forest products that are harvested from the high mountain forests include timber, firewood, fodder/forage, leaf litter or bedding materials, medicinal and aromatic plants (MAPs), Bamboo/nigalo and other NTFPs like Lokta and Allo. Forest products harvested from high altitude forests can be broadly divided into two major categories: (i) Products of consumptive or domestic purposes and (ii) Products of Commercial uses. Generally with the exception of MAPs, Lokta and Allo other forest products are used largely for consumptive purposes. However, with the increased access to roads and emergence of market centers in many parts of the high altitude region and across the border, wood in high altitude area has become a commercial products and its trade down town centres inside Nepal and across the border to Tibet is in fast rise.

Assessment of demand and supply of forestry products is mainly based on secondary information that includes DFOs Periodic forest management plan, DoF forest products database and MPFS's estimation of growing stock and annual sustainable yield, other literature. Personal experience of the research team is also used where appropriate.

MPFS has provided baseline information about 20 years ago, which is not yet updated. The consumption pattern at household level and market demands for specialized wood has drastically changed over the last few years. The available information about demands and supply of timber and firewood are area specific and very scattered. Despite, the national database and official records and the sample data are used to assess the demand supply scenario. A substantial quantity of wood and non-wood products is supplied from private forestry and community forestry. Only a bigger quantity of trade exported out of the district is recorded. Products consumed at household level and traded for commercial purposes at local level never enter into the database system of DFOs and DoF. Even records of quantity of forest products traded with the transit permit from the DFOs are poorly maintained. Efforts have been made to fill in some of the information/data gaps from local communities using PRA tools.

The data and information on fodder and forage is scarcely available though these products have high socio-economic and ecological significance. Neither the actual number of livestock[12] that solely depend on high mountain forests and pasture is available nor are the annual production of forage and fodder and the carrying capacity of high altitude forests and pasture available. Therefore, the demand and supply assessment of fodder and forage is based on population estimate made by CBS, Forest management plans and DDCs profile. Nonetheless efforts were made to identify the trends of availability of forage/fodder during the field survey.

[12] Livestock that are reared in high mountain/high himal have typical feeding habits. Stall feeding is not a practice like in mid hills. Grazing is mobile and seasonal. Fodder trees are never cut and carried as in mid hills and Tarai but fed directly in the forests.

4.1 Demand and supply of forest products for consumption

4.1.1 Fuel for energy

Wood is the major source of energy for cooking, heating and lighting purposes. More than 95% household use firewood for cooking and heating while the percentage of households using alternate energy sources such as kerosene and LPG is 3.2% and 0.4% respectively (see table 4.1). Most interestingly about 0.2% households mostly from the Transhimalayan district (Mustang and Manag) also uses animal dung for cooking (CBS 2008).

Table 4.1: Percentage households using different sources of fuel for cooking

Types of fuel	% of HH
Wood	95.8
Kerosene	3.2
LP Gas	0.4
Biogas	0.1
Livestock dung	0.7
Others(Agriculture waste, electricity)	0.2

Source : CBS, 2008

Similarly, percentage of households using alternate energy sources such as electricity, keresene, LP Gas is high as compared to Mid-hills (Table 4.2 /Figure 4.1). More than 66% households use kerosene for lighting and about 21% households have access to electricity. Rest of the population (12.3%) mostly uses the traditional source of lighting, the pine splits locally known as *Diyalo*[13] and a few affluent households enjoy solar energy (CBS, 2008)

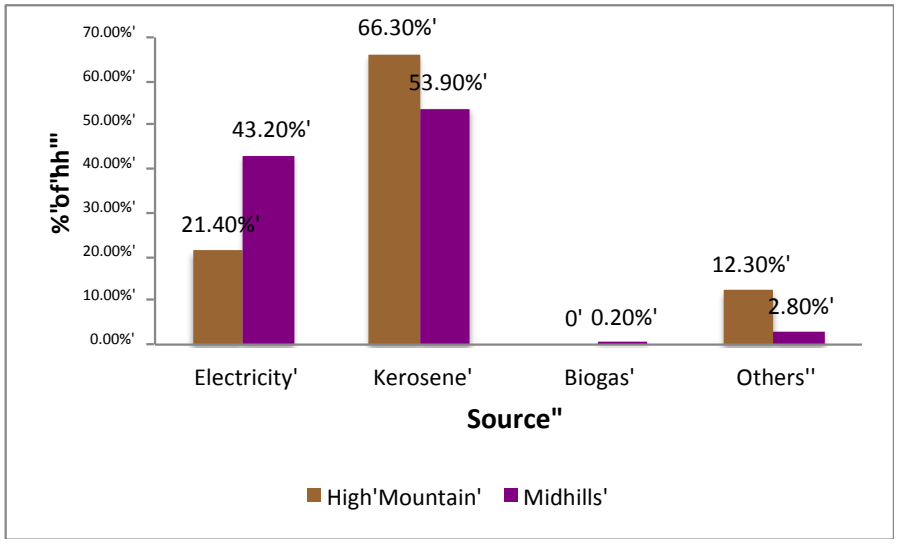
Table 4.2: HH using various sources of energy for lighting in High Mountain and Mid-hills

Energy Source	High Mountain (in %)	Mid-hills (in %)
Electricity	21.4	43.2
Kerosene	66.3	53.9
Biogas	0	0.2
Others (solar and biogas)	12.3	2.8

Source CBS:2008

[13] Diyalo is the most traditional energy source for lighting houses. It is mainly extracted in splits from the breast height of live pine/conifer tree (Chir pine in the Mid-hills and Blue pine Hemlock and Fir in the high mountain areas) . Very poor in the Mid-hills and households in the remote and inaccessible areas of high mountain areas largely use Diyalo for lighting and stimulator for igniting firewood.

Figure 4.1: Diagrammatic representation of HH using various sources of energy for lighting in High Mountain and Mid-hills



4.1.2 Household consumption of forest products

Consumption of various forest products at household level in the sample sites of the various districts is presented in the Table 4.3. The data shows that the consumption pattern varies across the districts according to location, accessibility, remoteness and lifestyles. In the district linked with roads, market centers or towns and tourism hot spots the consumption of timber is high as compared to remote and poorly accessed districts with low tourist pressure.

Among nine districts, the annual consumption of timber in Mustang (a tourist hot spots and recently linked with rough roads) is the highest (3.95 m^3/HH) as compared to other well road-linked and market developed districts of Sindhupalchowk (1.98m^3/HH), Baglung (1.7 m^3/HH), and Dolkha (1.42 m^3/HH). Most interestingly consumption of timber in Taplejung and Jumla is very low as compared to other districts. Similarly, the annual consumption of firewood is higher in Mustang (9 ton/HH), Jumla (7.3 ton/HH), Myagdi (7.2/HH), Sankhuwasbah (5.47 ton/HH) and Sindhupalchowk (5.01 ton/HH) as compared to other districts.

In addition to wood, significant quantity of leaf litter is consumed, which varies from 1.3 ton to 10.8 ton/HH/year. Forage/fodder consumption varies from 1.5 ton -14.4 ton HH/year. Bamboo[14]/Nigalo/Malingo is the other product that has a great value for the livelihoods of the high altitude communities. Until a few years ago, mattress of nigalo/malingo were the basic items or the only means of shading their shelters and protect young calves against frost and rain for the livestock herders particularly the transhumance herders. However, with the increased accessibility of plastic and its convenience the use of nigalo/malingo mattresses has

[14] The common Bamboo is not grown in high altitude areas where small bamboos known as Malingo and Nigalo are common. Malingo is confined up to lower temperate region but different varieties of Nigalo ascends up to temperate region occurring as a under storey crops in Mixed broad leaved and mixed broad leaved confer forests.

drastically gone down even in remote and inaccessible areas such as Chepuwa VDC of Sankhusabha.Malingo and nigalos are now mostly used for making agriculture accessories such as Doko Thunse (a bigger basket especially used for carrying leaf litters) and Dalo which they often bartered with food grains in the Mid-hills or sold for cash in the nearby market centers or road heads (Baral 1996, 2005).

Table 4.3: Household Consumption Pattern of Forest Products in the Sample Districts

District	Timber (m^3/year	Firewood (ton/year)	Leaf litter (ton/year)	Forage/ Fodder (ton/year)	Nigalo* (headload/year)	Edible plants/MAPs** (kg/year)
Taplejung (KCA)	0.17	1.3	1.3	1.5	2.5	0.5
Sankhuwashva (Chepuwa VDC)	0.68	5.47	8.73	6.47	NA	NA
Dolkha (Kalichowk, Sailung and Chordhum cluster)	1.42	4.8	8	5	3	1.25
Sindhupalchowk (Golche and Tatopani VDC)	1.98	5.01	5.01		3	0.5
Baglung (Burtibang, Dhorpatan)	1.70	3.96	6.48	14.4	NA	NA
Myagdi (Sikha/Ghara, Ghodepani)	1.28	7.2	NA	4.32	NA	NA
Mustang (Tukuche and Lete VDC))	3.54	9	10.8	4.32	NA	NA
Jumla	0.57	7.3	3.65	7.3	NA	NA
Bajhyang	1.28	2.4	2.46	2.41	NA	NA
Bajura	1.42	4.76	6.82	9.88	NA	NA
Average High Mountain	**1.40**	**5.12**	**5.33**	**5.56**	**0.85**	**0.75**

Source: COMFORTC, Field Survey 2012; *Baral, 2005; **LFLP/FAO/COMFORTC, 2011

Data for Nigalo and NTFPs were not available from the field survey however, a study carried out by Baral 2005 in Sindhupalchowk and FAO/LFLP, COMFORTC, in Sindhupalchowk and Panchthar district in 2011 show that on an average 2.5 head load to 3 head load of nigalo is collected[15] and used for various purposes. Similarly, on an average 0.75 kg of edible plants (mushrooms, wild honey, walnut and ferns) and natural fibers such as allo for weaving special traditional cloth (bhangro and shawl) and argheli for making coral (damlo) is collected from the forests for domestic uses.

4.1.3 Sources of forest products

High altitude communities extract/harvest forest products mostly from certain types of forests. Dry land farmers collect firewood and timber mostly from lower temperate forests and also go to temperate region for specific products such as shingles for roofing, special

[15] There are traditional bamboo/nigalo weavers in the upper Mid-hills (close to the upper limits of permanent human settlement, mostly Tamang, Rai/limbus and Magar who collect nigalo from the high mountain forests during the moth of Nov-December before the winter season and weave various products as per the request of the Mid-hills communities or demands of the local or road head traders. Basket made from Nigalo are more durable and fetch higher price than those products made from ordinary bamboos.

timber (champ and other confers), Nigalo, Mushroom, and Allo (nettle). While tranhumance graziers use the forest from lower temperate forests to Alpine scrubs, but mostly for firewood, small and pole sized tree for constructing their temporary sheds and collection of MAPs and NTFPs mostly for commercial purposes. Supply sources of forest products by management regime are depicted in the table 4.4 and figure 4.2.

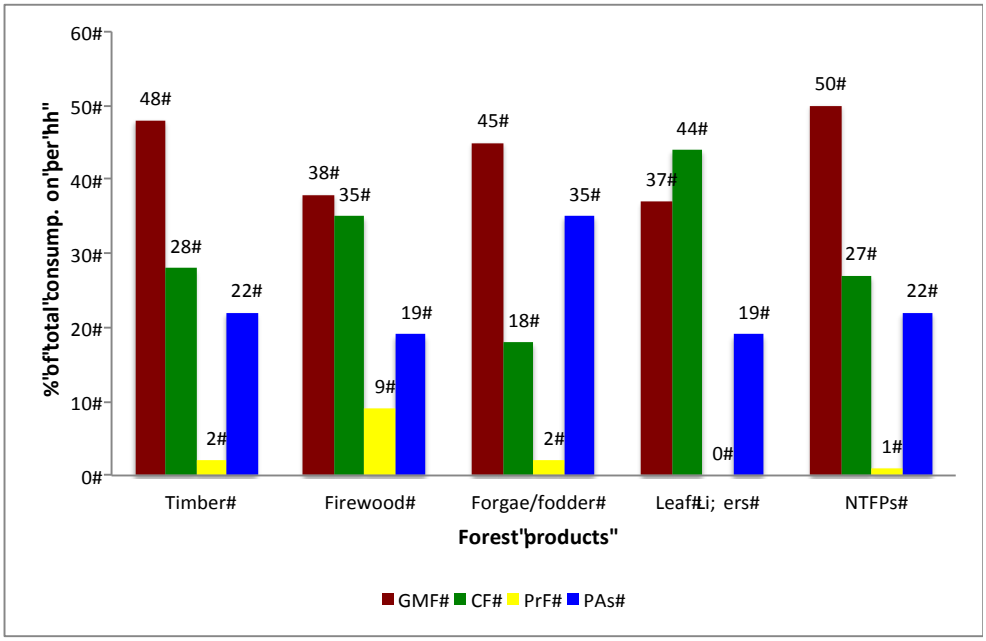
Analysis of data revels that the high altitude communities depend largely on government managed forests for their needs of forest products. Even the communities in the protected areas management systems largely depend on nearby government forests for timber, forage and fodder.

Table 4.4: Percentage of supply of forest products per hh from different management regimes

Forest Products	GMF	CF	PrF	PAs	Total
Timber	48	28	2	22	100
Firewood	38	35	9	19	100
Forage/fodder	45	18	2	35	100
Leaf Litters	37	44	0	19	100
NTFPs	50	27	1	22	100

Source: COMFORTC Filed Survey, 2012

Figure 4.2: Diagrammatic representation of the supply of forest products per hh from different management regimes



4.1.4 Harvesting of forest products for commercial purposes

There is a big gap of data/information on the sale of forest products from community forests. The DoF has maintained data of wood and non-wood products harvested and traded from GMF and private forests but have not they well recorded from community forestry and private forestry. However, a significant quantity of timber/wood is extracted and sold to local sawmills; veneer mills and city based wood traders from community forestry and private forestry. The quantity of wood and nonwood traded from GMF during the fiscal year 2062/63 to 2066/67 is presented in table 4.6.

Table 4.5:A comparative summaries of studies on the use of forest products in the Hills and Mountain of Nepal

Study	Fox (1983)	Mahat et al (1987)	Lavensom (1979)	Bajracharya (1983)	Wiart (1983)	Metz (1989)	Hardie et al (1987)	Stevens (2003)
Village type	Lower elevation	Mid-hills	Mid-hills	Mid-hills	Lower High Mountain	High mountain	High Mountain	High Mountain (Sagarmatha NP)
Region	Western	Central	Western	Eastern	Central	Western	Eastern (Sagarmatha NP)	Eastern
Method	Interview/ weigh	Interview	Interview/weigh	Interview	Interview/ weigh	Interview/ weigh	Interview/weigh	Interview/ weigh)
Fuel wood use kg/person/HH /yr	570	408	688	940	1330	2022.2	9.5 t/year/hh	13.5 (5 t/yr/hh)
Fuel wood from Public forests (%)	28	36-87	no data	no data	>80	>80	>90	>90
Fodder from Public forests (%)	44.57	14.3	no data	no data	>44	>50	>90	>90
Grazing dta	1.8 hr/day	none	none	none	bite counts	none	none	none
Bedding data	none	2/3rd of fodder	none	none	none	none	none	none
Consumption of timber kg/person/yr	no data	no data	no data	no data	375	230	18-24 m3/hh	24 m3/hh/yr

Source: Acharya (2003); Stvens (2003)

The annual consumption data of forest products collected from the field survey are close to figures available in literatures. There is a wide variation in estimates of forest products consumption in Nepali villages (table 4.5). Consumption rate of wood (timber and firewood) in High Mountain are much greater than those in lowland areas, probably due to the cooler temperatures and greater abundance of wood (Metz, 1991 as cited in Acharya, 2003). Table 4.5 summarizes the result of eight intensive studies on the use of forest products in the hills of Nepal. Four of these (Wiart, 1983, Metz, 1989, Hardie *et al* 1987, and Stevens, 2003) cover high altitude areas. These studies shows the level of dependency of high altitude population on public forest, with people gathering over 80% of their basic needs of forest products from National forests including national parks, government managed forests and community forests. High use of timber in many districts is associated with the culture of high mountain indigenous communities. Houses in high mountain area are relatively bigger (150-200 sq m) and normally three storey's as the ground floor is used for keeping cattle, goats and are too cold for living. The first floor is the main living room with kitchen and second floor is used for storing food grains and other valuable property.

4.1.5 Distribution of Trade of wood by districts

The volume of wood traded from the 25 high mountain districts is depicted in the table 4.6. On an average about 0.49 million cft of timber 298 chatta of wood is traded from high

mountain regions of Nepal (DoF, 2012). The data shows that annual volume of wood traded is in increasing trend though it remained slow during the insurgency before 2065. Three districts Sankhuwashbha, Ramechap and Kaski are the major exporter of wood (above 1 lakh cu ft) while district in remote and poorly road-linked areas such as Myagdi, Rolpa and Darchula, where the export of wood is very low (less than 500 cft). Of 25 eight districts do not trade any timber for commercial purpose. They are: Taplejung, Rasuwa, Mustang, Manag, Dolpa, Kalikot, Mugu, and Bajura (Table 4.7 see Annex XIV).

Table 4.6: Quantity of Wood Traded from High Mountain Region of Nepal (25 districts)

Fiscal year	Timber (cft)	Firewood (Chatta)
2062/63	115965	297.1
2063/64	9828.7	6.8
2064/65	446731	396.2
2065/66	692841.9	170.1
2067/68	1182741	618
Avg/year	**489621.5**	**297.64**

Source: DoF, 2012

Table 4.7: Scenario of timber trade from 25 high altitude districts by volume per year

Wood Volume Category	No of district	Remarks
Above 100,000 cft	3	Sankhuashabha, Ramechap and Kaski
50-99,000 cft	5	Terhathum, Solukhumbhu, Okhadhunga, Dolkha and Baglung
10-49,000 cft	2	Sindhupalchowk and Gorkha
2- 5,000 cft	3	Myagdi, Rolpa, Darchula
< 500 cft	3	Humla, Jumla, Bajhang
No trade	8	Taplejung, Rasuwa, Mustang, Manag, Dolpa, Kalikot, Mugu, and Bajura
Total	**25**	

Source: DoF, 2012

4.1.7 Non-timber Forest products

Table 4.8 presents the overall MAPs and other NTFPs traded in Nepal over the period 2004/05 to 2009/10. The data shows that on an average 37.85 ton /year of lokta/argheli, 34.25 ton/year of loth salla and 12.65 ton/year of MAPS (DoF, 2012)..

High mountain areas are generally known as store house of high value NTFP but their share on overall NTFP's trade is very small. Review of official trade records of DFO shows that when the quantity of Chirauto and Sunpati is taken out from MAPs, the share of other MAPs is negligible in terms of volume. In contrast, they, fetches thousand times more than the price of Chiraito and Sunpati such as Yarsagumba and Panchaunle. When MAPs and other NTFP from high mountain forests perspective are taken in to account, two major categories of NTFPs (i) MAPs and (ii) Locally manufactured or industrial raw materials such as lokta/argheli[16], allo, and lothsalla are the major ones. As collection of lothsall is basically

[16] Argheli actually is not the product of high mountain region, it is usually found in the transitional zone between lower temperate region and upper subtropical region of the Mid-hills.

regulated by the government, and its collection at present is prohibited, MAPs and Lokta seem two products in trade in high mountain regions. The other two products Guddichau (Jumla wild Mushroom) and wild honey though small in quaintly fetch high price in the market. Similar to Yarsagumba they are also high value products found in typical habitats but very small quantities of these products enter into the district and national database systems. Thus, data and information about these products is also missing. Similarly, the other basic but commonly found all over the high mountain regions in abundance and used for mainly consumptive and some for commercial purpose is Nigalo. Until recently, Nigalo never became a commercial product but with the increased in road networks and growing demands for bamboo products in urban and neighboring Indian cites it is becoming a commercial products (384.4 MT/year), particularly in the eastern region. On an average 384.4 thousand culms of Nigalo is traded per year (Table 4.8)

Table 4.8 : Traded quantity of MAPs and other NTFPs between 2004/5-2009/10 in Nepal

Fiscal year	MAPs (ton)	Lokta/Argheli (ton)	Loth salla (ton)	Nigalo (no '000')
2009/10	2.3	80.8	5	49.49
2008/09	11	67.6	0	447.9
2007/08	9.1	26.7	19.4	65.1
2006/07	53.5	17.9	13.4	702.3
2005/06	0	20.1	7.5	615.1
2004/05	0	14	160.2	428
Total	**75.9**	**227.1**	**205.5**	**2308**
Avg/year	**12.65**	**37.85**	**34.25**	**384.6**

Source: DoF, 2012

4.1.8 Annual Trade of NTFPs from the high mountain districts

The distribution of NTFPs traded annually from the 25 high mountain districts of Nepal is presented in the table 4.9 and Annex XIV. The table shows that on an average 131 MT of MAPs and 154 MT of other NTFPs are traded from these districts annually. The annual traded volume of NTFP highly fluctuated. This shows that the external factors make much influence in the trade of NTFPs.

Of the 25 districts Dolkha, Darchula and Bajura trade the highest quantity of MAPs (more than 100 MT per year) followed by Gorkha, Sindhupalchowk, Taplejung, Kalikot and Okhadhunga (50-100 MT) and rest of the districts trade between 10-100 MT (Table 4.10 Annex XV).

Table 4.9: Annual Trade of NTFPs (kg) across the High Mountain Region of Nepal (25 districts)

Fiscal year	MAPs (kg)	Other NTFPs* (kg)
2062/63	1372.5	569.3
2063/64	2157.8	2704.8
2064/65	825.9	855.4
2065/66	684.6	765.4
2067/68	653392.6	765377.6
Avg/year	**131686.7**	**154054.5**

Source; DoF, 2012

Table 4.10: Scenario of NTFP trade from 25 high altitude districts by volume per year

MAPs			Other NTFPs category		
Volume Category in kg	No of district	Remarks	Volume Category	No of district	Remarks
> 1 lakh	3	Dolkha, Darchula and Bajura	30000-40000	1	Panchthar
10-50,000	6	Gorkha, Sindhupalchowk, Taplejung, Jumla, Kalikot and Okhadhunga,	5000-30000	3	Sankhuwashabha, Dolkha, and Rolpa
2,000 to 9,900	3	Myagdi, Humla, and Rolpa	2000-4900	2	Rasuwa and Gorkha
100 -500	1	Panchthar	100-500	4	Ramechap, Sindhupalchowk, Bajhyang, and Darchula
<100 kg	9	Sankhuwashabha Ramechhap, Kaski, Terhathum, Solukhumbu, Baglung, Rasuwa, Mustang and Dolpa	<100	9	Solukhumbu, Okhaldhunga, Kaski, Baglung, Myagdi, Dolpa, Mugu, Taplejung, and Terhathum
No trade	3	Baghang, Manag, Mugu	No trade	6	Mustang, Manag, Kalikot, Humla and Bajura
	25			25	

Source: DoF, 2012

4.1.9 Volumes permitted by DFOs and volume traded by trade center

No comprehensive study has been done to assess the volume of timber/firewoods and NTFPs permitted for collection by DFOs and the actual quantity of forest products traded by trade centers. Review of contemporary literatures on MAPs harvesting and trade shows that the actual collection of NTFPs as against collection permits issued by DFOs would have been four fold. In other words, the collection permits cover only 25% of traded volume. The situation of timber, firewood, sand stones and other NTFPs is also similar. A large volume of timber and firewood would be sold directly to the local processors, saw mills and brick factories locally (Personal observation).

A study carried out by Forest Resource Information Project (FRISP) in 1995 has also observed similar observations. Of the 3053 ton of NTFPs traded during 2044/45 to 2048/49, DFOs had given permits for only 778.38 ton. FRISP had drawn the following two conclusions reading the issue. The DFO try to restrict collection of most MAP by issuing permits for relatively small volumes but do not check the actual volumes collected and or, the supply potential is larger than estimated by DFOs (FRISP, 1995)

4.2 Change in Demand and Supply Pattern

4.2.1 Demand and Supply of Wood Products and Fodder/forage

Until ten years ago wood in the high mountain region was not a commercial commodity[17]. But now it is increasingly growing as a major commodity in Nepal as well as Tibetan markets. Various pull factors such as accessibility, relatively better life, developing markets and infrastructure facilities, better job opportunities and a number of push factors such as remoteness inaccessibility, harsh climatic condition, out migration of youth and labour scarcity have made a drastic change in the demands of timber in high altitude areas both in domestic as well as commercial purposes.

An attempt has been made to assess the extent of change in demand and supply of various forest products in the high mountain region of Nepal.

Timber

From the utilization point of view, demands of timber in high mountain area can be broadly divided into three major categories.

(i) Timber for traditional houses (in remote and inaccessible areas)
(ii) Timber for construction of new houses and building for the migrated households in and around new towns, road heads and market centers
(iii) Timber for commercial purposes (tourism business, hydropower, social service centers and infrastructure such as schools health centers etc.

(i) Timber for traditional houses

There is no much change in the timber demand to construct traditional houses. Construction of new traditional houses has gone down. On an average 2-3 houses are built in a typical remote village such as Chepuwa of Sankhuashabha. The percentage of household using pine shingles is also in decreasing trend. It has gone down by 25-50% in several locations. About 15 years ago about 60-100% of HH in several villages of Dolkha (Bhedpu, Sailung, Shyama, Kalinchowk Lapilang and Gaurishankar VDC) used to have pine shingles. By now more than 75% of HH have replaced pine shingle by slates or GI sheets (Direct observation). Similarly, demand of timber for transhumance herders has also decreased number of transhumance herding has gone down. Many of them have abandoned their life styles. Some of them have settled in the new town centers, some have migrated to cities or abroad and a few have started dry land farming.

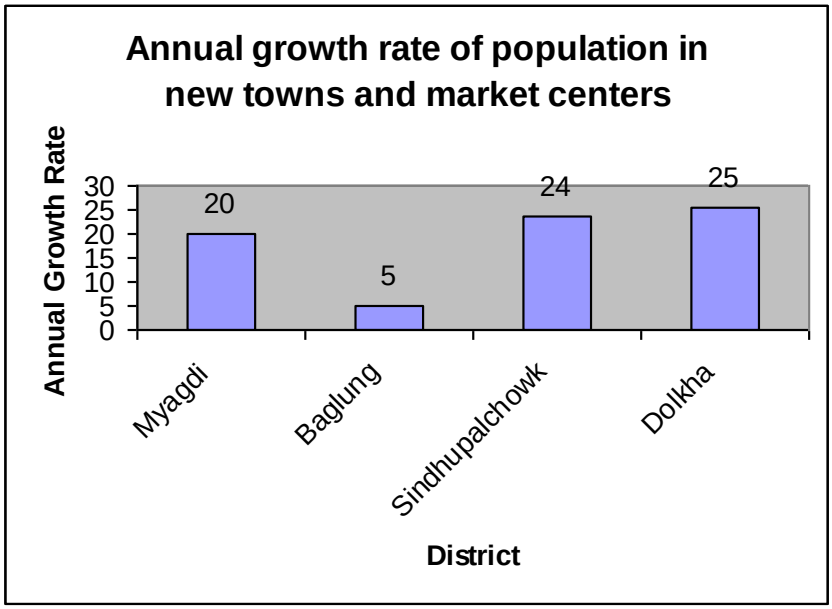
(ii) Timber demand at new road heads and market centers

The demand of timber (large sized trees) to construct houses and building in and around emerging towns and market centers have increased rapidly, as the population of these centers has increased by many folds. Observation of some of the market centers and towns in four

[17] With the exception of the traditional barter system largely practiced in certain trade centre bordered to Tibet China.

districts[18] (Myagdi, Baglung, Dolkha and Sindhupalchowk) shows that the annual population growth in these centers varies between 5-25% per year. More than 5000 new houses were built in these towns and market centers during the last 10 years or so. Assuming that a simple two story building would require about 300 cft of timber, the total quantity of timber harvested from the local forests is equivalent to 1.5 million cft or 150 thousands cft/year. This is a huge quantity for a rural area. The whole demand is to be met or being met by GMF or the protected areas, where they can get the preferred species and quality timber.

Figure 4.3: Annual population growth in new towns and market centers of four districts.



(iii)Timber for commercial purposes

The change in the demand of timber at high altitude forest has significantly increased as a result of hydropower development, tourism business and timber business. As discussed earlier majority of hydropower projects are located in the vicinity of high mountain forests where large number of work forces are involved. Huge quantity of timber is required to complete a hydropower project. It includes construction of structures (permanent or temporary), tunnels, offices and quarters, and temporary sheds. Simultaneously, a new market emerges accelerating construction of new houses by the immigrants which in turn compels the government or the local community for the expansion or construction of public service centers. Officially, the hydropower authorities or the contractors are supposed to buy timber from free markets and use the wood and forest resources with legal mechanisms. But, legal provisions are often violated as the monitoring of wood consumptions seldom happens. There are several reasons behind this. The weak governance, political fragileness and the socio-politically power held by the hydropower authorities and their contractors, the weak monitoring by forest officers in the district and his/her staff are some of the factors behind.

[18] The TL of the study had worked in these district as a district forest officer and high altitude forest management specialist for more than 2 years each between 1980-2003, and had done extensive tours of high altitude areas of Sindhupalchowk, Dolkha and Ramechap between 2054 to 2065.

As a result of this, majority of demands for timber is met from local forests where the local traders in one way other, in association with private farmers and community forests, supply the timber. This is the scenario of timber harvesting in hydropower areas derived from personal experiences[19] although no facts and figure have been published so far in Nepal. As more than 500 hydropower projects have already been planned and proposed, unless special measure is taken pressure to high altitude forests is inevitable. The impact of these many hydropower projects in the degradation and deforestation of High mountain forests would be huge.

Another sector that has a substantial influence in local demand and supply of wood product is the tourism in protected areas management systems. As discussed earlier, number of tourists in Nepal is increasing at a rate of 35% a year and at least 40% of tourists who enter into Nepal visit Protected Areas (CBS, 2010, DNPWC, 2011). Tourist visit is not uniformly distributed throughout the national parks and conservation areas but concentrated in several locations or routes. On an average 96657 tourist visit protected areas of Nepal (Table 4.11).

Table 4.11: Number of tourists visiting Protected Areas between 2060/61 to 2067/68

National Park	2060/61	2061/62	2062/63	2063/64	2064/65	2065/66	2066/67	2067/68
Sheyphoksundo	215	252	119	208	607	591	558	519
Sagarmatha	21960	17750	20100	23313	28170	29499	31189	33390
Langtang	3396	4122	4230	6097	9219	9915	10603	11119
Makalu Barun	189	103	74	227	594	1443	1903	1666
Rara National	16	5	28	46	141	105	157	207
Khaptad	8	0	1	7	10	20	5	27
KCA	418	166	156	328	534	599	454	579
ACA	44969	34579	36000	50129	65257	74128	85278	95314
MCA	551	573	598	617	1233	1659	1896	2629
GCA	0	0	0	0	0	0	0	318
ANCA	0	0	0	0	0	0	0	
DHR	0	0	0	0	55	25	17	77
Total	71722	57550	61306	80972	105820	117984	132060	145845
Nepal	172290.0	154716.0	165304.0	245910.0	291040.0	349195.0	381789.0	455237.0
%	41.6	37.2	37.1	32.9	36.4	33.8	34.6	32.0

Source: DNPWC, 2011

Data/information about the impacts of tourism on the deforestation and forest degradation is not available. No detail study is carried out at national level. However, study done by various researchers such as Stevens 2001, 2002; Hardie *et al* 1987; Byers 1987; Brower 1990, 1991; Bjonnnness 1980, 1983; in Sagarmatha National Park have reported the trend of change in demand and supply of wood both in magnitude and nature of use. Review of these studies reveal a substantial increase in the flow of tourist, change in the trekking and expedition

[19] Based on the experiences of the team leader of the study team while working for the government between 2042-2047 in Gorkha; 2042-2047 , 2048-2050 in Dolkha, and 2054-2057 in Sindhupalchowk when Lower Myarsyangdi, Khimti, and Upper Bhotekoshi and Indrawati Hydropower proejct were constructed respectively.

pattern, and drastic increase in tourism business. Many Sherpa communities have already changed their traditional herding life styles of yak/chauri and joined tourism business. Stevens reports that majority of villages in Khumbu (80 no) and Pharak[20] (30 no) were renovated to meet the requirement of tourism and serve as inns. And the number of inns/lodges or hotels have been increased from 62 to 169 in Khumbu and 14 to 100 in Pharak between 1986 to 2000 (Steven 2003). Because of this the demands for sawn timber has been increased from 18 m^3/house in 1979 to 24 m^3/house (Hardie *et al*, 1987 cited in Stevens, 2003). Similarly the demand of sawn wood for the construction of inns and hotel increased from 7500m^3 in 1987 to 15000m3 in 2001. The total demand for wood (sawn timber) in 2003 was 3000 m^3 (Steven 2003). As the National park restricts cutting of not more than three trees per structure for domestic purpose, Khumbu inns and hotels owners export timber[21] from Pharak villages where the local community and labour of the inns and hotel owners harvest timber from the GMF. And the deficit demands for sawn timber are met from the neighbouring district of Dolkha, where Helicopter is used for transportation.

As the road access is increased in many high hill areas, a significant number of traders have entered in to the high mountain in search of specialized wood business (veneer) making it a lucrative business. Trees retained on farm land for more than years are the entry areas of timber business followed by trees cleared during the road construction. Review of the DoF trade figures in the last five years shows that more than 80 % timber traded was from the hills and mountain (table 4.7). This trend will increase in coming years as road networks are in increasing trend.

Looking at the present trend of wood harvesting and government's inaction to manage or reforest the sustainability of forest resources looked to be in danger. Trees sold from private land and community forests to traders will further increase the pressure on GMFs and PAs. As these trees would go in the trade business and local people would obviously meet their HH demand from the high mountain forests that largely remained as open access.

Firewood

Wood energy is the only source of energy for the high mountain people. With the increase in access and change in life styles Kerosene and LP Gas are increasingly used in town and market centers. As the migration of high mountain people is increasing to in lower mountains the population growth at the high mountain is low as compared to other areas. Moreover, the transhumance herding is in decreasing trend. Thus, there will be not much increase in the per capita consumption of firewood in remote rural areas.

However, the consumption of firewood will increase in market centers, and in areas influenced by infrastructure project of tourism, hydropower, and roads. As discussed earlier, a significant number of outsiders visit and stay in the high mountain areas for various

[20] A village outside Sagarmatha National Park

[21] Khumbu inns and hotel owners exported 15000 m^3 in 2001 while demands for sawn timber in 1987 was 750 m3

purposes. Their presence will increase the requirement of firewood. The present tend of tourists visiting PAs shows that their number will go on increasing in selected PAs unless special measures to divert tourists in other protected areas is not taken. It means more lodges; hotels and more number of porters will create more localized demands for firewood. Experiences from the past hydropower project shows that at least 10-20% labour engaged in these projects settle down permanently in the project areas (Upper Kaligandaki EIA Report 1995). From this it can be concluded that demands for firewood in the high mountain region is increasing at an rate of 30-80 % in and around market and tourist centers while it is decreasing by about 15% in remote and distant rural areas devoid of road access and market centers.

Fodder and forage

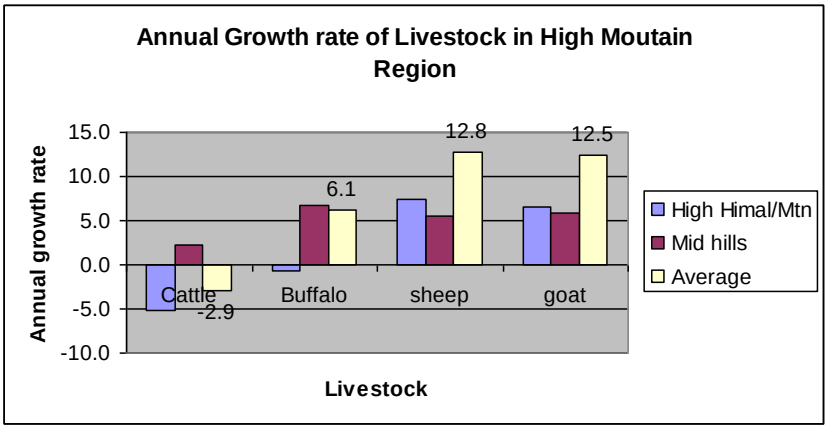
Forage and fodder is the basic products of transhumance glaziers, which they derive from the high mountain forests and pasture. Supply of forage and fodder in the high altitude region is already deficit. The deficit will continue in future, as there is no plan to manage and improve the pasture and fodder trees in the high mountain areas. However, with the change in life styles, in migration and shortage of young people and openings of other economic opportunities together with ban on grazing by the CFUGs the number of households adopting transhumance herding and number livestock is on decreasing trend (Table 4.12). The population of typical high altitude cattle the yak/chauri is decreasing at about 3 percent per year (Figure 4.4). However, number of herders in certain parts of the districts such as Dolkha, Sindhupalchowk, Taplejung, and Panchthar is in increasing trend.

Table 4.12: Livestock Population in High Mountain Region (25 districts) between 1985 and 2007 (in million)

Livestock	1985	2007
Cattle (mainly yak and chauri)	6.4	7.21
Buffalo	2.8	3.4
Sheep	0.8	0.471
Goats	4.9	6.9

(Source: CBS, 2008)

Figure 4.4: Annual growth rate of livestock in high mountain region



A traditional herder Kunjok Nurup from Limi VDC of Humla, who used to own 100 yaks and 500 sheep some years ago now has only two yaks and eight sheep (Acharya 2003). Similarly, horse farming used to be one of the major economic activities in the high mountain about 15-20 years ago. With the increase in road access this business is completely washed out. It is now limited mainly on transhumance region of Dolpa and Upper Mustang.

Furthermore, Bishop (1989), in a detailed study of one village in Nepal, reported that older people there were no longer as willing as in former times to endure the hardship of high altitude life on the lonely summer pastures. They were thus changing from being milk producers to being breeders of hybrid animals. To produce the hybrids, they were using cows at the lower altitudes nearer the villages and mating them to yak bulls. The hybrid animals were then sold as replacement stock, making for an easier life for the herdsmen and their families compared with milk production from yak. In summary, overall demands for forage and fodder will not be changed and number of traditional herders will be decreased but concentrated livestock herding will continue in the years to come.

Leaf litter and other forest product of domestic use

Leaf litter and other bedding materials are associated with livestock rearing and cropping. Herders generally use pine bark as a bedding materials for the young claves and sometimes for shading their temporary huts. The dry land farmers mainly use leaf litter from the forest of lower temperate regions. As the number of livestock in the high mountain region is in decreasing trends and the supply of leaf litter is surplus as compared to demands, there will be no much changes and effects of the demands and supply of leaf litter. From forest fire management perspective unless green manure get advantaged over chemical fertilizers and the government develop special economic incentive packages to harness the comparative advantage of largely under used farm land, the huge quantity debris and leaf litter deposited on the forest bed will continue to be one of the major fire hazard in the year to come.

4.2.2 Demand and supply of MAPs and NTFPs

NTFPs mainly MAPs are the major economic sources and means of livelihoods of many people in the high mountain areas. However an analysis of traded quantities of NTFPs from the high mountain district of Nepal shows a decreasing trend of the trade despite the growing demand. The existing trade of selected high valued MAPs from MAPs rich district shows that annual trade of majority species except Padmachal has drastically declined. Jatamashi trade has decreased from 120 tons in 1997/98 to 13.78 tons in 2010/11. Similarly, Kutki trade has gone down from 13.3 tons to 11.14 tons and Sugandhawal has gone down from 12.9 tons to 8.46 (Table 4.13). Respondents in the 10 sample districts identified four important reasons for the decline of NTFP production. They are: inaccessibility and remoteness, government policy, no appropriate management and unhealthy competition (Table 4.15).

Table 4.13: A comparison of selected high value MAPs trading between 1997/98 and 2010/11 (in tons)

MAPs	1997/98	2010/11
Jatamansi	120.0	13.78
Kutki	13.3	11.145
Padmachal	16.7	4450
Sugnadhawal	12.9	8.46

Table 4.14: Trade of NTFPs from Jumla from 2002/203 to 2010/11

	2002/03	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11
Atis	0.399	0.272	0.295	0.181	0.198	0.34	0.31	0.521	0.15
Bhutkesh	3.7	0.254	0	0	0	0	0.4	0.697	0.31
Bish		7.543	6.843	0.15	2.602	3.55	0.73	0.945	1.07
Guchi chyau	3.847	0.237	2.621	1.006	1.169	1.146	0.167	0.342	0.953
Jata Masi	26.703	43.996	67.296	28.288	35.958	30.133	23.61	29.101	58.375
Sugandhawal	12.92	21.005	17.927	6.218	4.73	8.495	9.275	6.449	8.46
Kutki	13.3	0	0	0.395	4.284	5.128	1.41	5	11.145
Chiraito	1.074	0.727	0.518	0.985	0.543	0.579	0.452	0.252	1.225
Subtotal	**48.643**	**74.034**	**95.5**	**37.223**	**49.484**	**49.371**	**36.354**	**43.307**	**81.688**
Other Maps	14.642	10.162	5.638	5.069	3.605	24.89	47.593	43.223	111.215
Total	**63.285**	**84.196**	**101.138**	**42.292**	**53.089**	**74.261**	**83.947**	**86.53**	**192.903**

Source: DFO Jumla, 2012

Figure 4.5: Annual trade growth of high value MAPs in Jumla

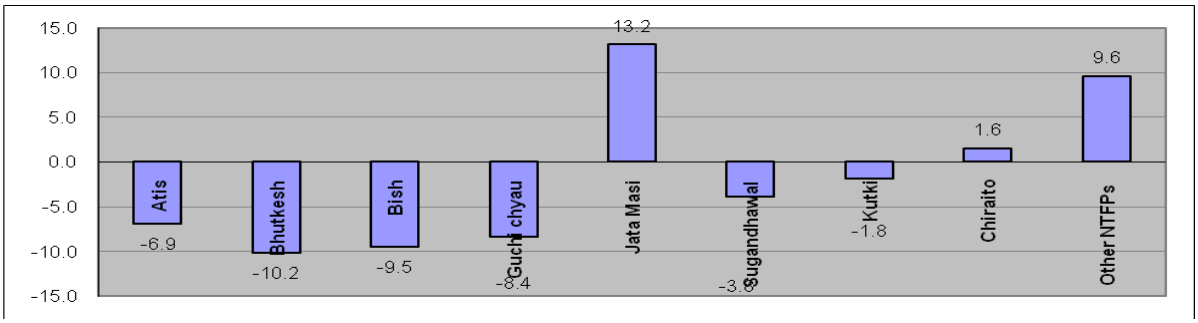


Table 4.15: Reason of decline in production of NTFP (Multiple choice)

	Users		Traders		Civil Society		Government		Total	
Inaccessibility and remoteness	51	23%	8	20%	27	32%	13	33%	99	26%
Government policy	35	16%	5	12%	17	20%	6	15%	63	16%
No appropriate management of NTFP	34	15%	7	17%	13	15%	9	23%	63	16%
Unhealthy compitition	38	17%	6	15%	11	13%	2	5%	57	15%
Lack of information of market price	8	4%	1	2%	2	2%	1	3%	12	3%
Lack of market	6	3%	0	0%	2	2%	1	3%	9	2%
Royalty rate	6	3%	2	5%	2	2%	1	3%	11	3%
Community forest	16	7%	4	10%	3	4%	0	0%	23	6%
Complicated collection and export process	5	2%	5	12%	3	4%	2	5%	15	4%
Monitoring system	20	9%	1	2%	1	1%	1	3%	23	6%
Others	2	1%	2	5%	2	2%	3	8%	9	2%
Don't Know/Can't Say	0	0%	0	0%	2	2%	0	0%	2	1%
Total	221	100%	41	100%	85	100%	39	100%	386	100%
	N=117		N=23		N=47		N=22		N=209	

COMFORTC Survey, 2012

In summary, demands and supply scenario of MAPs and NTFPs is also not balance. As demand for MAPs and other NTFPs is high and Tibet China is replacing the monopoly of Indian market, the increased demand of MAPs will continue. This could lead to immature collection, over harvesting. The lack adequate institutional arrangement and open access nature of high mountain forests will make the degradation of NTFPs to continue in the years to come particularly in remote areas.

4.3 Demand trend of major wood products perceived by respondents

Respondents of 10 districts perceive that the demand of forest products in general has increased. On an average 29% respondents reported increase in the demand of forest products, while 27% reported no change, 18% decrease and 26% reported don't know (see table 4.15). Most important factor is that about 46% and 41% reported increase in the demand of timber for household and firewood for household purposes respectively. Whereas the demand of the timber and firewood for commercial purpose is less increased at 26% and 10% respectively (see table 4.16).

Table 4.15: Trend of demand of forest products as perceived by the respondents

	Type of respondents									
Demand trend	Users		Traders		Civil Society		Government		Total	
Increase	219	31%	50	36%	64	23%	33	25%	366	29%
Same	198	28%	42	30%	61	22%	34	26%	335	27%
Decrease	107	15%	17	12%	66	23%	32	24%	222	18%
Don't Know	177	25%	29	21%	91	32%	33	25%	330	26%
Total	701	100%	138	100%	282	100%	132	100%	1253	100%

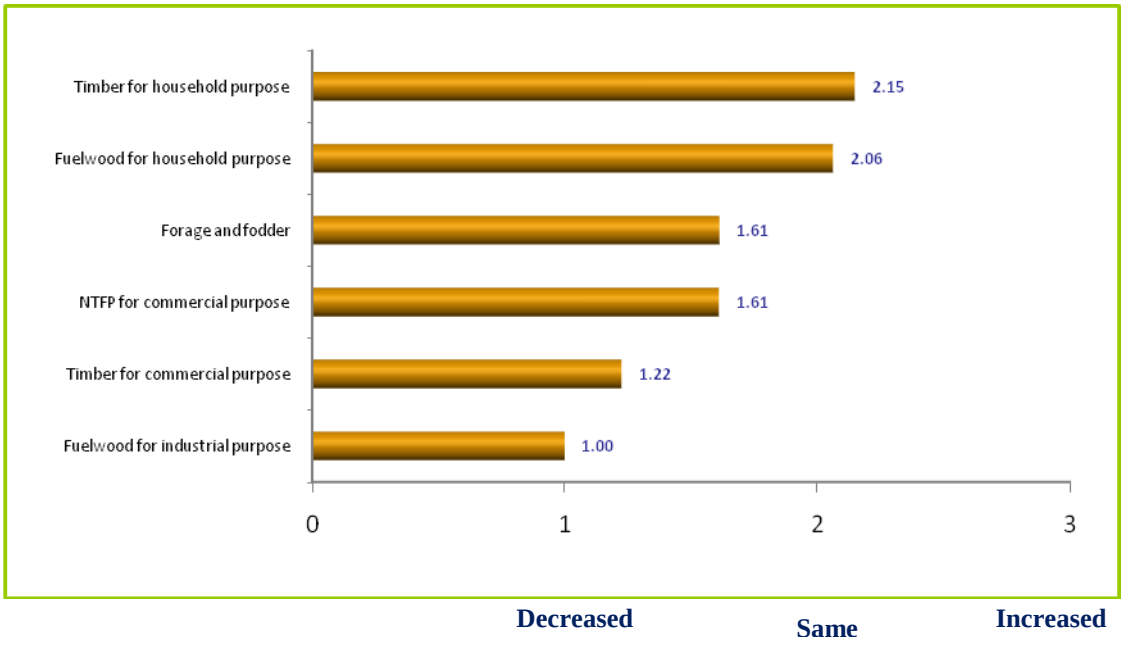
Source: COMFORTC Filed Survey, 2012

Table 4.16: Trend of demand of forest products for different purposes as perceived by the respondents

Respondent	Increase in trend of demand of forest products for different purposes											
	Timber for HH Purpose		Timber for commercial purpose		Firewood for household purpose		Firewood for industrial purpose		NTFP for commercial purpose		Forage and fodder	
	N	%	N	%	N	%	N	%	N	%	N	%
Users (N=117)	57	49%	37	32%	51	44%	13	11%	30	26%	31	26%
Traders (N=23)	12	52%	9	39%	9	39%	3	13%	7	30%	10	43%
Civil Society (N=47)	22	47%	5	11%	20	43%	2	4%	6	13%	9	19%
Government (N=22)	6	27%	3	14%	6	27%	3	14%	5	23%	10	45%
Total	97	46%	54	26%	86	41%	21	10%	48	23%	60	29%

Source: COMFORTC Filed Survey, 2012

Figure 4.6: Trend of demand of forest products for different purposes as perceived by the respondents



Chapter V: Future demand and supply scenario

5.1 Future demand and supply scenario

5.1.1 Forest area available for forest product by regime

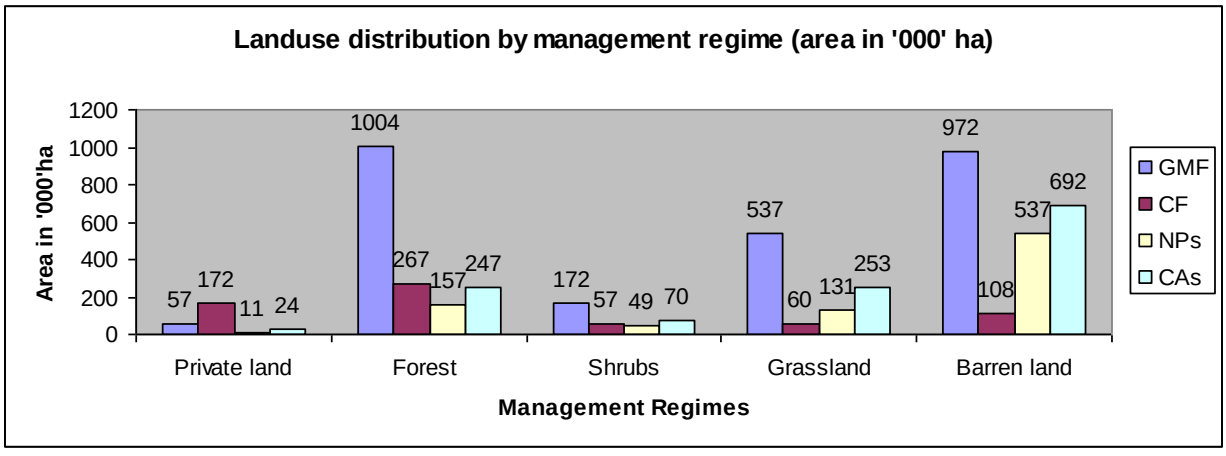
The total area of forests including shrubland in High mountain area is 2,022,000 ha of which about 520,000 ha belongs to High Himal region. Four categories of land: private land, forestland, shrubland and grassland are identified as potential sources of forest products (wood and non-wood including forage/fodder). Areas of these lands by management regimes are presented in table 5.1. It is estimated that altogether about 5,577,000 ha of land will be available for the production of forest products of which barren land comprises the largest share (41.41%) followed by forests (30%) grassland (17.59%). And the share of shrubland and agriculture is 6.24% and 4.74% respectively.

Table 5.1:Land and forest areas available for the production of forest products in 25 High Mountain districts by management regimes

Landuse	Area under DFO Jurisdiction	% of total High Mountain area	PAs	% of total High Mountain area	Total
Private land	229.25	4.11	34.71	0.62	263.96
Forest	1271.01	22.79	404.07	7.25	1675.08
Shrubs	228.74	4.10	119.14	2.14	347.88
Grassland	596.39	10.69	384.11	6.89	980.50
Barren land	1080.26	19.37	1228.82	22.04	2309.08
Total	**3405.65**	**61.07**	**2170.85**	**38.93**	**5576.50**

Source: After Department of Survey and TIPs Ecological Maps 2001

Figure 5.1: Landuse distribution by management regime (are in '000' ha)



5.1.2 Accessible area for the production of forest products (wood and non-wood)

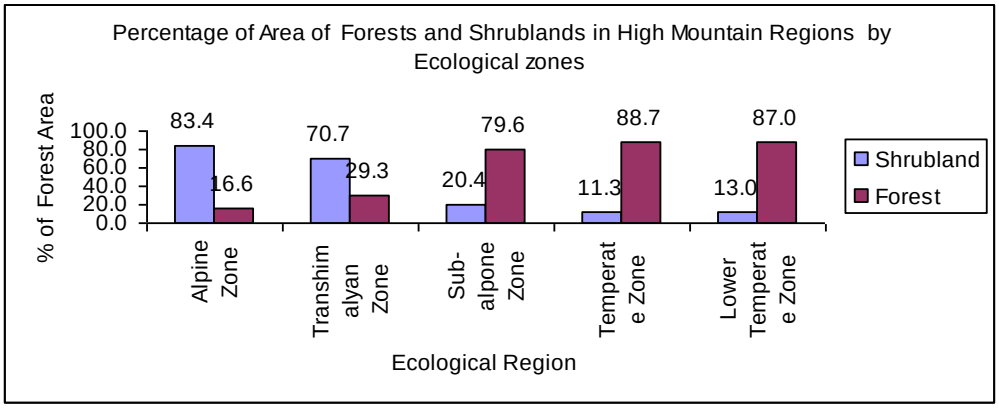
Because of steep slopes not all forest, shrubs and pastureland are accessible for forest products harvesting and use purposes. To calculate the potential accessible areas the whole landuse in the 25 high mountain districts was categorized into four different classes. Therefore, from forest harvesting and utilization purposes forests/shrubs falling into the lower category of slope (0-30 degree) has been considered the accessible area for wood harvesting and areas falling between 30-45 degree slopes mainly for NTFP collection and pasture. Steep slope areas above 45 degree are considered as no harvesting zones or protected forest areas (in case of forest/shrubs and grassland under DFO jurisdictions). Thus, about 419,000 ha of forest and shrub (33% of total forests and shrubs) will be available for intensive management of commercial production of woods. This figure is very much close to the accessibility factors for High Himal and High Mountains recommended by MPFS[22]

Table 5.2: Accessible area of forest/shrubs and grassland under DFO jurisdiction for the production of forest products. (in '000' ha)

Slope Category	**Forests**	**Shrubs**	**Grassland**	Effective Area	Remarks
0-15^{o}	99.14	13.72	66.20	84.65	Available for Commercial purposes
15-30^{o}	391.47	55.13	179.51	334.95	do
30-45^{o}	573.23	108.65	245.12	511.41	Available for NTFP/ Pasture and Domestic purposes
>45^{o}	207.17	51.47	104.96	258.64	No harvesting and protection zone
Total	**1271.01**	**228.74**	**596.39**	**1189.64**	

Source: Based On GIS Map, 2001

Figure 5.2: Percentage distribution of areas of forest and shrubland by ecological regions in 25 High Mountain districts



[22] MPFS(1988) accessibility factors were mainly recommended from NTFPs and pasture management perspective and domestic use of woods

5.1.2 Forest productivity and sustained yield

Recent data on the productivity of forests, their growing stock is absent. So, the data and information used by MPFS (table 5.3) is taken as the basis for calculating the standing volume by types, for the calculation of sustained yield of wood and TDN (forage/fodder). Based on the MPFS(1988) per ha standing volume and annual sustained yield, the total available sustained yield of timber and firewood is 3364.1 thousand tons and 141.54 thousand cubic meter of round timber. Similarly, a total of 9850.5 thousand ton of TDN will be available from forests in both national forests and protected areas (Table 5.4).

Table 5.3: Standing Volume and per ha annual yield by forest types Area in '000' ha and volume in '000 m^3 timber and '000' tons

Ecological Region	Forests (ha)		Sustainable Annual wood supply/ha			
	Area in ha	Standing Vol/ha	Firewood (ton)	Timber	Firewood (ton)	Timber (m3)
High Himal	135.2	24	2.2	0.106	297.44	14.3312
High Mountain	1135.8	225	2.7	0.112	3066.66	127.2096
					3364.1	141.5408

Source: Based on MPFS, 1988

Table 5.4: TDN Supply Sources/year ('000' t) from National Forests, CAs and Farmland

Sources	**Area in '000'ha**	**High Himal**	**High Mountain**	**Total Supply**		**Grand Total**
		Per ha	**Per ha**	**High Himal**	**High Mountain**	
Forests	263.96	5.5	4.88	1451.8	26.8	1478.6
Shrubs	1675.08	4.58	3.6	7671.9	16.5	7688.4
Grassland	347.88	1.22	2.53	424.4	3.1	427.5
Barren land	980.50	NA	NA	-	20.0	20.0
Farm land and crop residues	2309.08	NA	NA		236.0	236.0
Total				**9548.1**	**302.4**	**9850.5**

Source: based on APROSC,1986 and MPFS, 1988

5.1.3 Accessible sustained annual yield and supply (except NPs)

As discussed in the earlier section not all forests, shrublands and grassland are accessible for forest products harvesting point of view. Areas above 45 degree slope are highly sensitive for timber harvesting. Local people in some locations may harvest some quantities of wood and small poles in localities where forests in less sloppy, areas are small, and scarcity persists. Majority of these forests can only be used for the collection of NTFPs and for grazing. Harvesting of timber and other forest products in the NPs are strictly protected while wood for domestic purposes can be harvested from conservation areas. Grazing and collection of NTFPs even for commercial is also not restricted in CAs. Taking into account these factors the annual sustained yield of three products has been estimated and presented in the table 5.6.

Table 5.5: Distribution of landuse by regime

Landuse	Land /forest areas outside PA		Protected Area Systems (PAs)	
	Government Managed Forests(GMF)	Community based Forests	National Parks	Conservation Areas
Agriculture	229.25	0.00	0.00	10.62
Forest	1271.01		156.68	247.39
Shrubs	228.74	29.82	49.33	69.81
Grassland	596.39	0.00	131.01	253.10
Barren land	1080.26	353.92	536.75	692.07
Total	**3405.65**	**707.83**	**884.38**	**1286.47**

The table below shows the estimated wood supply from forests and shrublands from the government managed forests and community forests after applying the slope criteria discussed earlier. The table 5.6 shows that the estimated annual sustainable quantity of firewood and timber is 2753 thousand ton and 3747 thousand m3 of round timber respectively.

Table 5.6: Estimated annual sustainable quantity of firewood and timber available

Management Regime	Total Accessible Areas			Sustainable Annual Supply	
		Firewood	Timber	Firewood	Timber
GMF	484.36	2.8	0.11	1356.208	53.2796
CF	306.17	2.9	12	887.893	3674.04
CAs	181.76	2.8	0.11	508.928	19.9936
Total	**972.29**			**2753.029**	**3747.313**

Source: After MPFS, 1988

Forage and Fodder

Table 5.7 presents the estimated accessible annual TDN production calculated using the criteria discussed in the earlier section. The figure in the table shows that a total of 957 metric ton of TDN will be available annually where the share of GMF is substantially greater than other mode of forestry.

Table 5.7: Accessible Annual TDN supply from forests and grass and by management regime

Management Regime	Accessible Areas			TDN Supply		
	Forest	Shrub	Grassland	Forest	Shrub	Grassland
GMF	826.3747	141.19	295.7519	4545.06083	646.6577	360.8173
CF	219.6692	294.32	337.8921	1208.18073	1347.975	412.2284
CAs	203.6016	119.77	150.9448	1119.80907	548.5372	184.1527
Total	**1249.646**	**555.2773**	**784.5889**	**6873.05062**	**2543.17**	**957.1984**

Source: After MPFS, 1988

MAPs and other NTFPs

As discussed earlier, data and of total growing stock and annual sustained yield of NTFPs are not available. As the majority of high value NTFPs and other NTFPs shows decreasing trend, average per year trade of NTFPs is taken the sustained supply of NTFPs (although, the data provided by the DoF/DFO does not reflect the real scenario). More quantities of NTFPs is harvested and traded than the available record of DoF.

Similarly, the other much used and highly important NTFPs from farmers prospective is leaf litter. The data on supply side for these products is not available. However, the forests in the high mountain areas deposit a huge amount of leaf litter in the floor and its sustainable supply would not be a problem.

5.2 Alternate supply scenario and per capita consumption (20 years)

The current trend of consumption and supply of wood demonstrates a vicious circle of localized and selective over cutting, productivity decline and further over cutting to meet the both basic needs and the development driven needs.

As discussed earlier, the consumption pattern can be categorized into three major categories. Consumption of wood in typical remote high altitude rural areas differs from Mid-hills, where small poles or small trees, squared timber or occasionally sawn timber are mostly used. The second kind of consumption is in the growing towns and market centers, where the preference is often sawn timber of selected or preferred matured tree species. The next consumption of wood is for commercial purposes used for building structures required for development projects and commercial purpose such as hydropower and tourism business.

The consumption of NTFPs mainly involves two streams of harvesting. Medicinal and aromatic plants are generally collected for commercial purposes and the market largely guides its collection. The consumption of MAPs for domestic purposes is negligible. Therefore, it is very difficult to estimate the per capita consumption of MAPs. Other NTFPs particularly edible plants and natural fiber including Nigalo are consumed relatively more as compared to MAPs but their consumption hardly imbalance their supply.

The other highly important and scarce forest products from the high altitude communities are forage and fodder, particularly in the winter season. There are two streams of use system of fodder. The dry land farmers often cut and carry the forage/fodder while the transhumance herders entirely depend of grazing. As discussed in the earlier, on an average livestock husbandry in many districts or regions is in declining trend, though there are instances where it is increased. The number of livestock head and holders varies across the region. Livestock in the eastern region and some areas of central region has shown increasing trend while the number of herders and herd size in some parts of districts in the same regions and Karnali zone is drastically declined. Taking into account these factors and by applying the methods of calculating the TDN requirement (discussed in chapter 4) the per capita consumption of fodder/forage has been estimated and projected for the next 20 years.

The other forest product used in substantial quantity is leaf litter. No detailed and scientific data that gives the national scenario of consumption and supply of leaf litter is available. However, looking at the leaf litter deposited on the floor of high altitude forests and the population of the dry land farmers, there is abundant supply of leaf litter from the high mountain forests. However, it can be assumed that with the increased awareness on environmental conservation, scarcity of chemical fertilizers, demands for organic food and vegetables and road access, per capita consumption of leaf litter to make green manure or farmyard manure will certainly be increased in the years to come.

However, the existing scenario of forest products use patterns will be changed. Rapid urbanization , increase in road access and migration of rural people to urban areas demands for large sized construction timber will be replaced by cement, and concrete and specialized woods (plywood, particle board and other form of specialized woods). Similarly, demand of wood fuel in market centers and growing urban areas of the high mountain regions will also be gradually replaced by alternative energy sources such as LP gas, electricity cooking and heating. Similarly, the use of improved utensils (such as pressure cooker, rice cooker, improved cooking stoves, biogas, micro-hydropower and bio-briquette and change in feeding habits of livestock have reduced the per capita consumption of wood fuel in most of the rural areas close to the road network and growing towns.

Furthermore, the conventional mode of forest management[23] has been shifted to people-centered approach. Various management modes such as Community forestry, Group Leasehold forestry, and Collaborative Forestry, have been developed and implemented. Fulfillment of forest products needs of the local community and livelihoods of poor, women and dalits are the prime concern of forestry sectors. Therefore the present open access scenario of the high mountain forests will be changed because the area of community based forestry will go on increasing rapidly in the years to come and will be brought under sustainable management.

Since 2003 the forest authority has adopted a multi-stakeholders approach through the establishment of District Forestry Coordination Committee (DFCC). Under this approach, forestry is also a concern of elected body, civil society and green sector line agencies. Moreover, management of forest resources has become the concerns of persons or agencies beyond the forestry professionals and institutions. Civil societies, NGOs, Users, and local government are equally interested in forestry management, particularly in advocacy, and media outreach.

The tremendous success achieved within a short period of 10-12 years from community forestry has encouraged the other two major Departments (Department of National Parks and Wild Life Conservation, and Department of Soil Conservation and Watershed Management) to develop participatory Watershed Management approach in Soil Conservation and

[23] Conventional forest management practice is focused to produce immediate goods with the greatest possible profit margin as well as desired condition for increasing production of goods in the future. It is based on top down pyramid, where expected procedures and outputs are detrimental at the top, and extended downwards through a bureaucratic chain of command.

Watershed Management and Buffer Zone Community Forestry Approach in National Parks and Wildlife reserves Conservation

Concerns on environmental issues such as clean energy, air, green products and organic farming at both national as well as international level is growing. There is strong participation of stakeholders from policy makers to youths, farmers, and forest users groups and their network, and civil societies on environmental conservation and lobbying for environmental and user friendly production systems. Market for green agro-forestry products including wood, MAPs, fruits and other NTFPs natural fiber such as nettle, hemp and Nepali paper is in an increasing trend and essential policy measures for environmental conservation and mitigating impacts of climate change biodiversity conservation Strategy and Implementation Plan, National Adaptation Programme of Action (NAPA) to Climate change, etc will also bring about changes forest products use patterns.

5.2.1 Calculation of per capita consumption of forest products

To estimate the demand and supply scenario of the next 20 years, the following trend, consumption patterns are assumed.

A. Timber

Timber for typical rural high mountain villages

Maximum demand of the timber in the remote villages is for roof shingles. The use of pine shingles for roof is in decreasing trends and it will continue to decline in the years to come with increased road access, economic opportunities and government interventions. Therefore per capita household consumption of timber in these areas will be decreased at least by 20% in the first five years and then by 20-30% in the following fifteen years

The timber for transhumance graziers would not increase in the years to come. On an average the number of the livestock in the high altitude areas is in decreasing trends, therefore, the consumption of wood by transhumance glaziers will also decline. However, there will be extreme pressure on certain areas where the number of livestock and herders has been increased drastically, for example in Gumdel region of Ramechap and Solukhambu, Taplejung and Panchthar (although Panchthar does not fall in 25 high mountain districts). Whatever the case, these transhumance graziers consumes very small quantity of poles and round wood, if their system of wood harvesting is improved; it will have negligible negative impacts to the forests.

Based on this assumption per capita household consumption of timber in typical rural High mountain areas is estimated as:

Total population= 30% of total population of high mountain districts

Population growth= -1.5

Timber/HH = 16 m3

Maintenance = 3 m^3/HH/year

Timber for market centers and growing urban areas

It is assumed that houses in these areas will be of two and half storey equivalent to 100- 120 sq meter of permanent type (mud/cement-stone/brick) with roofs of GI sheet or RCC. Population at these centers will go on increasing and soon after it will stable as more economic frontier will be emerged in other areas with increased road access and emergence of new hydropower projects and other economic opportunities.

Total population= 20% of high Mountain population

Population growth rate=Average 15% from next five years

Timber /HH =350 cft

Timber for repairing =30 cft

Timber for service centers = 4000 cft/year for first 7 years

Repairing = 800 cft/year

Timber for commercial purpose and for tourism business

Tourism business demands a substantial volume of timber for constructing inns, hotels and other social service and recreational centers. At present two national parks (Sagarmatha and Langtang) and a conservation area (Annapurna Conservation Area) are the major preferred tourist destinations. Of the remaining PA system, the flow of tourist is very low. Therefore, there are few hotels or inns. As the number of tourist in these PAs is in increasing trend, the number of structures required to meet the tourism requirement will also be increased accordingly. Therefore, demands or consumption of timber in these three PA areas will be increased at least by 20%.

Similarly, it is anticipated that the government will take necessary steps to reduce pressure over the three PAs by developing special tourism promotion packages for the remaining PAs of the high mountain regions thereby diverting the tourists. Based on these assumptions the per capita hotel/inns consumption or demands for timber is estimated as:

Timber for inns and Hotel in ACA, LNP and SNP =3000 m3 (@ 24 m3/structure)

Repairing/Maintenance = 750 m3

Timber for Other PAs area = 1200 m3 (15 m3/structure)

Repairing/Maintenance = 400 m3

Timber for local forest based industries

Small cottage industry or micro-enterprise type of wood based industry operated at household level is the common feature of rural markets and towns center. Recently, with the increase of road access, small saw mills and veneer mills are also emerging in high mountain regions. As a result of this, wood in high mountain areas has become a lucrative business, particularly the farmers who had retained significant number of trees on their farmland. Review of the forest management plans of 25 high mountain districts and field survey in sample district reveals that on an average there are 15-25 micro to small forest based industries in each district. It is also anticipated that small saw mills and veneer mills which now are limited to well accessed

urban and semi urban districts such as Kaski, Sindhupalchowk, and Dolkha will soon be expanded or moved in the rest of the high mountain districts in the years to come.

Growth rate of forest based industry= 3-5%

Average per year consumption capacity micro-enterprises= 400 cft

Saw mills (on an average 3 in number) = 20-3000 cft/year

Veneer Mills (1-2 per district) = > 100000 cft

B. Firewood

Per capita consumption of Firewood

Wood will remain the major source of energy for the rural areas however; its consumption will go on decreasing with the pace of development of marker centre and urbanizations. Number of alternative energy sources such as LPG, electricity, solar energy will be available for lighting, heating and cooking. Similarly a number of households using improved fuel-efficient stoves and utensils will also be increased. It has also been observed trend of cooking animal feed (kudo) and snacks for agriculture labour (*khaja, arni*) using such fuel-efficient stoves. This will save a substantial quantity of firewood (about 50%).

To the contrary of the rural household, there is another scenario induced or brought about by the development intervention such as hydropower, big drinking water projects and irrigation schemes, road construction and tourism development. Although these development projects remain for a short period of time, but they impacts on the population dynamics of rural areas exerting pressure to other local forests areas. The government has already planned and proposed more than 500 small to mega hydropower projects and thousands of kilometers of roads including the high mountain highway. The present trend of labour flow from one place to another will continue in the next 20 years. Similarly, a large number of porters will be involved in tourism business as the number of tourist is also in increasing trend. Taking into account all these factors, the per capita household and per capita labour/porter consumption of firewood is estimated as follows:

Transhumance herders and dry land farmers
Population = 5% of total population of HA area
Transhumance herder @700 Head load/HHH/year = 12 t (airdry)
Dry land Farmer (@500 head load/HH/year) = 7 t (air dry)
Total population= 30% of total population of high mountain districts
Population growth (both) = 1.5
Town or market centre based households
Total population= 20% of high Mountain population
Population growth rate =Average 15% for next five years
Per capita household consumption (@ 100 head load/HH/yr) =1.8 t/HH/yr
Labour engaged in Hydropower
Average number of labour in a 50 MW capacity project= 2000-3000 labour
Per capita consumption of fire wood per hydropower (@ 540 kg/labour) =1350 t
Hotels ad Lodges

LNP, ACA and SNP = 9 t/hotel/year
Number of Hotels/inns = 700-1500
Growth = 5%
Other PAS = 6t/year
No of Hotel/Inns-= >20
Growth= 10%

C. NTFPs

Annual demands and Supply of NTFPs

Data on per capita consumption of NTFPs is absent. However, annual quantity of NTFPs entered into market through the government channel is available. Studies done by various researchers as discussed in the earlier section reveals that permit issues by DFOs far exceeds the quantity traded. Demands for MAPs and other industrial raw materials is huge, but is under supplied. In recent years the monopoly of Indian market is broken by China. However, the over harvesting and immature harvesting and illegal trade to Tibet also is accelerating in recent years. As a result of this, production and supply of most of the high value MAPs and other NTFPs in many district is significantly declined. Unless the present trends of over exploitation and early harvesting is not checked, many species of MAPs will be threatened if not endangered. An experience from *Taxus bacata* and even Chirauto (aslli[24]) in some districts such as Dolkha as reported by the local farmers is rarely found.This is the present scenario.

Demands for herbs and natural fibers in the international market have been increased and the government has also developed a special NTFP development and management policy. In addition, many national and international organizations such as IUCN, ICIMOD, ANSAB, SNV, UNDP, Dabur Nepal, DFID, SDC and WWF are also working on various aspects of NTFPs development and management. As a result of this, a significant number of community or cooperative based micro-enterprises have been established. There are initiatives for the institutional and technical capacity for value addition, marketing, business planning, and ex-situ conservation of many high value NTFPs.

Moreover, the community forestry Users groups are engaged in the process of certification, ex-situ conservation and management of natural herbs species. Therefore, the condition of NTFPs in the year to come should improve and necessary measures to stop over harvesting and illegal trade would be taken.

D. Forage and fodder

Demand and supply of forage and fodder

Forage/fodder is one of the scarcest resources in the high mountain region after the food grains. Pastures are over grazed and their productivity is very low. Despite tremendous

[24] Three to four varieties of Chirauto is found , locally they are called first grade second grade etc. The real (aslli) that have medicinal value is *Swiertia chirauta* found in temperate region and now cultivated in many parts of the country in lower temperate region.

efforts in the past for the development and management of pasture under a special programme, no significant success could be achieved. Forage and fodder need in the high altitude areas are obtained from two major sources natural pasture land (alpine and sub-alpine pasture) and forests floor including trees having fodder value. Dryland farmers supplement a significant quantity of fodder and forage (about 25-35%) from their farmland while the transhumance graziers entirely depend on grazing. The scarcity of fodder in winter is severe. As a result, kharsu[25], the only available feed materials for the livestock during the winter season when the forest floor is covered with snow is badly threatened.

Moreover, the expansion of community forestry in the high mountain without acknowledging the socio-ecological value of indigenous pasture management system and ban on grazing animals on their traditional pasture, lopping of kharshu trees for feeding the livestock has not only threatened the livelihoods of transhumance herders, it has also put irreversible impact in many adjoining government managed forests. Two major government agencies are responsible to help address the issues of pasture: Department of Forests (DoF) and Department of Livestock (DLS). But none of these organizations has so far done any significant work on pasture. Even after the nationalization of Kahrkas in 2016, there is no pasture development policy of the government. There is poor coordination between these two entities.

However, the present scenario is changing. DLS in coordination with DoF is drafting Pasture Development Policy and the government has planned to launch special programme for the management of pasture land. Moreover, the there-year interim plan and the current three year plan approach paper have given much emphasis for the overall management of high altitude forests and pasture. CFUGs have also begun realizing the value of indigenous pasture management systems. Conflicts between CFUGs and transhumance graziers in many districts have been negotiated. The government is also launching a special high altitude focused project named Himali in support of ADB, where one of the major components will be pasture and livestock development. Therefore, the present situation will be changed significantly and condition and productivity of forests, fodder trees and pasture should be improved. Based on these assumptions, the per capita livestock demand for forage and fodder will be as follows:

Current population of Livestock in HA = 7,386,707 (4062689 LU)
Population Growth Rate =7.13
TDN =0.45 t/LU

E. Other non-wood forest products

The other nonwood products that do not have much market value but tremendous domestic values are leaf litter, edible plants, wild mushroom, nigalo, etc. Among these leaf litter and nigalo have significant economic as well as ecological values. High altitude forests are rich in

[25]A pioneer species while its other family members all shade their leaves in winter but this gift of the nature to the transhumance herders and the mountain farmers shades its leaves during the rainy season when the herds go to alpine pasture

both leaf litter and nigalo. Leaf litter deposited in the forest floor makes the forest vulnerable of forest fire. They are under used due to introduction of chemical fertilizer. Similarly, plastic and synthetic industrial materials have replaced the use of Nigalo.

With the increased awareness on the value of using organic materials and the growing demands for organic products, the demand of both these species would be increased in the years to come. The nigalo once limited in rural areas is now entering into the markets slowly and gradually. However, It will take many more years for the leaf litter to be a market product. The following assumption has been made to estimate the per capita consumption of leaflitter and Nigalo.

Leaf litter @ three thunse (a big bamboo/nigalo basket) /HH= 9t/hh/year
Nigalo: 2-2.5 bundle /HH/year

5.3 Projection of forest products for the next 20

Using the per capita consumption figures as assumed above, the demand and supply of timber, firewood, NTFPs and forage/fodder for consumptive and commercial purposes are projected and annexed in Annex XV. However, lack of per ha volume and yield of other Non-wood products except forage and fodder NTFPs no annual sustainable supply of these products has been projected (Table 5.8 and 5.9)

Table 5.8: Projected Demands for Forest Products

Forest Products	Unit	Year/Period							
		2012	2013	2014	2015	2016	2017	2018-022	2023-032
Timber	cub.m	4819.8	4682.1	4556.7	4443.9	4344.4	4208.7	4032.3	3897.8
Firewood	ton	4644.6	3961.9	3384.0	2895.7	2484.1	2116.8	1805.1	1540.8
Forage/Fodder (TDN)	ton	1828.2	1965.3	2112.7	2271.2	2441.5	2624.6	2821.5	3033.1
Leaf litter	ton	5913.0	6356.5	6833.2	7345.7	7896.6	8488.9	9125.5	9810.0
MAPs and other Nonwood	ton	841.0	841.0	841.0	925.1	1017.6	1119.4	1231.3	1354.4
Nigalo/bamboo (bundle)	bundle	1874.3	2014.8	2165.9	2328.4	2503.0	2690.7	2892.5	3109.5
Edible plants)	kg	624.8	671.6	722.0	776.1	834.3	896.9	964.2	1036.5

Source: Based on MPFS , 1988 and Expert judgment

Table 5.9: Projected Sustainable supply of wood and Forage/fodder (ton)

Forest Regime	Accessible Area	2012		2013-017		2018-022		2023-32	
		Sustainable Annual Supply		Sustainable Annual Supply		Sustainable Annual Supply		Sustainable Annual Supply	
		Firewood	Timber	Firewood	Timber	Firewood	Timber	Firewood	Timber
GMF	484.36	1356.21	53.28	1491.83	58.61	1627.45	63.94	1763.07	69.26
CF	306.17	887.89	3674.04	976.68	4041.44	1065.47	4408.85	1154.26	4776.25
CAs	181.76	508.93	19.99	559.82	21.99	610.71	23.99	661.61	25.99
PF	264	198.00	13.20	217.80	14.52	237.60	15.84	257.40	17.16
	Total	2951.03	3760.51	3246.13	4136.56	3541.23	4512.62	3836.34	4888.67
TDN	2590	10373.42		11929.43		12966.77		14004.12	

Source: Based on MPFS , 1988 and Expert judgment

Gaps in Demand and Supply of Wood

Despite huge areas of forests and low population in the high Mountain areas, the supply of wood shows negative scenario. There will a deficit of about 1700 thousand MT of firewood and 857 thousand cubic meter of timber till 2017. This is because of two major factors less than 25% of total areas of forests in the high mountain are accessible or can be managed for wood production. The other factor is rapid population growth, particularly from increased market centers, tourism business and infrastructures development such as hydropower and roads. However, as discussed in the earlier section, the deficit of wood does not remains long. When the accessible forests both GMFs and CFs are brought under sustainable forest management, supply of wood will be increased with the increased in productivity and intermediate yield (firewood and small timber) will also be available from tending operations. As production of timber takes considerable longer period than that of firewood, the negative trend of timber supply will be out of seen over the next ten years.

Table **5.10: Gaps in Demand and Supply of Wood (timber '000 m3 and Firewood(FW) in '000' MT**

Year	Demand		Supply		Deficit	
	FW	Timber	FW	Timber	FW	Timber
2012	4644.62	4617.92	2951.03	3760.5	-1693.59	-857.41
2017	2093.366	4208.66	3246.1	4136.6	1152.77	-72.095
2022	1779.361	4032.31	3541.2	4512.6	1761.87	480.3
2032	1512.457	3897.75	3836.3	4888.7	2323.88	990.91

Chapter VI: The policy, legal frameworks and institution

6.1 Policy and legal frameworks

Government of Nepal (GoN) has a number of policy and legal documents in forests management, conservation, collection, production, handling, use and trade of both major and NTFPs endorsed in different years a summary of implication of some major polices and legal frameworks from the perspective of High altitude forest management is presented in the table 6.2 below.

Table 6.1.: Major Forestland sectoral polices and legal framework relevant to High Mountain Regions

Policy and Legal framework	Main Features	Effects (+/-)
Master Plan for the Forestry Sector	It is the first comprehensive policy document in Nepal's forestry sector. The plan recognizes participatory approach to forestry appreciate the scope of NTFPs as an important area of intervention from economic as well as conservation view points Though it has not explicitly mentioned about management of high altitude but recommends institutional and technical capacity of forestry institutions and phased wise handover of large block of national forests to local communities for management with technical forest management plans	It has brought significant impacts on the restoration, rehabilitation and management of forests in the Mid-hills, Inner taria and Bhabar but handover of large block of high altitude forest up to China boarder beyond the capacity of local users without assessing the local institutional and technical capacity and acknowledging life styles, and prevailing local indigenous forest and pasture management systems has invited many socio economic and ecological adverse impacts on tarai and High mountain regions of Nepal; Fails to appreciate the scope of NTFPs as an important area of intervention from economic as well as conservation view points Has given very low propriety to pasture development while more than 800% pasture land lies in high altitude areas;
Revised Forest Policy 2002	This policy is basically focused on the commercial management of highly productive forests in the tarai and Inner tarai regions through collaborative approach of natural resource management;	No policy recommendation for high altitude forest resource management, however, it has introduced a new concept of collaborative forest management of most productive and commercial large block of forests in accessible areas ;
Community Forest Operational Guidelines (2000)	A practical tool for the filed officers involved in implementing CF programme with detailed stp by steps process and of handing over CF and preparing forest operational plans incorporating second generation issues of forest management;	The guidelines underestimates a the national and international values and unique features of high altitude forests and generalize CF handover process similar to Mid-hills; Handover of large block of forests in the high altitude excluding the traditional users in CFUgs and redistricting their access to pasture and other forest products have seriously jeopardised socio-economic and ecological consequences;
Leasehold Forestry Policy , 2002	Targeted to population below poverty line through rehabilitation of degraded forests; Simplifies handover process of	Has brought significant impacts on restoration of degraded forests and livelihoods improvement of poor rural farmers in areas where land is the limiting factor of livelihoods improvement

	leasehold forestry	However, a special policy is required in high mountain region where the land is not the limiting factor but inaccessibility and other bio-physical and climate factors;
The Interim Constitution of Nepal, 2007	Envisages the people as the source of power through decentralization; Empowers the state to purse the policy of mobilizing the nation's natural resources and heritage in a useful and profitable manner suitable to the national welfare; and Guarantees the protection of environment, the rare wildlife, forests and the vegetation.	Provides enough constitutional rights to develop forest policy and legalization for the sustainable management and economic development of the country. However, a strong and stable government is required to execute the constitutional arrangement into actions.
Nepal Biodiversity Strategy	A comprehensive policy document focusing on community based biodiversity conservation and management of critical habitats of wildlife and protection of endangered and threatened flora and fauns (which are largely concentrated in High Himal and Mountain areas)	Biodiversity Implementation Plan is in place, however, they are rarely implemented in a planned way; An biodiversity implementation guidelines is required for effective implementation and mainstreaming the strategy into forestry sector plans and programmes;
2004 Herbs and NTFP Development Policy	Focuses on community based commercial conservation (in-situ and ex-situ conservation) of high value NTFPs through public private partnership, their forest certification.	Provides tremendous opportunities for the participatory conservation, and management of NTFP and value addition through public private partnership approach and utilization of NTFPs The policy has not been effective because of lack of implementation guidelines
Forest Act 1993 and Forest Regulations 1995	Provides legal provisions for the implementation of strategies , plans and programmes recommended by the Master Plan for the4 forestry sector in a more effective, and decentralized way	Poor enforcement or implementation of legal provisions made for the management of government forests such as management of Production forests (Tarai and Inner tarai forests) and Protection forests (Siwaliks and High altitude forests) Forage and fodder has been recognized as NTFPs but the acts and regulations is silent about the management of pasture land;
Three tear Interim plan and three year perspective Plan	It has recommended the forestry sector to focus on increasing forest productivity and contribution to poverty alleviation. and maintaining minimum of 40 percent forests of total land area of the country	Lays strong foundation for maintaining the forest cover and increasing forest productivity and contribution to national economy through intensive forest management and promotion of forest based enterprises
National Agriculture Policy (NAP) 2004	It has given priority to community forestry leasehold forestry, private forestry and management of pastureland;	The plan is poorly implemented, No coordination in terms of planning and resource sharing between agriculture and forestry sector; A strong decentralized agro-forestry and pasture development coordination mechanism between forestry and agriculture sector is needed for better outcomes;

Environment Protection Act (EPA) 1996	It delineates scope and procedures of environmental impact assessment of developmental actions	Environmental impact assessment exercise has been institutionalized in forestry sector; However, no efforts is made for the implementation of environmental action plans, environmental monitoring and auditing to mitigate and assess the impacts of development interventions; Forestry sector has completely failed to save forest land from other landuse.
Agriculture Perspective Plan 1995	Adopts Master plan for Forestry sector; Stresses special focus on the protection of Siwaliks hills and supports management and pasture areas;	Long term plan of agriculture sector developed and implemented. Forestry sector programmes were considered as output therefore no input support was provided to farmers;
The Local Governance Act , 1996	Provides more Autonomy to local government and ensures Natural resource management and Environmental conservation through plantation and other conservation measures Empowers to levy taxes on utilization of natural resources and allocating at least fifty percent of total income from natural resources to NRM and environmental conservation	Serious conflicts between Forest Acts and regulations over use of resources
The Public Roads Act, 1974	Gives the department of roads an authority to build roads in the forests. It also provides the department an authority to excavate and utilize the soil, stone or sand lying nearby roads for construction and maintenance of roads. Act.	Rights and authorities conflict with the provisions of the Forest Acts and process and procedures made by the Acts and mitigation measures provisioned by the environmental Acts and regulations are rarely followed;
Water Resources Act, 1992	Empowers the state to use water without affecting the environment	Conflict in jurisdiction and authority between the Ministry of Water Resources, and the Ministry of Forests and Soil Conservation affecting the conservation of forest

6.1.1 Lesson learned and gap analysis

MPFS, The constitution of Nepal, Interim plan and three years perspective plan all provide sound policy basis for the government managed, community, leasehold and private forestry. The National Conservation Strategy, revised forestry policy emphasis on conservation of Churia hills as ecologically sensitive zone and area for least human disturbance. However, no such policy exist for the conservation of biodiversity rich (endemic flora) with high watershed values and highly vulnerable to climate change zones-the high altitude regions.

The Forest Act 1993 and Forest Regulation 1995 give the legal basis to enforce the forest conservation, management and utilization of forest products in all types of forest products. The Soil Conservation Act 1982 is not enforced in the field as per its provision. Environment

Conservation Act 1997 compels to make environmental impact assessment before launching any project, which have positive or negative impacts. In the National Parks and Wildlife Conservation Act 1973, the DFO is authorized to take action against illegal hunting of the wildlife in the forest areas. Local Self Governance Act, 1998 has provision to establish plantation and environment conservation by the DDC and VDCs in its area.

Though all the aforementioned Acts directly or indirectly furnishes sound legal basis for forest conservation, management, and utilization of the forest but these Acts are not effectively enforced in the government forest. The Forest Act and Local Governance Act are conflicting in some clauses. There is a lack of an enabling environment and attitude of the government staff to efficiently enforce these Acts in the field.

6.1.2 Policy and institutional gaps

Some of the major **policy gaps**[26] in forest sector are:

- Forestry sector seems incompetent in technical capacity to develop and implement landscape specific sustainable forest management and development modalities to harness the comparative advantages of high altitude forests and take benefits form global issues of biodiversity conservation and climate change.
- There is no long term human resource development and institutional restructuring in the forestry sector
- It has been realized that the Churia hills and High Mountains are the most sensitive zones, however, it lacks specific policy for their conservation and linkage between High Altitude-Mid-hills and Tarai;
- Conflict over ownership and management of pasture land between forestry and Livestock sector is still prevalent and there is no policy for pastureland management;
- The role of private sector in wood-based industry, private forestry, alternative energy and NTFP promotion, processing and export is highlighted by the forestry policies.
- Private forestry has shown much enthusiasm but there is a lack of policy to encourage private forestry, transport of products from one part of Nepal to another and export.
- Inter and Intra-ministerial coordination as well as institutional coordination among the stakeholders are poor that weaken timely accomplishments of the objectives of forestry sectors as envisioned by the polices and subsequent plans;
- The M&E strategy 2002 is yet not fully operational and is used mainly at the level of policy reference. There has been a gap of translating M&E strategy into practice with action on indicators testing, modifying and using at different hierarchy levels
- There is a big gap in information generation and management. It has resulted in difficulties for MFSC in regularizing its activity monitoring system and in visualizing contribution of forestry sector activities in poverty reduction and environmental conservation strategies of the country.
- There is big gap in the forest policy and its implementation strategy and mechanism, efforts are made to maximise loopholes polices instead of its motive and essence;

[26] Gaps identification and Lesson learned have been derived from various literatures cited in the report and personal experiences of the study team

- Environmental impact assessments have been made obligatory for any type of development interventions however, they have been limited as legal reference legal document. There is lack of a strong institutions at the national and district level to enforce and monitor the mitigation measures and assess the impacts of such in the district. As a result of this the construction of roads without fulfilling any kinds of legal requirements is becoming a major drivers of deforestation and forest degradation in the Mid-hills and high altitude areas of Nepal.
- Newly constructed roads in many parts of the Mid-hills and mountains has opened access to remote high altitude areas access to high altitude opening quite a significant numbers of new urban/ town and market centres. However, lack of land use planning and scarcity of private land for expansion there is tremendous pressure to the nearby forest for land and timber required for the expansion of urban areas and building houses and other infrastructures.
- Despite recognition of forest fire a major drivers of deforestation and forest degradation no priority is given to prevent , control and manage forest fire as if it a natural phenomena prevention and control is beyond the human capacity;
- The Forest Acts and Local Governance Act, he Public Road Act, Water Resources Act, Nepal Mines and , Mines and Minerals Act 1985 are conflicting in some clauses. There is lack of an enabling environment and attitude of the government staff to efficiently enforce these Acts in the field.
- Principle of Payment for Environmental Services (PES) Biodiversity conservation, Carbon sequestration, Soil and watershed conservation etc.).

6.1.3 Successful Lessons from Forest Policies and Programs

- Based on the above discussion, and an analysis of the drivers of deforestation and governance, we can generalize the following lessons. Strategic options for future improvement are given in the next section.

Policy Formulation and Planning Process

- Top down approach has a little success. Home grown innovations based on searching by the local stakeholders and with accountability feedback system are more successful in containing deforestation and devising governance modalities.
- No single forestry solution or model fits all physiographic zones. Community Forestry is relatively a success story in the hills, but it is a contentious issue in the Tarai. Distant users of the south, the communities living along the sides of east-west high way, and the people living in the Siwaliks could jointly work out a modality of forest governance and management in the Tarai and Siwaliks. Similarly, consultative platforms have to be created for finding out a better governance structure to manage the mountain forests.
- Policy formation based on practice and piloting reduces the transaction cost of implementation. Thus, this way, the policy making becomes more effective. "Policy declaration" without consultation and practicing it in the field does not work in Nepal.

Organizational Structure and Functioning Mechanisms

- Decentralization of forest governance is essential for success. Stakeholders at the grassroots' level have better "time and space" knowledge of the site, and are better able to resolve collective problems in the forestry sector.

- Hierarchical organizational set up and culture have a limited success in the forestry sector.
- When foresters are engaged with in advising rather than in policing the forests, they seem to become more trust worthy to the villagers. Team building with local people's organizations and other stakeholders at the village and district level can be more effective in forest conservation.
- When foresters facilitate local level institutional building process and provide assistance in technical forestry, chances of better forest management increases. Institutional innovation is necessary to promote technical improvement in forest management.
- Forestry programs linked to livelihood seem to perform better. This allows local people to own the forestry program. Since many poor and excluded groups reside in the rural areas, they could be properly represented in forest management and most of the benefits from the forestry program should accrue to them.

Implementation of Plans, Programs and Projects

- Bottom up planning and participatory approach are effective means to improve forest conditions, and strengthen rural livelihoods.
- Collaboration between and among government and non-governmental organizations, grass root institutions, and private sector provide effective synergy.
- Findings of monitoring and evaluation should be utilized for learning and further improvements of policies and programs.
- Small-scale forest enterprises based on local raw materials further enhances the chances of better forest management. This way, the local people can get more benefits in terms of employment and income

Table 6.2 : Perception of respondents about the role of different policies on DD

Causes	Users		Traders		Civil Society		Government		Total	
Forest Policy	110	23%	1	50%	35	38%	16	31%	162	26%
Protected area or Conservation Policy	83	18%	0	0%	25	27%	14	27%	122	20%
Development Policy	74	16%	0	0%	10	11%	7	14%	91	15%
Local Governance Acts and Regulation	75	16%	1	50%	12	13%	7	14%	95	15%
Economic Policy	70	15%	0	0%	6	6%	4	8%	80	13%
Other sectoral policy	61	13%	0	0%	5	5%	3	6%	69	11%
Total	473	100 %	2	100 %	93	100 %	51	100 %	619	100 %

Figure 6.1: Role of different policies on DD as perceived by civil society members and government.

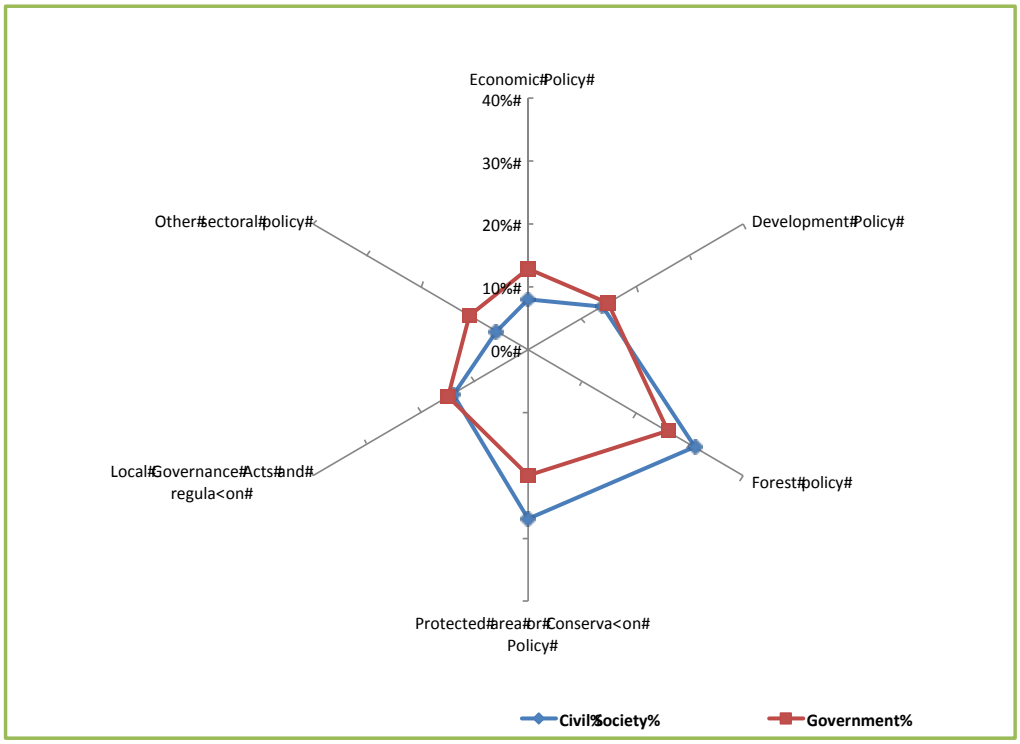


Table 6.2 presents the perception of respondents about the role of different policies in DD. A highest percentage of respondents believe that the forest policy has the greatest influence followed by the protected area and conservation policy. The perception on the importance policies found to be varied between civil society respondents and government respondents. Civil society respondents considered the role of forest policy and conservation policy higher as compared to government respondents. owever, the government respondents considered the role of development policy, economic policy, other sectoral policies and local governance act and regulation higher as compared to the civil society members.

6.2 Institution and capacity

6.2.1 Tenure system and informal institutions

Most of the high altitude forests are national forest, protected areas or community forests. The upland pastures areas are government owned. However, local traditional tenure systems and informal institutions do exist in many areas. Uprety (1994) reported the influence of traditional *kipat*[27] legacy in most pastures of Mahamangkhe and Yamphudin VDCs in Kanchenjunga area. Despite such a kipatya system, Brown (1994) reported a number of

[27] Kipat is a type of communal land ownership historically prevalent among certain ethnic groups although Land Reform Act, 2064, abolished it. Under this system, the members had the usufructuary rights to use community land and pastures, but no power to sell it. Regmi (1976) lists the following groups as possessing Kipat system: Limbu, Rai, Majhiya, Bhote (the residents of the upper Tamor and other areas), Yakha, Tamang, Hayu, Chepang, Barmu, Danuwar, Sunuwar, Kumhal, Pahari, Thami, Sherpa, Majhi and Lepcha (Brown, 1994).

community managed pasturelands in the high altitude villages of Ghunsa, Gyepla, Pholey, Wonagchung Gola, and Yangma of Kanchenjunga areas. In these areas rules like when to move livestock to higher pastures and how long to remain such areas are made by community meetings. The users from outside need to pay a fee, either per head or per herd. Brown (1994) also reports of another kind of local institution in Ghunsa and Pholey of Kanchenjunga as 'grass cutting days. Ward representatives in these two areas, in consultation with community members decides certain days in the month of Asoj (mid-September to mid-October) as grass cutting days and allow community members to harvest hay for the winter. The grass cutting continues until all the grasses are harvested.

Another kind of institution commonly known as kiduk and Gothala kiduk also exist in upper tamor and Wolangchung Gola areas. The Bhote and Tiberan refugee communities in upper tamor practice the kiduk system where donation management, local credit systems and informal local governance systems are practiced (Brown, 1994). In Wolangchung Gola area, the Gothala kiduk system is practiced which regulates the timing of grass collection, herd movement and also promotes the collective welfare of herders (Uprety, 1994). Another kind of institution that used to be in practice among the Sherpa communities of Solukhumbu were the *Shinga naua system.* It used to be a classic example of a successful common forest management system. The Shinga naua were locally appointed officials with responsibility for allocating forest resources and enforcing compliance to locally crafted rules. Later, this indigenous system was replaced by the government apparatus, which led to a conversion of property rights regime of forests from a common- pool resource to open access resource.

The extent and effectiveness of such kind of informal institutions are not well documented. But failing to recognize these institutions, use-rights and management systems have made a failure of government effort to improve pasture land (Rai and Thapa, 1993). These institutions have emerged for a regulatory need and equity need of the local area. Brown (1994) has reported many of such institutions functioning very effectively. So, such institutions can provide a solid foundation to strategize the management of high altitude forests, pastures and NTFPs.

6.2.2 Major actors and their roles

Three broad categories of actors are closely interlinked or are associated with proximate and underlying causes of deforestation and degradation of forests in high altitude areas. These actors can be classified as primary actors, secondary actors, and tertiary actors who engage and interact in complex ways either to escalate or halt the degradation and deforestation. The actors and their key roles are:

Primary actors- They include the local people both the upland dry farmers and transhumance pastoralists, distant seasonal users, entrepreneurs such as hoteliers, cheese factory owners, wood based entrepreneurs, NTFP collectors and traders, and tourists, mountaineers, trekkers, and other users. This category of actors is the primary and secondary users of forests, pasture and NTFPs for a number of purposes.

Secondary Actors-They include state entities such as Ministry of Forests and Soil Conservation and other related ministries, Regional Forest Directorate, Department of forests,Department of Plant Resources, Department of National Parks and Wildlife Conservation at macro level, District Development Committees, District Forest Office, DFCCs, District Agriculture Office, District Livestock Development Office and other line agencies as meso level and Range Posts, Village Development Committees, local schools and other service providers at micro level. Non-state entities such as Nepal Trust for Nature Conservation, other NGOs, Forest users groups and Conservation area management Committees; and supra-organizational[28] entities such as FECOFUN, other federations, VDC networks, VFCCs. These actors play a number of roles such as in policy arrangement, regulatory mechanisms, monitoring and evaluation, advocacy and lobbying, collective bargaining and supporting and empowering.

Tertiary actors-These actors include international institutions and bilateral or multilateral projects and programmes. Key organizations in this category include International Centre for Integrated Mountain Development (ICIMOD), IUCN World Conservation Union, World Wildlife Fund, Nepal, The Mountain Institute (TMI), and Asia Network for Sustainable Agriculture and Bioresources (ANSAB). These actors are engaged in policy influence, planning, program implementation, capacity building, and research and knowledge development.

The above lists show the extent of actors engaged in high altitude areas and the complexity of engagements. Although these organizations are mandated to work in high altitude areas, the presence in reality at the high altitude areas is only that of primary actors. Most of other organizations are based on the lower areas and there is a severe information and knowledge gap on the technical, institutional, social and environmental aspects of high altitude. Most of the key personals consulted during the study were actually had never been to the high altitude or had been to few times during their service period. These visits were also of religious visit of Gosainkunda, Muktinath or similar places.

Most organizations have had very limited or no programs at all in the high altitude areas. Even if there is a program it is very difficult to send staff to implement the program or monitor as the access is difficult and the staff do not see any support, motivation or incentives to visit to area of such a harsh environment. Apart from access and difficult environment to travel, the high altitude areas are inhabited by distinct ethnic groups such as *Rai, Limbu, Tamang, Jirel, Thakali, Magar, Gurung, and Sherpa* with unique culture and lifestyles. They have developed a number of different adaptive strategies and practices adopt in the harsh climatic and environmental conditions. All these together with transport and communication difficulties make the primary actors difficult to connect and coordinate with outsider secondary and tertiary actors.

[28] Aldrich (2007) has used the term supra-organizational entities for alliances, coalitions, associations and networks that engage in the collective action.

6.2.3 Knowledge, information and capacity

Community forestry hand over and establishment of national parks, conservation areas and buffer zones are the major government initiatives taken to conserve and manage the high altitude forest resources. The extent of the drivers of degradation and deforestation (as discussed chapter 3) is so extensive that the current attention of the state entities including the Department of Forests is far too insufficient.

The existing knowledge and capacity of the Department of Forests is not sufficient enough to deal with the issues and challenges of high altitude areas. Firstly, the Department Forests is overstrained by the issues of the Mid-hills and the Tarai. This makes it difficult to reach out to high altitude and allocate its staff and resources. Secondly, existing knowledge base of the department is not enough to deal with the environmental, technical, social and institutional dimensions of the high altitude forests, pasture and NTFPs. Thirdly, the department of forests would able to motivate a very few staff members who would be prepared to work in such a harsh climatic condition. Shrestha (2000) has suggested employing the residents of high altitude areas with the assumption that they would be more likely to live and work under the generally harsh climatic conditions. Similarly, developing high altitude-specific curricula to make a new generation of foresters more knowledgeable about the high altitude area would be an option to increase the knowledge base.

Research and development of technical and technological knowledge on different aspects of management, harvesting, and utilization of forests, NTFPs and pasture is in prime need. Knowledge developed in the similar climatic condition in India, Bhutan, Pakistan, China can be accessed and adapted.

A simple improvement in lopping technology of Kharshu can increase the fodder production and improve the condition of the species. The indiscriminate lopping without considering the flowering and seeding cycle has retarded the regeneration, and the young seedlings are browsed by livestock or badly damaged by indiscriminate grass cutting (Messerschmidt and Rayamajhi, 1996). Similarly, a technical improvement in felling, logging, and transporting can reduce wastage and maintain the health and vigour of the forests (Acharya, 2003). Many reports stress that the improvement in NTFP harvesting, storage and processing can enhance the value, productivity, and sustainability of the products (ibid).

The capacity of primary actors needs to be increased in such technical and technological aspects of forests, NTFPs and pasture. Their awareness on the value and the complex nature of high altitude resources need to be increased.

At community level, their collective consciousness needs to be awakened by increasing their awareness on the causes and consequences of deforestation and forest degradation. Their empowerment, awareness on the property rights and leadership development would make them better able to raise their voices, advocate and lobby in the high altitude issues, and engage and better influence in the policy processes and demand the service from service providers.

Chapter VII: The Way Forward to REDD Strategy

7.1 Core problems, challenges and gaps in addressing DD

The core problems from the management perspective of the high altitude forests are associated with the policy, institutional arrangement and the governance at multiple levels. Though the current policy and institutional mechanisms have certain positive influences in specific localities, it has failed to address the needs, unique characteristics and the challenges of the high altitude region. There is institutional vacuum and the policy mismatching the core issues. The current induced institutional mechanisms have undermined the century old informal institutions. The socio-political status of high altitude people have not able to raise their voice and influence in the national political decision makings and on various pull and push factors towards resource management and livelihood improvement. All these core issues have resulted into inability to address the proximate causes of DD as discussed in chapter 3.

As the way forward, we suggest the following policy options and working strategies to address the issues of DD in the changed context of climate change and other global environmental concerns.

7.2 Holistic approach of addressing DD

The core problems and challenges of high altitude forest degradation and degradation discussed in earlier sections is not the outcome of simple processes but the outcome of complex phenomenon associated with unique features of high mountain regions. So, to address these issues, a holistic approach comprising of all the four dimensions of subjectivity and objectivity are needed to be considered.

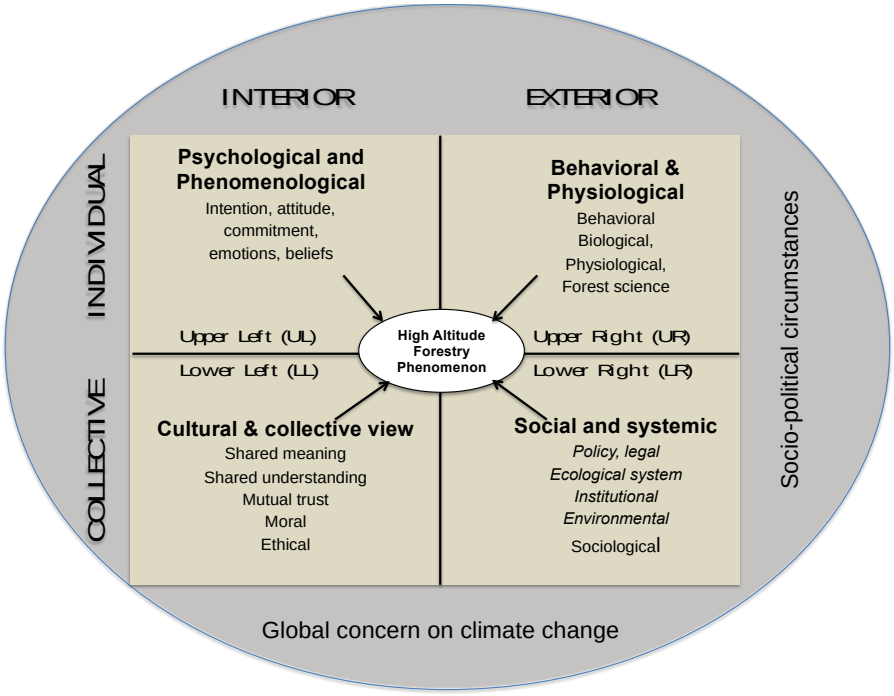
These four dimensions are explained by the Integral Model[29], which provides at least four irreducible perspectives-objective, interobjective, subjective, and intersubjective.

The objective perspective examines the exterior behavior of individual phenomena such as the physiological science of individual plant species that exists in high altitude areas and knowledge, capacity and skills of local people and resource managers about the individual species, their habitat and the complexities of the high altitude areas. The interobjective perspective is associated with the forest ecosystem, human ecosystem, institutional and social systems, policy arrangements related to the high altitude areas. These two perspectives though provide a valuable data and information but miss to capture the complete phenomena and also miss the motivational aspect for actions. So, two additional perspectives-subjective and intersubjective, which have been largely excluded from academic ecological discourse and day to day resource management practices, are also needed to understand. The subjective dimension includes immediate thoughts, feelings, sensations, attitude, and commitment and so on of all the actors of high altitude areas. Who does what, with what motivations are all

[29]For detail of integral model see Wilber (1997).

determined by these subjective dimensions. The intersubjective dimension includes the shared understanding, collective vision and mutual trust among all the actors and stakeholders. All these perspectives make four ways of seeing things as quadrivia perspective.

Figure 7.1: The holistic view of the phenomenon of the high altitude forests.



Adapted from Wilber (1997)

The complexity of the forestry phenomenon at the high altitude areas cannot be fully understood and addressed from any of the partial view, but a comprehensive holistic view is needed. These views give a new understanding about the level of complexity of high altitude forestry as:

a) Each member of actor groups has various level of interiority (experience, perception, intentions, attitude, and commitment) that influences the causes of DD.

b) Members of actor groups interact among each other and create shared meaning, understanding, and trusts that have multiple effects in the way they functions and make decisions.

c) High altitude forestry involves individual behavior of different actor groups shaped by their knowledge, skills and competency; and the characteristics of individual natural species.

d) High altitude forestry influences and is influenced by the policy arrangement, institutional arrangement, social system and the natural ecological system of forestry.

To be able to address the drivers of deforestation and forest degradation, the quadrivia perspective need to be acknowledged, understood and dealt in a holistic way at the every level from micro to macro level in the changed context of global trend and concerns of climate changen(See figure 7.1).This suggests such a holistic perspective that need to be considered while developing strategies, approaches, and programmes to address the proximate and underlying causes as discussed above.

7.3The Way Forward

Based on the above conceptual framework of quadrivia perspectives, the following way forwards in four broad headings are suggested in order to address the issues and challenges of forest resource management in the high mountain region of Nepal. They are:

1. Redefinition in attitude, mindset and ethics
2. Knowledge and capacity development and management
3. Developing collective vision and common understanding
4. Policy and institutional arrangements

7.3.1 Redefinition in attitude, mindset and ethics

a) Redefinition in attitude, mindset and values

The present deforestation and forest degradation in the high mountain is the cumulative outcomes manifested out of the attitude, mindset, values and motivation of various actors (primary, secondary, and tertiary discussed in section 6.2.2) at individual and organizational levels. So, to address the causes of the deforestation and forest degradation, these actors' attitude, mindsets, values, and motivation need to be respected, recognized, acknowledged at the same time need to redefined as per the changed context and new understandings of the complexity. The change in these subjective aspects do not happen as quick fix but needed a profound efforts and passions with increased knowledge, understanding, ownership, participation, and review and reflections.

b) Equity dimension

Equity dimension in forest management is one of the ethical question regarding who benefits and who loses. A just and equitable distribution of benefits and cost is one of the major factor affecting attitude, motivation and commitments towards resource use and management.

Equity in relation to natural resource management connotes access to use and fair distribution of benefits among the users and it emerges from unequal treatment, unfair and unreasonable distribution of wealth and investment and returns in collective undertakings. The concept of sustainable development does not limit the equity issues to the present generation it implies equally to the next generation too. Forest management in High Mountain is not related to production of timber, firewood or products for industries but for the conservation of biodiversity and watershed management. It is also intricately related to livelihood and is an indispensable component of a rural livelihood. Therefore, forest management must be

understood as a process of equitable redistribution of local resources, ownership, management and access. In the context of high altitude forests the following equity issues have to be addressed.

- Equity within transhumance graziers
- Equity between transhumance graziers and up-land dry farmers.
- Equity within groups or villages.
- Equity between forest users groups and the groups of people who are excluded.

7.3.2 Knowledge, capacity and management

a) Human resources and capacity

The existing knowledge and capacity of the Department of Forests is not adequate enough to respond the resource management need of the high altitude areas. The department lacks the knowledge and capacity to deal the environmental, technical, social and institutional dimensions of the high altitude forests, pasture and NTFPs. Similarly, the departmental attention and capacity is pulled by the issues and challenges of mid-hills and the Tarai. This will make the department difficult to allocate its staff and resources for high altitude areas. A very few of the current staff of the department would be ready to station in the high altitude areas unless motivated by a good incentive packages. It would be appropriate to encourage employing the residents of high altitude or encourage them for the forestry education. Similarly, developing high altitude-specific curricula, faculty development, and resource center development would be appropriate options to make a new generation of foresters more knowledgeable about the high altitude area.

The awareness and capacity of primary actors, secondary actors and tertiary actors need to continually strengthen. More collaborations and knowledge sharing could be one of the options. The awareness and capacity of the Department of Forests need to increase about the complex nature of high altitude areas, its forests, NTFPs and pastureland. A periodic visit and interactions about high altitude issues and challenges with the departmental leadership would increase their awareness and perception.

b) Restoration and management of high mountain forest resources

<u>Units of management and environmental zoning</u>

A watershed approach of resource management is holistic, logical for evaluating the biophysical linkages of upland and downstream activities. The impacts of forest degradation are not site specific but are extensive covering a large areas and transboundary. The life styles of the high altitude communities, particularly the transhumance graziers, is also based on watershed resources. So, it is more appropriate to take a watershed approach of forest management in the high altitude areas.

Another important aspect of high altitude area is resource use pattern. Not all areas are used simultaneously and for the same purpose. Areas and types of resources vary with time and

season. An approach of environmental zoning would help identify the areas need to be protected, areas that need to be rehabilitated, and the areas for harvesting. Thus, the high altitudes natural resources can be divided into management zones such as: i) Community Forest Zone, ii) High Mountain Forest Zone, iii) Sub-alpine and Alpine Pastureland Zone, iv) Biodiversity Conservation Zone or Protection Forest Zone, v) Sacred or Religious Zones, and vi) Farm/crop Land Zone.

Forest fire management and rehabilitation

As discussed earlier forest fire is the major cause of DD. The majority of fire incidents are intentional and escaped from the Mid-hills, therefore are manageable. However, climatic condition, topography and location of high mountain areas make forest fire management (control and suppression) highly risky and expensive. A separate forest management strategy based on integrated forest fire management linked with the Mid-hills and adequately designed preventative measures could be the most cost effective as well as high mountain friendly approach of forest fire management.

The climatic condition and physiographic location of the areas makes high altitude areas not practical for artificial regeneration. The only alternative would be to encourage natural regeneration or co-manage with NTFPs or Forage production. Majority of fire burnt areas fall into the zone of conifers with Abies and Tsuga. Regeneration of these species is satisfactory if protected from cutting and further burning. Regeneration in mixed and broadleaved forest is difficult so co-management of either NTFPs or forage production can be initiated.

Management of oak forests and alpine and sub-alpine junipers and cuppressus forests.

Discussions in the earlier section reveal that the lower oak forests and alpine and sub alpine juniper scrubs and forests are highly degraded and need immediate interventions. Oak forests and livelihoods of high altitude communities, particularly the transhumance graziers is closely related. For most of the communities whose major source of income is livestock farming, kharsu (*Quercus semicarpifolia*) forage is one of the basic product, without which the life styles cannot sustain. Not all the oak forests are of the same quality, equal in status and distribution. Some are over-matured, heavily degraded. While others are middle-aged, young or immature relatively in better condition, and the other are scattered throughout the temperate regions.

The junipers and cuppressus forests in the alpine and sub-alpine regions are the only source of firewood for the herders. Because of their decorative and other medicinal and cultural values they are also heavily lopped. Experiences from Sagarmatha National Park show that restoration of these forests through both natural and artificial regeneration is possible, provided special intervention measures are taken. Therefore, based on the existing condition of these forests and dependency of the transhumance herders and potential alternatives source of energy a special package of forest management of these forests have to be developed and implemented in collaboration with stakeholders such as PAs, DLSO, tourism board, hoteliers and local government.

Consolidating community forests and their intensive management

The exclusion and equity issue is widespread in most cases of CF hand over at the high mountain areas. Large chunk of forests are handed over to small groups of households beyond their capacity to manage. Therefore, these issues have to be addressed, consolidated, harmonised and incorporated into the existing forest operational plans of concerned forest users groups.

Equally important is the immediate management intervention of government managed forests in and around the growing towns and market centers. With increased access and other infrastructural facilities, there is a huge pressure to nearby GMFs and CFs for forest products particularly for timber and firewood. So, to stop further degradation of forests and maximize the comparative advantages of increased population and infrastructure facilities, both GMFs and CFs/BzCF should be brought under intensive management.

Community forestry at high altitude

CF has demonstrated forest restoration and development in most part of the country though several governance issues remained questionable. Many areas of high altitude have already handed over as community forests and demonstrated a reversal in deforestation and forest degradation. However, in many parts of high altitude, the historical use rights of tranhumance graziers and secondary users are reported to be overlooked. Several studies suggest the modification of CF approaches to make it more appropriate in the context of high altitude areas. These modifications would require establishing the use rights of transhumance graziers and secondary users and also considering the equity issues and the national and global concern of climate change.

Management of NTFPs

The environment under mixed forest is very much favorable for the growth of NTFPs. Most commercial species that can grow well in shades and open areas can be identified and promoted where possible. Management activities include assessment of existing stock, improvement of harvesting techniques, processing for value addition.

Similarly, the research and study on the use, harvesting techniques, regeneration methods, processing, storage etc of the important NTFP and MAP species available in high altitude areas need to be carried out.

Management of pastureland

Although the department forest owns the pasturelands the utilization of transhumance graziers and their livestock associates these with the department of livestock services. This makes the pastureland a multi-sectoral issue that needs collaboration, collective efforts and partnership.

Biodiversity conservation and eco-tourism zone: Promotion of protection forestry

Forest areas set aside for the conservation of biodiversity, protection of endangered species (flora and fauna) and areas with outstanding natural beauty can be managed as eco-tourism zone. Forests in remote inaccessible and in areas more than 45% slope mostly of protection

forests features come under this zone. Major activities in this zone could be: formation of biodiversity conservation committees, preparation of a simple participatory biodiversity and eco-tourism plan, survey of biodiversity threatened, protection of the endangered/threatened biodiversity or forest ecosystem by limiting biotic interferences, and complementary programmes to awareness raising on biodiversity, transhumance trekking etc.

Research and development

High altitude areas lacks the understanding of resource condition, land use changes, ecological systems, indigenous management systems, property rights and tenure systems and socio-cultural aspects of resource management and utilization. Technological innovation on resource utilization, processing and management can open up substantial opportunities for the economic development in high altitude areas and also the restoration of forests, pasturelands and ecosystems. Similarly, the knowledge and technologies developed in the similar areas of India, China and elsewhere can be explored and adapted.

Technology intervention here refers transformation of indigenous knowledge and skills for increasing the productivity of forests/pasture and farming system and promotion of forest/farm based income generation activities in a sustainable way. From the standpoint of current expectations, resource availability, materials and circumstances, most traditional technologies are inadequate and more modern technologies are inaccessible. The role of rural technologies is to generate new technological options, each more effective than the traditional and more accessible than the modern.

Technology developed by experts using high science based modern research without local participation and ignoring the rural specificities, knowledge, skills and capacity are highly unsustainable. For an example, the intervention made by the Department of Livestock Services under the Northern areas Pasture Development Programme (NAPDP) in ten northern districts of the country in collaboration with Food and Agricultural Organisation (FAO) virtually failed. Because of the intervention consisted of technically oriented or package for physical development of the area and undermined the ecology of the high altitude areas and the indigenous knowledge of the community there in (Rai and Thapa, 1993 cited in Acharya 2004:33). High altitude communities require participatory action research based technologies that help integration of knowledge generating process rather than knowledge only.

Technological improvement in NTFP's plantation or domestication, harvesting, storage, handling and processing is missing. Some institutions and projects such as SNV/Nepal, ANSAB, Humla Conservation and Development Association (HCDA), and NACRMLP have developed technology for a few products such as chirauto, lokta,, atis, and sugandhbal, and lopping regulations of kharsu trees, however, the technology initiated in those areas and the lesson learned from there have not been disseminated or shared with in other parts of the country (Subedi, 2001).

Methods of harvesting trees and conversion of timber are primitive, inappropriate, and wasteful. Logging methods are also destructive and not environmental friendly. Logs or timber are often slide down steep mountain slopes and damaging fragile slopes thus, inviting

soil erosion. Thus an appropriate cost effective local knowledge based wood harvesting and logging technology has to be developed for maximizing benefits from the existing abundant dead and dying woods/trees.

7.3.3 Collective vision and common understanding

a) Collective vision

As discussed earlier, a number of actors are engaged and responsible for the management and conservation of high mountain forest resources. However, most of these actors work in isolation with a minimum coordination and common understanding. Moreover, the planning and implementation modalities differ from each other and lack a common vision and goals. In order to capitalize the collective energy, knowledge and for the wise use of available resources a common vision has to be developed and the efforts of all actors and stakeholders need to be directed toward it.

Box 7.1: Main stakeholders of high mountain forests.

1. Natural Resource User groups and their Networks, (FUGs, transhumance grazing groups, and their various resource use based sub-groups and networks) will be the key institutions for the overall management various management zones or blocks including distribution of forest product and community development planning (LIP) and mobilisation of funds. Each groups will be independent for the management of their forests or natural resource but will work under the supervision/guidance of their respective networks and high altitudes natural resource management committee and the concerned District Forest Offices.
2. Local NGOs/CBOs and Indigenous Institutions - often religious groups, monasteries, and other community based organizations (partners and service providers to FUG, and users groups)
3. Local government VDC and DDC (Planning, livelihood improvement, resource sharing, conflict management and co-ordination)
4. Government line agencies including Soil Conservation, National Parks and Wildlife Conservation, Livestock Services and Agriculture Development Office and District small and Cottage Industry Office (Service providers, planning; technology transfer, human resource development, conflict management and co-ordination, monitoring and guardianship).
5. Donors or Projects/INGOs (Facilitator, Development of management strategies and model , technology transfer and financial support)
6. Department of Forests (Impact monitoring and policy formulation)

b) Coordination

At present there is very poor co-ordination even with major stakeholders like livestock, and agriculture offices, VDCs and DDCs. There is not even good coordination within the same line Ministry. There is also a lack of institutional fora where high altitude issues can be shared and discussed and strategies developed. A number of initiatives have been taken in the past, but never institutionalized. High altitude forest management advisory committee was formed from the Project Coordination committee (PCC) meeting of Dolakha –Ramechap Community Forestry Project in 2049, and later of Nepal Australia Community Resource Management Project. However, neither of these initiations functioned for long, except a joint tour to Bharaibkund sub-watershed area of Sindhupalchok in 2055, for reasons that are unknown (Baral 2005). Recently the forestry sector has established another multi-stakeholder forum to meet the institutional gaps evolved particularly for the management of GMFs. This new institutions is also highly debated and not also expanded to hills and high mountain regions

High mountain forest resource management and improvement of the living standard of the high altitude community cannot be done by the forestry sector alone. Therefore, all high mountain resource management programmes should also open up opportunities for partnerships with local government, line agencies FUG networks, corporate and private entrepreneurs, and others who can come up with environmentally and socially sound, poverty alleviation supportive forest ecosystem management proposal for forest management units. Therefore, it is essential to integrate the plans and programmes of these major stakeholders into high altitude resource management plans and programmes through better coordination and cooperation with concerned agencies.

7.3.4 Policy and institutional arrangements

a) Policy reform

The current policy and institutional arrangements are evolved to address the issues and challenges of Mid-hills and the Tarai. So, these arrangements do not fit well to address the specific needs and challenges of high mountain areas. Many of the species, MAPs, NTFPs, biodiversity and the unique eco-regions are not only of national significance but of global concern and significance. Nepal has gained much knowledge and lessons from a number of participatory approaches of resource management. They include: community forestry, Leasehold forestry, collaborative forest management, buffer zone forest management. All these approaches have their own strengths, weaknesses and challenges. The success factors of these approaches can give valuable lessons to practice in the high altitude forests. The very different context of high altitude forests demands a separate "High Altitude Forest Policy". Such policy should seek a holistic approach of development integrating livelihoods, culture, ecological and social systems, and the hope and aspirations of the communities living in the area. The policy formulation process should able to engage high altitude communities and stakeholders so that it is owned by the local communities and stakeholders.

b) Institutional arrangements

The various forest management approaches practiced in Nepal are Community forestry, The Leasehold forestry, the landscape corridor approach and the recently developed collaborative forestry. Although Forest Act 1992 has also identified religious and protection forests as parts of nation's government forests, no management models or approaches exist or have been developed so far for these functional categories of forests.

The community forestry (CF) is widely practiced in the Mid-hills and is one of the most successful programmes. CF in Mid-hills are small in size, relatively accessible, surrounded by human settlements, and the users are well defined, distinct more or less fixed, subsistence farmers and their resource use pattern or need is almost common. High altitude forests are large in size, inaccessible, devoid of permanent human settlement, and users are transient, diverse, mostly transhumance graziers, and their resource use pattern is more complex. Therefore, the Mid-hills CF model cannot be applied directly for high altitude forests.

Studies done by Baral (2000) from Sindhupalchok and Dolkha suggest that implementing Mid-hills model in high altitude areas bring various ecological and socio-economic

adversities. Exclusion of transhumance graziers from the users of CFs has forced them to either sell their livestock or change their way of living. Disturbance on the movement of transhumance graziers by FUGs and restriction on access to forest resources compels them to stay in their own political territory- the VDC for longer periods has accelerated deforestation and resource depletion. In many instances, lower oak forests are heavily lopped and Junipers and Rhododendron forests in Sub-alpine areas and Fir forests in temperate zone have been cleared or many gaps have been created to mitigate the deficit of forage/fodder from CFs (Baral 2000). Thus among transhumance graziers there are very negative perceptions about CF. Similar observations have also been made by Bhatta, (2002), Graner (1997) on their study in Humla and Sindhupalchok.

The leasehold forestry is further divided into two sub-groups. Those are: Group leasehold forestry or An individual/industry or a corporate body leasehold forestry. The group leasehold forestry designed mainly for people living below poverty line in the hills and mountains has been successfully implemented in the Mid-hills. Western Upland Poverty Alleviation Project (WUPAP) has just initiated to cater even in the high altitude areas; however, no information is available for high altitude areas. The other sub-types of leasehold forestry being designed for commercial purposes focusing on rich private individuals or industrialists have little significance to the context of high altitude forest management.

The collaborative forestry approach is new to Nepal. It is being developed for Tarai and bahabar forests and is under piloting, its success is yet to come. Whatever be the impacts of this approach this much is true that the bio-physical, and socio-economic condition of these two areas and objectives of forest management being entirely different, the existing collaborative approach of forest management is not applicable in the high altitude areas. One of the major objectives of forest management in Tarai and bhabar regions is to produce large sized, commercial timber and firewood for meeting industrial needs and revenue collection. The objectives of forest management in the high altitude areas are not focused on timber production or revenue collection, but on maintaining forest ecosystems or" biological forests' in favour of forage/fodder and NTFPs production and improving the livelihoods of the community without jeopardising the biodiversity values of the forests.

The high altitude areas differ greatly from Mid-hills and Tarai in bio-physical, natural, socio-economic and institutional aspects. Although the forests in high altitude areas are remote and inaccessible, and devoid of permanent human settlement, they are large and contiguous forests, diverse in vegetation types, and rich in biodiversity. The population is low but the users of the forests are diverse other than local people, and transient mostly transhumnace graziers (Baral, 1996). The markets for forest products are distant and there is a limited range of utilization, which is more single-purpose and product oriented- particularly non-timber forest products (Messerschmidt and Rayamajhi, 1996). Therefore, these unique features of the high altitude areas and the national objectives of poverty alleviation and biodiversity conservation clearly indicate that the community forestry or other forestry strategies adopted for the Mid-hills cannot be applied without proper modifications to the management of high altitude forests (Baral 2005).

The landscape corridor approach including the Sacred Himalyan is another model practiced in the western tarai and eastern hills of the country. This model being focused mainly on conservation of biodiversity also consists of many ingredients of participatory natural resource management closely resembling the Mid-hills community forestry model. As this is also being piloted more studies on the impacts of this model have to be undertaken before its application in high altitude areas. Nonetheless, the strategy taken or developed by this model particularly for biodiversity conservation could be a great tool for developing management models for high altitude forests (Baral 2005).

Since many forests close to the settlement of high altitude areas have been handed over to FUGs, community forestry approach could be a good starting point for initiating management and conservation activities in high altitude forests. CFUGs can play the role of a custodian in overall management and conservation of the unique resources. However, the Mid-hills CF approach requires modification to fit some of the special features of high altitude areas. Some major modification on the current model and Forest Acts and regulation introduced by various authors or researchers such as Jackson, 1999; Messerschmidt and Rayamajhi, 1996; Hunt and Chhetri, 1998; and Shrestha, 2000 Baral, 2004, 2000) are Introducing the concepts of a) geographical users, b)single product users, c) involvement of less formal groups like focus groups or their network, organization or institution interested or working in high altitude areas; provision of construction of goth (cattle shed) and recognition of traditional users or transhumance graziers as bonafide users of the forests. In addition cultivation of potato (the major stable food in the high mountain) is equally important and should be included in reformed policies (Baral 2005).

Nonetheless, not a single management model can meet or consider the unique characterstics of the high altitude areas described earlier. Modification of the community forestry approach alone cannot be the necessary condition of high altitude forest management. It is necessary, therefore, to look for some form of diluted autonomy and functional control of forest and pasture resources by the resource users including the locals within the framework of overall legal control of the state (Baral, 1996, 2005). Therefore there is an urgent need to develop a separate national forest management strategy for upper slope that will blend the existing CF, CoFM, and landscape management policies and strategies. Furthermore, it is necessary and appropriate to acknowledge and recognize the existing informal institutions and based the local institutional arrangement on these foundations. For the planning, coordination, and monitoring of forestry programs including the high altitude forestry, the District Forest Coordination Committees (DFCC) should be strengthened, authorized and made functional.

c) **Handing over of the management ownership**

Management handing over process may proceed gradually and in different phases. In many occasions, handing over may go simultaneously together with the consolidation phase In the first phase responsibilities such as conflicts resolution, distribution of forest products for local use, collection of NTFPs and marketing, developing pro-poor forest based micro- enterprise within FUGs or resource users groups and other preliminary forest and group management activities can be handed over. Once the users groups and their committees/network gain more

practical experiences and strengthen their institutional capabilities more responsibilities including technical such as tending, logging of dead and dying trees and marketing, establishment of forest based enterprises at watershed and area level can be handed over in the next phase. And finally, the whole management of the high altitude natural resources can be handed over to the high altitude natural management committee. The main criteria for hand over could be the level of motivation, quality of implementation of the management plan, public participation in forest management, type of forest and object of forest management

d) **Costs-benefit sharing mechanism**

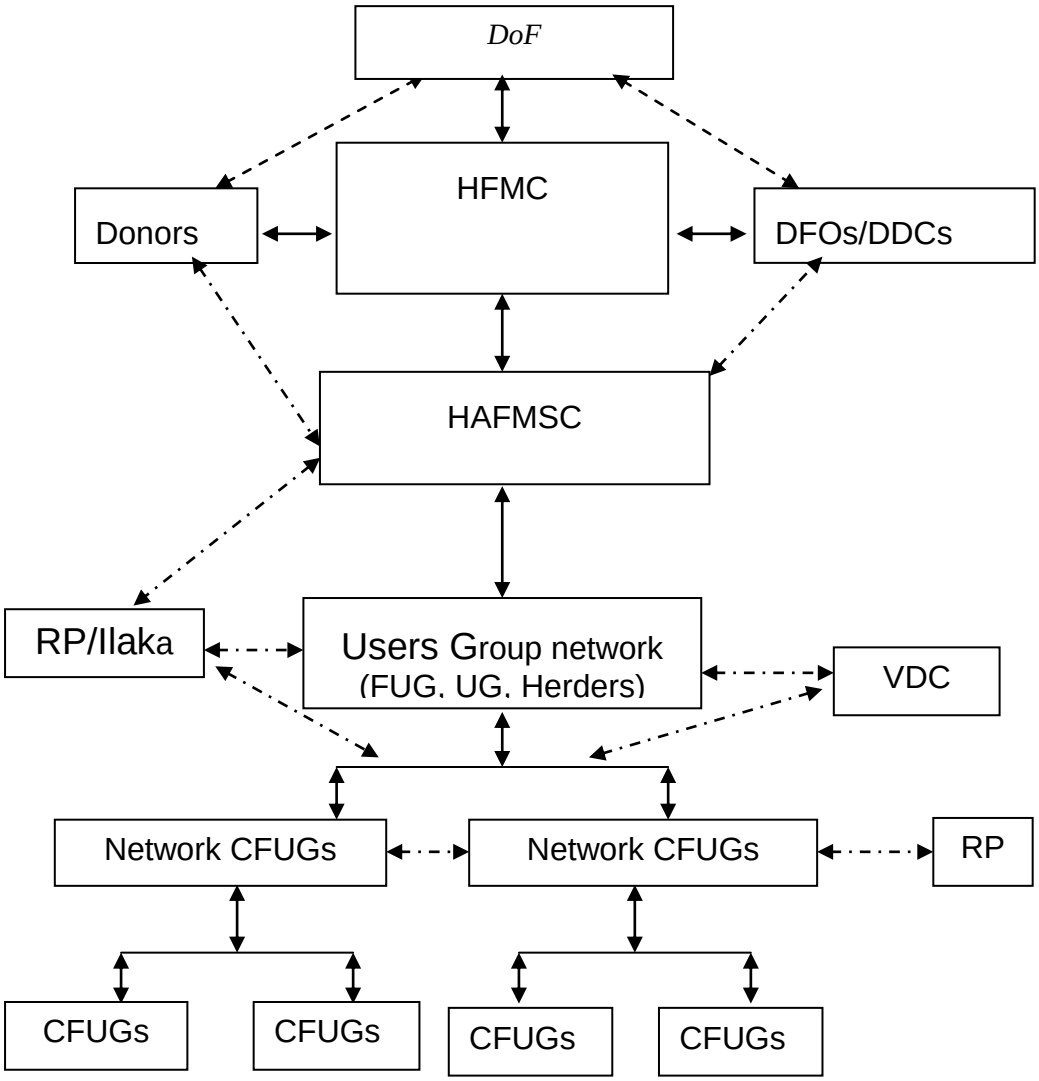
This is the most fundamental issue of conflicts between the government and the local communities. High altitude forests at the present context are unable to produce enough revenue for the national treasury. The only source of revenue for the government is from some high value jaribuiti Medicinal and aromatic plants) and some local industrial raw materials such as Yarsagumba, lothsalla, argeli, allo and lokta because, timber business in high altitude areas is not economically feasible. Moreover, the transaction cost of enforcing rules and regulation and monitoring of management activities in high altitude areas is so high that the existing government capacity is almost unable to play leading role in overall management. Thus considering the objectives of forest management and the existing government capacities, there should a trade-off of use of forest products or livelihoods improvement and forest management (including biodiversity conservation) between the local communities and the government. Therefore, a well-defined benefit sharing mechanism has to be developed in consultation with various stakeholders including from central level and the government should exempt the local communities from the burden of paying royalty, rather the government should focus on value addition and levying taxes on value added products.

e) Institutional structure

Multiple macro political and economic factors and forestry related regulatory and fiscal policies are at work triggering deforestation and degradation in Nepal. Prominent among them are prevalence of weak governance at the political level followed by weak institutional arrangements to manage the more than 60 percent of high altitude forests under Government regime (Kanel et al 2011) . Based on the experiences from the past and lesson learnedfrom various forest management regimes in practice Dangi et al. (2008) propose following institutional modalities for better forest management in Nepal:

- ***Autonomous partnership*:** Private Forestry, Community Forestry (CF), Pro-Poor Leasehold Forestry (PPLF), and Collaborative Forest Management (CFM);
- ***Nested partnership*:** Pro-poor activities inside CF and CFM; CF management practices within CFM;
- ***Regulated partnership*:** Industrial Leasehold Forest (ILF), Religious Forest (RF), Buffer Zone Management (BZM), and Conservation Area Management (CAM);
- ***Restricted partnership*:** Residual Forest Management (RFM), and National Parks and Reserves.

Figure 7.2: Users Group Based High Altitude Natural Resource Management Model (Network of CFUGs, NTFPs, and Kharkas)



These institutional models could be the major basis of identifying institutional arrangement conducive to the high mountain communities and their environ, Based on the overall essence and objectives of these model Baral 2005 has also suggested a set of institutional arrangement. Baral (2005) has suggested various objectives based institutions at district and implementation levels under the umbrella of a High Altitude Natural Resource Management Committee (see Figures 7.2; for objective based sub-institutional structures see annex). The HANRMC will be formed from the transhumance users groups and FUGs representing all the users groups, district level stakeholders and will be chaired by the concerned District Forest Officer. The HAFMC will be the supreme body for the overall management of high altitude natural resources. The main responsibility of this committee will be overall planning, resource allocation, supervision and monitoring, conflict management, communication, and co-ordination among various users groups, line agencies, and local government. This committee will be accountable with the high altitude natural resource users groups

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