Feasibility of REDD+ in Bhutan

A scoping study

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Table of Contents

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This REDD+ feasibility and scoping study is based on a short and condensed stakeholder consultation process with key agencies and officials of a series of government institutions, NGO's and multilateral organizations. The constructive, critical and sometimes blunt insights, views and comments on REDD+ potential and feasibility in Bhutan are highly appreciated and are essential building stones of this report.
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It is hoped that this scoping study will be helpful in catalyzing the REDD+ process in Bhutan and will be supportive to knowledge enhancement, capacity building and overall readiness for REDD+ piloting and future implementation in Bhutan.

Thimphu, Chubachu, December 22nd 2010

Hans van Noord

List of Abbreviations

AAC	Annual allowable cut
API	Air Photo Interpretation
A/R	Afforestation / reforestation
CBA	Cost-benefit analysis
CCBS	Climate, Community and Biodiversity Standard
CDM	Clean Development Mechanism (one of the Kyoto mechanism to reduce GHG emissions)
CF	Community forest
CFMG	Community forest management group
COP	Conference of Parties (to UN conventions)
CORRB	Council of RNR Research for Bhutan
DGPC	Druk Green Power Cooperation
DoA	Department of Agriculture
DoE	Department of Energy
DoFPS	Department of Forests and Park Services
DoL	Department of Livestock
EU	European Union
FAO	Food and Agricultural Organization
FMU	Forest Management Unit
FRA	Forest Resource Assessment
FRDD	Forest Resource Development Division
GCS	Global Conservation Standard
GHG	Green House Gas
GNH	Gross National Happiness
HFLD	High Forest Low Degradation
IEDMP	Integrated Energy Development Master Plan
IFM	Improved Forest Management
LCMP	Land Cover Mapping Project
LUSS-LUPP	Land Use and Statistics Section/Land Use Planning Project
MoAF	Ministry of Agriculture and Forestry
MRV	Monitoring, Reporting and Verification
NCD	Nature Conservation Division
NEC	National Environment Commission
NFI	National Forest Inventory
NP	National Park
NSSC	National Soil Services Centre
NTFP	Non Timber Forest Products
ODA	Overseas Development Assistance
PES	Payment for Environmental Services
PPD	Planning and Policy Division
RDC	Regional Development Centre (previous RNR-RC)
RGoB	Royal Government of Bhutan
RNR	Renewable Natural Resources
RS	Remote Sensing
SAARC	South Asian Association for Regional Cooperation
SDC	Swiss Agency for Development and Cooperation
SFM	Sustainable Forest Management
SLMP	Sustainable Land Management Project
SNV	Stichting Nederlandse Vrijwilligers (Netherlands Development Organisation)
SPOT	Satellite Pour l'Observation de la Terre

TOE	Tonne of Oil Equivalent
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standard

Executive Summary

Bhutan has a unique position, as a developing country with a very high forest cover and a history of very limited deforestation and forest degradation. Bhutan has committed itself to become carbon neutral to negative and intends to safeguard the carbon sequestration function of its forests to its best ability. This scoping study aims at exploring the feasibility of implementing a new developing mechanism under the UN Framework Convention on Climate Change (UNFCC) to Reduce Emission from Deforestation and forest Degradation (REDD). Bhutan has become a member of the UN-REDD programme in April 2010 and is especially interested in the opportunities of the most recent development of REDD, named REDD+, that will include financial compensation for the role of conservation, sustainable management of forests and enhancement of carbon stock in developing countries. **Chapter 1** of this report introduces the REDD+ concept, Bhutan's unique selling point as a high forest low degradation country combined with a long history of nature conservation and good environmental governance, and Bhutan stance in the international climate change arena. After a first introductory workshop in Bhutan on REDD+ in June 2010, this study aims at identifying constraints and opportunities for REDD+ in Bhutan and explores thus more broadly the feasibility of the developing mechanism. The objectives of the study are to:

- Identify the most promising entry points and options for engagement in REDD for both the emerging compliance market and the voluntary carbon market based on a feasibility study,
- Recommend on the best position of Bhutan on REDD and how to take this position forward into the international climate negotiations.

The scope of the study is to keep momentum in introducing REDD+ in Bhutan and to asses the nations capacity and knowledge base, essential for compliance and voluntary market entrance, combined with an overall analysis if it is worthwhile to commit to the REDD mechanism, weighing its advantages and disadvantages, scoping the potential and possible impact and contribution to the development goals of RGoB. The study started with a stakeholder consultation of all key agencies and organisations from December 7 to 16 2010, seeking their expert knowledge and insights and benefited from the feedback of many stakeholders participating in the debriefing of the key findings and recommendations on December 20th 2010.

Chapter 2 contains a closer assessment of the forest assets of Bhutan, with attention for forest cover and change over time, forest types, drivers of forest degradation and related trends, present forest management types, and the demand and supply balance of timber and fuelwood. Forest cover surveys carried out present a diverse range of forest cover percentages, but all indicate a very high forest cover, with 75.65% as most widely used percentage (LUSS-LUPP 1995, adjusted for new country area). There is a clear need to carry out more frequent and systematic land cover surveys and the soon to be published Land Cover Mapping project are seen as a good step to fill the present data quality gap. A GIS study is presented, carried in parallel to this feasibility study, in which the forest cover trend of Bhutan is analysed, making use of satellite imagery of 2001 and 2010 and a similar classification method. Although the results are not conclusive, they indicate only very limited and localized forest degradation and most likely localized forest growth. Similar time-series and sequential analysis are highly recommended to improve spatial monitoring. The chapter looks with some detail into the forest types of Bhutan and the large area of nature conservation, now covering more than 51% of the country. Trends in forest cover and as impacted by landscape processes as drivers of forest change and forest degradation are discussed with attention to slash-and-burn agriculture, livestock and grazing areas, forest fires, leaf litter collection, fallowing of agricultural land, infrastructure development, firewood collection, timber extraction and other drivers of forest cover change, including mining and climate change. The trend that seems to emerge is a complex one, with several drivers of negative change that seem to become less outspoken (tseri, grazing, fallowing) and allow for forest cover to expand and quality to improve, or at least degradation pressure to ease. The extraction of timber and firewood at growing rates, surpassing the Annual Allowable Cut (AAC), is having a definite impact on the forest cover and causes localized severe forest degradation. The imbalance in supply and demand of timber and firewood needs

careful attention and policy interventions to enable future sustainable forest management, to safeguard the multiple functions of Bhutanese forests.

In **Chapter 3** attention is given to what is known in studies on Carbon in Bhutan, how this knowledge is now still based on assumptions and global defaults instead of actual local measurements and a first attempt is made to estimate carbon and valuation for CFs, FMUs and protected areas. Only very limited information is available on biomass and carbon stock and specific properties of distinct forest types. The Forest Resource Assessments are the main studies that have tried to assess above- and below-ground biomass and carbon stock, but these assessments are very much based on assumptions, inter- and extrapolations and global default values and have to be gradually replaced by actual measurements. For community forests, protected areas and forest management units it is attempted to sketch a rough valuation of the carbon stock and increment, based on assumed increment rates and conservative carbon market prices.

In **Chapter 4**, governance issues are assessed related to the embedding of REDD+ in the Bhutanese government system. As REDD+ is about long-term commitments, governance must be ensuring a stable and conducive environment, able to deliver on the multilateral and bilateral commitments and with policies, laws and regulation that permit the development of REDD+ mechanisms. MRV is discussed, together with lessons to be learned from CDM experiences and the recently started PES pilots in Bhutan. The legal environment, together with the institutional setting are considered to be very conducive, as forest and nature conservation have been firmly embedded in the constitution and laws and regulations of the country and have been actively implemented to safeguard forest cover and forest quality.

The feasibility of REDD+ in Bhutan is the focus of **Chapter 5** with attention to a quantitative and qualitative assessment of advantages and disadvantages. A full monetary cost-benefit analysis is not feasible as the financial details of the funding mechanism are still unclear and evolving, and therefore a qualitative CBA is presented, weighing perceived advantages against identified constraints and disadvantages. Main advantages described relate to the possible financial reward for good custodianship, reaping global benefits by sequestering carbon locally, the multiple benefits that could be the result of sustainable management of forest resources through safeguarding sustainable access to natural resources, enabling food security and rural livelihoods, protecting biodiversity and enhancement of soil and water conservation. The benefits therefore could be multidimensional and not be limited to "just carbon money". A critical advantage would be the trickling down of global resources to local communities, by rewarding them for their active good custodianship of their community forests and protected areas. Disadvantages described cover the considerable investment needed in knowledge building and capacity development of staff that is often already stretched to be able to meet the monitoring, reporting and verification requirements. All in all the potential of the small nation of Bhutan is limited considering its size and the therefore limited financial amounts at stake and finally it is discussed that a local funding mechanism is available, the intended ploughing-back of hydropower revenue for nature conservation and enhancement of sustainable watershed management, offering a much easier pathway to fund similar forestry activities. Remaining questions are discussed related to the REDD+ mechanism, namely permanence, leakage and governance. The Overall balance of the CBA:

- **The qualitative CBA** seems positive as the REDD+ would be a catalyst to build the knowledge base on the forest ecosystem, which is a necessity beyond the carbon market, and will serve many more objectives.
- **The quantitative CBA** is less certain, but if geared towards multiple benefits and linking the funds to the communities, tends to give a green light for REDD+, under the premise that piloting should prove the actual benefits.

In **Chapter 6** it is argued that a considerable amount of effort has to be put into capacity building to raise the knowledge level of forest ecosystems considerably, to enable REDD+ to be an effective mechanism for Bhutan. The Chapter looks into some of the key areas of interest and identifies some fundamental activities to be carried out. The forest science base as it is needs clear reinforcement as too little is known of the main forest types and properties and targeted research should fill gaps on biomass and carbon estimates and forest typology and cover. The NFI being developed will be instrumental to raise the knowledge level

considerably and advance from the present use of global default values for carbon estimated to actual field measurements of distinct forest types. A short description is given of the IPCC criteria for eligibility and a brief overview is given of the emerging standards with project guidelines for the voluntary market. The chapters finalizes with a concise description of key national stakeholders and main partners for capacity building and REDD+ piloting.

In **Chapter 7** three distinct pilot possibilities are presented, though to be essential to build experience and local capacity and offer the opportunity to assess with more conviction if the REDD+ mechanism fits the national conditions and needs. These pilot projects will help to learn-by-doing and it is thus essential to assess, plan and initiate a number of REDD+ pilots. Community forests a thought to be a good trial platform as they already offer an organized and established community with a certified CF management plan and committee. CFs are rapidly growing in number, with now almost 300 CFs in Bhutan covering 32,200 ha reaching 13,000 households. Community involvement is guaranteed and the CFs are known for being rather conservative in their extraction from their CF stock, leading to good increment rates and related carbon stock enhancement. The CFs will be an easy pilot to ensure multiple benefits for local livelihoods, conservation and biodiversity. Another pilot could be started in a national park, with REDD+ funding as a reward for prior conservation efforts and continued protection of large intact primary forest areas. Revenues could be used for community support and park management enhancement. A third opportunity would be a pilot with FMUs as there is good scope for improvement of forest management towards standards that were initially aimed at in the FMU plans, leading to SFM and better stock enhancement.

In **Chapter 8** the key findings are wrapped up, followed by an overview of recommendations to improve the forest system knowledge base, build capacity and prepare for an institutional set-up that is able to gain experience with dedicated REDD+ trials in Bhutan.

Key findings:

- The present knowledge base on forest cover, forest degradation, carbon stock and carbon fluxes needs to be brought to a higher science-based level. The planned NFI will offer an immediate opportunity to build a nation-wide data base of forest typology and carbon stock. It should be combined with more rapid and focused research to establish carbon baselines for certain forest types, CF's, FMU's and protected areas. A nested approach could be used without the immediate need to cover the whole country and would imply to start with voluntary carbon standard projects.

- Trends in forest cover seem to indicate an environment in which most drivers of forest degradation and even deforestation are becoming less important. **Grazing pressure** is slowly reducing because of falling livestock population, cattle and yaks, linked to government policy to promote improved breeds and socio-economic changes within the pastoralist communities. More focus on dairy groups and stall feeding, together with improved pasture and fodder development are seen as positive for the regeneration capacity and resilience of the forest. The **tseri** ban has resulted in a marked drop in tsheri practice and a considerable area of tseri land will slowly turn into forest. No clear trend in **forest fires** is observed with an apparent cyclic and random frequency and area affected, ranging between 1,000 to 22,000 ha yearly in the last decade. The likelihood of more frequent climate extremes would lead to higher risk of forest fires and requires a close monitoring and prevention strategy. **Fallowing** of agricultural land is clearly on the rise due to a complex of factors linked to livelihood strategies, off-farm employment opportunities, rural-urban migration, wildlife pressure, labour shortages and irrigation problems. More fallow land ultimately will be favourable for forest cover.

- Trends in the main drivers of forest degradation seem overall rather favourable, as most of these drivers of forest cover change and forest quality change have reduced over recent time, except for timber and firewood extraction. These both show an imbalance in the supply/demand balance, leading to unsustainable management and forest degradation, and with the supply side having only limited growth potential to match an increasing market demand, this imbalance is threatening to become more explicit and having further negative impact on forest cover and forest quality.

- New approaches should be considered for rapid carbon estimates, as LIDAR, which would be very suited for the Bhutanese terrain, although on-going trials in the Nepalese Terai have to be evaluated if they indeed are suited for more mountainous terrain conditions.

- Linking with and learning from regional experiences as in Nepal and through SAARC are thought to be strategic and critical to gain relevant exposure and raise our technical confidence.

- An approach aimed at multiple benefits, combining carbon sequestration with clear benefits for biodiversity, livelihoods and communities, is most apt for the Bhutanese conditions, and is enabled by a very conducive policy, legal and historic setting.

- Benefit-sharing mechanisms, bringing global funds down to the community, are essential for real ground-level impact.

- The qualitative CBA seems positive as the REDD+ would be a catalyst to build the knowledge base on the forest ecosystem.

- The quantitative CBA is less certain, but if geared towards multiple benefits and linking the funds to the communities, tends to give a green light for REDD+, under the premise that piloting should prove the actual benefits.

- Although the precise funding mechanisms for REDD+ are still uncertain after COP16, it will offer Bhutan a means to be credited for its past and on-going efforts in conservation and sustainable forest management. The limited forest area of the country however, and the therefore relatively small carbon stock and fluxes will only enable limited global funds to reach Bhutan.

- The costs to become eligible though a targeted effort, with considerable time, staff and money needed, will be considerable. The experience of the related CDM process for hydropower projects in Bhutan to register, become eligible, set a baseline and be verified and validated learns an important lesson that credits do not come at no cost. A quantitative cost-benefit analysis should incorporate the real costs to be made to get any benefits. The net initial benefit might be limited, but the broader gain in enhanced knowledge of our forest ecosystem and multiple benefits to be gained from are thought to give a net positive balance.

- As concluded after the first REDD+ seminar in June, a National REDD Advisory Committee and a Technical REDD Working Group should be set-up to guide the REDD readiness process. These bodies will develop a National REDD Strategy, setting out the intention and possible pathways over time and formulate a REDD Policy. The groups will have the responsibility to give technical and policy guidance to the Bhutanese negotiators to the COPs and the representation in the UN-REDD Framework.

Recommendations

It is recommended to:

- Build our scientific knowledge base on forest carbon stock and flows, through forest type mapping, focused forest type research and the roll out of a detailed and nationwide NFI.

- Enhance our capacity to have a detailed inventory and capacity to apply internationally accepted guidelines for carbon measurement following agreed eligibility criteria, moving from global default values towards forest type specific properties, and ultimately, permanent plots. The upcoming NFI should be designed in such a manner that appropriate biomass and carbon measurements are carried out in line with international guidelines, so that per forest type distinct biomass and carbon properties can be assessed.

- Create a REDD+ Technical Working Group and Policy Committee and start development of REDD+ National Strategy and, and if needed, a policy and guidelines.

- Start pilot project identification and preparation including selection of specific CFs, FMUs and NP's, Dzongkags and geographic location to have a representative selection of the Bhutanese landscapes and forest types and to identify potential partners and modalities.

- Feed the decision makers with accurate technical information and advice through the REDD working group and/or policy group- It is crucial here that WMD staff and forest officials are involved to brief and advice policy makers and international negotiators.

- Seek international HFLD REDD+ alliances; take actively part in the international climate change debate and present Bhutan as a country for piloting REDD+

- Learn from / engage in SAARC or regional REDD+ pilots (CF/WWF/NFI etc.) as being developed in India (NFI), Nepal (WWF-NFI-CF) and Bangladesh (Sundurbans).

- Learn-by-doing by trialing/piloting REDD+ projects in CF / NP FMU and/or at a landscape level with emphasis on expanding knowledge base and linkage with multiple benefits and benefit sharing to local communities, allowing for testing governance systems at ground level and benefit sharing mechanism to bring carbon cash to the communities, which should be the ultimate objective. The voluntary carbon market will be the first modality to follow to trial and start piloting different projects, in anticipation of formalization of a new global commitment period Post-Kyoto.

- Ensure earmarking of any carbon $ as green/forestry/community $ and let the money thus be used and reserved for these specific destinations and not to be absorbed by the treasurer for the national budget. Accordingly, it would be recommendable to use standards that recognize communities, biodiversity conservation and look for multiple landscape and community benefits.

- Initiate a resource mapping of biofuel for Bhutan by DoFPS and DoE, as an improved understanding and eventual improved use of biofuels in Bhutan would be able to make use of the waste products of timber processing, reduce the dependency on fossil fuels and enhance fuel efficiency to reduce forest pressure.

- Initiate studies on forest soil carbon as vital part of the carbon pool. Although this is already partly covered in the newly designed NFI methodology, underground biomass is not yet incorporated and represents a clear knowledge gap to be filled.

- Consider policy development to tackle emerging firewood and timber supply / demand clash as this is main driver of forest degradation by unsustainable extraction and one of the main concerns to ensure permanence of carbon stock

- Critically assess the 1% hydropower 1% plough back funds as additional funding mechanism for in-country NFI, scaling-up and upstart cost coverage support, together with broader, landscape-scale, watershed management forestry and sustainable agriculture practices.

1 Introduction

UNFCC and forests

Forests have become an increasingly important theme of the United Framework Convention on Climate Change (UNFCC). Since the 13rd Conference of Parties (COP13) in Bali, forests gain more interest by the developed and developing countries. Forests are considered to be responsible for an estimated 16 to 20% of overall greenhouse gas emissions (GHG) emissions, because of deforestation and degradation of especially the tropical forest ecosystem. Reducing emissions from deforestation and forest degradation (REDD) is seen as a cost-effective approach to reach global emission reduction targets and its scope has been expanded into what is called REDD+, including the role of conservation, sustainable management of forests and enhancement of forest carbon stock in developing countries. COP16 in Cancun resulted at least in an understanding and agreement between the Parties that forests will continue to be regarded as one of the preferred mechanisms in the Post-Kyoto, post-2012 era, but precise funding mechanisms, conditions and guidelines need to be further detailed and agreed upon.

Bhutan and forests

Bhutan has a unique position, as a developing country with a very high forest cover and a history of very limited deforestation and forest degradation. A long and consistent societal and governmental commitment to environmental preservation, based upon Buddhist principles and reflected in the guiding development vision of Gross National Happiness (GNH) has resulted in the inclusion in the country's Constitution of the pledge to conserve at least 60% of its landscapes with forest cover. This unique and singular commitment positions the country with strong legitimacy as a country with long-term policies and approaches in line with the envisaged REDD+ mechanism and as a strong candidate to be financially rewarded for its past and present actions to sequester carbon through its forests over time.

RGoB's commitment: carbon neutral to negative

The Royal Government of Bhutan made a strong commitment during COP15 in Copenhagen in December 2009, voiced by the prime-minister Jigme Y. Thinley by "…pledging that for all times to come, Bhutan will remain carbon neutral and that we will continue to follow and be guided by a strong sense of conservation ethics. That we will not produce GHG in excess of what we can sequester but that we will also serve as a carbon sequestration tank for the world in general. And that we would like to be rewarded for this." In follow-up to this remarkable commitment Bhutan has become an observer nation to the UN-REDD programme in April 2010, as an expression of its interest in involvement with the REDD+ mechanism development and seeking opportunities to prepare itself for the future opportunities.

REDD+ and Bhutan

In June 2010 a two-day seminar was organized on REDD+ potential by the Watershed Management Division of the Department of Forests and Park Services of the Ministry of Agriculture and Forests, supported by SNV Bhutan. Regional resource persons introduced the concepts and principles of REDD and REDD+ to a broad group of stakeholders and opportunities and constraints were discussed. This awareness raising event produced a draft document containing Bhutan's position statement on REDD+ and a number of recommendations, amongst which to further study REDD+ feasibility in Bhutan. This study, commissioned by the Watershed Management Division and supported by SNV, is the immediate result and a follow-up of the REDD+ seminar recommendations.

Study objectives

This study has as key objectives:

- Identification of the most promising entry points and options for engagement in REDD for both the emerging compliance market and the voluntary carbon market based on a feasibility study
- Recommendations on the best position of Bhutan on REDD and how to take this position forward into the international climate negotiations.

The study intends to include:

- historical field data on forest cover across Bhutan, based on existing documents and maps
- an assessment of perceived trends in forest degradation
- description of government policies and plans related to forest cover and exploration of "additionality"
- potential for REDD+ based on estimations of current carbon stock compared to potential carbon stocks through better forest management
- Information on carbon density in Bhutan
- Recommendations for the best entry points for engagement in REDD

Study scope

The expectation of the study is to keep momentum in introducing REDD+ in Bhutan and assess the nations capacity and knowledge base, essential for compliance and voluntary market entrance, combined with an overall analysis if it is worthwhile to commit to the REDD mechanism, weighing its advantages and disadvantages, scoping the potential and possible impact and contribution to the development goals of RGoB.

Stakeholder consultation

Essential part of this study has been the consultation of numerous stakeholders from December 7 to 16 2010, seeking their expert knowledge and insights in forest cover, state, degradation trends, timber and fuelwood supply and demand, livestock trends, institutional and regulatory setting, hydropower and CDM development, social forestry, conservation, plantation, forest ecosystem science, climate change and perceptions and ideas on REDD+ potential for Bhutan. The kind, realistic, constructive, and sometimes blunt and inspiring comments of all stakeholders have enabled this rapid scoping study immensely and the information and views shared have been essential for the report and its main findings and recommendations. A list of all stakeholders consulted is attached as Annex 1, including short excerpts of the discussions.

Study outline

After this Introduction Chapter, the report continues with a closer assessment of the forest assets of Bhutan in Chapter 2, with attention for forest cover and change over time, drivers of forest degradation and related trends, present forest management types, and the demand and supply balance of timber and fuelwood. Chapter 3 examines the translation of the forest cover in carbon: how much is there as stock in the forest, what studies have been done and what knowledge do we have of the pool and fluxes? The relation with GHG inventory is made, earlier insights in carbon footprint and a first approximation of value of the carbon stock. Governance and REDD+ is the main subject of Chapter 4, identifying the institutional and legal setting, the coordination mechanism and negotiation position related to REDD+, the MRV options and experiences and analogies from the CDM experience in Bhutan and the emerging PES mechanism. Chapter 5 addresses the key question of REDD+ feasibility, through a qualitative and quantitative attempt of an initial cost-benefit analysis, identifying advantages and disadvantages and addressing pertinent questions related to the REDD+ mechanism and Bhutan, concerning permanence, additionality, leakage and governance. The

existing knowledge base and capacity related to forest and carbon is the focus of Chapter 6, identifying knowledge gaps and needs to enhance the scientific base to be able to better match the developing guidelines for eligibility. Key partners and possible funding options are briefly discussed. In Chapter 7 possible piloting options are explored and some of the initial choices and preferences discussed. The report finalizes with an overview of key finding and a number of recommendations related to identified knowledge gaps, capacity needs and options for engagement in the developing REDD+ mechanism.

2 Bhutan's forest assets

This Chapter contains a closer assessment of the forest assets of Bhutan, with attention for forest cover and change over time, forest types, drivers of forest degradation and related trends, present forest management types, and the demand and supply balance of timber and fuelwood.

2.1 Forest Cover

Bhutan's forest cover is extensive, stretching from tropical to sub-tropical forests along the border with India in the south, up to the single conifers and birch of the upper tree line in the alpine zone of the north. Large tracts of forests are still to be considered as primary forests and naturally regenerated forests and clearings for agricultural land, road and infrastructure corridors and settlements are relatively small, compared to the overall forest system. The most commonly used figure of forest cover, 72.5%, is based on the Land Cover figures of the LUSS-LUPP project of 1995, based on satellite imagery (SPOT) of 1989 and 1990 and considerable ground truthing. Other land uses are much smaller, with agriculture, including horticulture, covering 7.8%, pasture 3.9%, settlements 0.1% and others 15.7%, mainly reflecting uninhabitable and inaccessible rock and mountain slopes, including glaciers (see table 1).

Table 1: Major land-use types of Bhutan

Land-use categories	Area in sq. km	As % of total land
Forests	29,045.00	72.5
Pasture	1,564.00	3.9
Agriculture	3,088.00	7.7
Horticulture	58.00	0.1
Settlement	31.00	0.1
Others	6,389.00	15.7
Total	**40,077.00**	**100**

(RGoB 1995, as used in FAO Forestry Outlook, 2009)

The total official country area has since been reduced to 38,394km^2 with the corrected national boundary demarcation (Memo Dr. Phuntsho Namgyel 2010), increasing the total forest cover therefore to 75.65%, including scrub forest. Including the first nation-wide forest assessment of 1976-1981, the Pre Investment Survey or PIS, 8 different land cover exercises have been carried out, with a large difference in remote sensing imagery used, ranging from stereoscopic air-photo interpretation (API) of air photos of 1956 to high-resolution, state-of-the art satellite imagery (ALOS-PRISM and AVENIR) of 2008. Classification methods are different between almost all surveys, as the definitions and legends used to cover forest and tree spatial units (Dr. Phuntsho Namgyel, 2010). The resulting forest cover data are therefore not depicting a clear trend and are difficult to compare over time. A series of additional issues, as relatively large cloud cover of imagery used, very limited or absence of ground trothing of draft maps and lack of technical sectoral input from foresters have further complicated the development of trustworthy land cover data sets. The PPD-LUSS-LUPP data of 1995, depicted in the Atlas of Bhutan, have followed a clear mapping methodology and used considerable ground trothing and have therefore been most commonly used as reference material. The recent Land Cover Mapping Project, initiated by NSSC-SLMP and PPD-MoAF has over the last 2 years carried out the latest nation-wide land cover and land use survey, making use of high-resolution imagery of a new Japanese satellite (ALOS AVENIR and PRISM at <10m spatial resolution), a consistent land use legend and extensive ground trothing at geog level and compiled at Dzongkhag level. The data is presently being finalized and reviewed and are expected to be released officially in January 2011 (pers.com. Tshering Dorji, PM-LCMP-NSSC and Chencho Norbu, Director DoA).

Table 2: Forest cover data as provided by a series of land cover surveys

Source	Year	Imagery	Forest cover (%) Corrected for official country area (Scrub forest %)	Total Cover (%) forest and scrub	Total Area in hectares
Pre Investment Survey	1976-1981	API 1956-8	74.00 (1.2) No complete coverage	75.2	2,887,289
FAO (Negi)	1983	API+Landsat 1977-9	67.02 (4.99)	72.01	2,768,207
MPFD	1991	SPOT 1989	59.80 (10.68)	70.48	2,706,009
Atlas of Bhutan (LUSS-LUPP)	1995	SPOT 1989-90	67.16 (8.49)	75.65	2,904,506
JAFTA	2000	Landsat TM 1999-2000	69.83 (13.57)	83.4	3,202,509
PPD	2006	Landsat TM 1999-2000	69.57 (12.59)	82.16	3,154,451
TERI	2007	IRS-P6 2004	64.38 (9.00)	73.38	2,817,351
LCMP	2008-10	ALOS 2007-8	?	?	

(Based on data compiled by PPD (2006), Dr. Phuntsho Namgyel (2010) and Kinley Tshering 2010)

To resolve this inconsistency it is highly recommended to repeat a consistent land cover survey, making use of standard imagery, classification legend and approach and ground trothing, as developed by the LCMP, and ideally carried out by the same GIS-RS expert team, with regular intervals to have a valid time series that allows credible and accurate trend analysis of forest and land cover trends.

SNV-WMD (2010)

Linked to this feasibility study, WMD and SNV commissioned another study, looking into a time-series analysis of RS imagery, to determine forest cover and change over the last decade. Landsat TM imagery of 2001 and 2010 was classified into forest and non-forest classes, allowing to analysis change in forest cover due to deforestation and reforestation. The analysis is not conclusive as some areas of Bhutanese territory were not covered in the images (extreme south-west border areas). Also cloud cover in the 2010 image hampers a complete comparison. The study shows, although the data are not complete, that deforestation is limited to some very small patches (in red) and reconfirms the belief that deforestation rates are very limited. No reforestation is shown, probably due to the fact that scrub forest is clubbed together with all other land use categories into "non-forest", and open forest land is not distinguished, underestimating forest cover as compared with the surveys shown in Table 2. The approach of a time-series analysis proves to be promising if one can make use of complete cloud free images. Although absence of field-truthing will make the results less reliable, it still will help enable a frequent monitoring of forest cover change at limited cost. See figure 1.

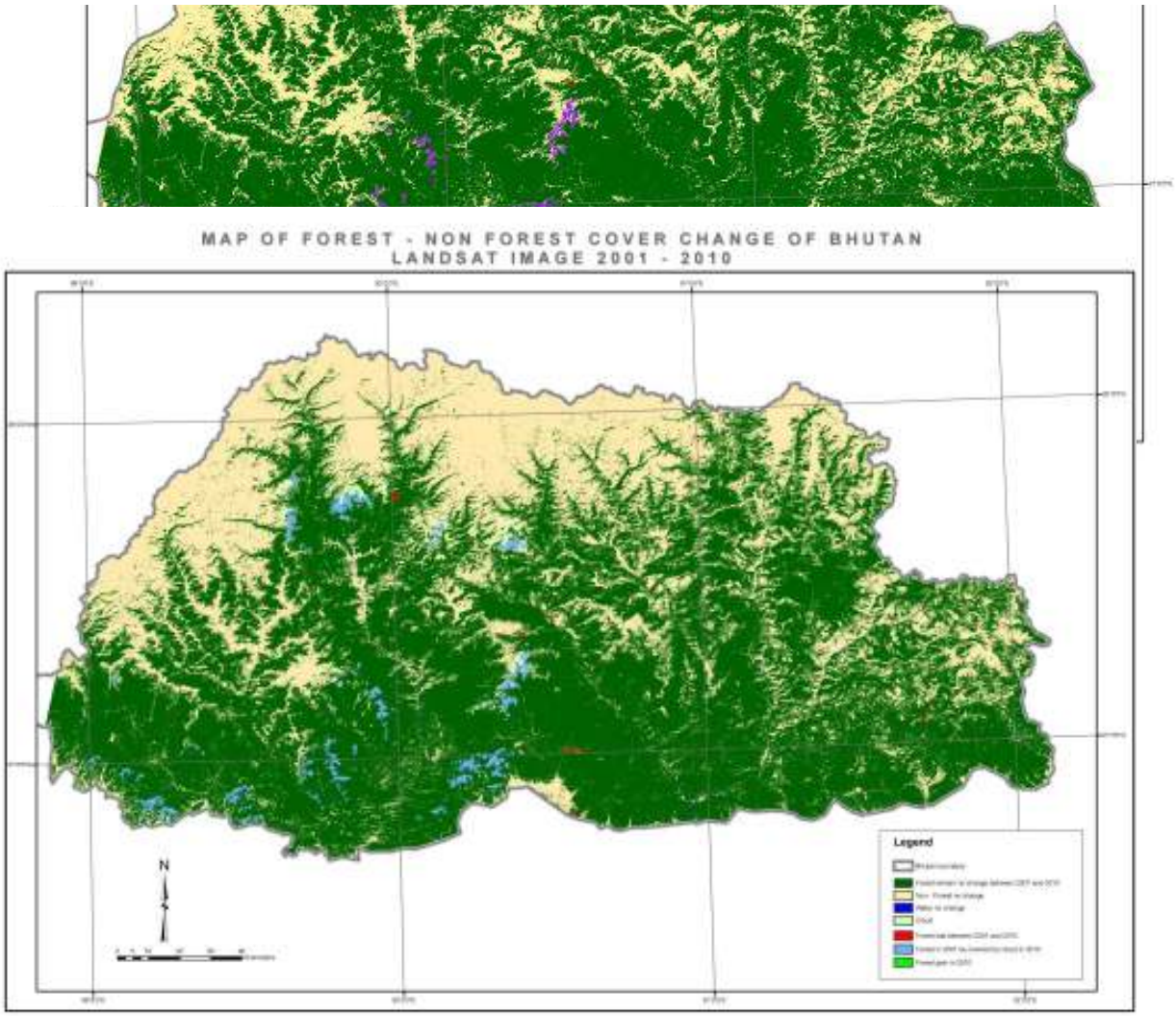

Figure 1 Forest cover change over the period 2001-2010, making use of Landsat TM images (Nguyen Hanh Quyen, 2010)

2.2 Forest Types

The PPD survey of 1995, as reflected in the table below, and reported in the FAO Forestry Outlook Study 2009, shows the forest composition of Bhutan into 8 main forest types. Broadleaf forest is by far the dominant forest type composing of 47.3% of the total forest cover, followed by mixed conifer, 16.8% and fir forest with 11.9%. Blue and chir pine cover smaller areas, together with mixed broadleaf and conifer forest. Forest plantations take up a very limited area with only 0.2% of the total forest cover and a considerable area is taken up by scrub forest, a broad category, classified as an area having less than 10% tree cover, often consisting of lower shrubs and consisting of a wide variety of actual vegetation types, ranging from early forest succession stages, degraded forests to high-altitude shrub areas.

Table 3: Major forest types of Bhutan

Forest types	Area (ha)	As % of forest area	As % of total land area
Fir	345,300	11.9	8.6
Mixed conifer	486,800	16.8	12.1
Blue pine	128,600	4.4	3.2
Chir pine	100,900	3.5	2.5
Broadleaf + conifer	135,800	4.7	3.4
Broadleaf	1,374,900	47.3	34.3
Forest plantation	6,400	0.2	0.2
Scrub forest	325,800	11.2	8.1
Total	**2,904,500**	**100**	**72.5**

(PPD 1995 and FAO, 2009)

Forest Management and Protected Areas

The functional classes of forest, as reported in the Forest Resource Assessment of 2005, indicate that only 14% of the forest cover is categorized as production forest, whereas protected areas (26%) and protection forest, (47.2%) build the main proportion of the total forest cover. The remaining 12.5% of forest cover has not been designated a function.

Table 4: Functional classes of forest

Functional classes	Area (ha)	Percentage
Production	360,122	14.0
Protected areas	676,514	26.3
Protection	1,215,284	47.2
No designation	320,380	12.5
Total forest	**2,572,300**	**100.0**

(DoF 2005 and FAO 2005, in Forestry Outlook 2009)

The Forest resource Assessment of 2010 gives a further division of forest management into 5 main categories: forest with management plan (FMUs and CFs) (9.78%), plantation (<0.01%), protected area (27.18%), protection area (45.8%) and forest without management plan (17.14%). The percentages are calculated for the 2010 data and divert slightly from the functional class percentages.

Table 5: Further division into forest management categories

Variable	Forest Area (000 ha)			
	1990	**2000**	**2005**	**2010**
Forest with management plan	49	184	251	318
Plantation	1	2	2	3
Protected Area	825	854	869	883
Protection Area	1390	1439	1464	1488
Forest without management plan	770	662	609	557
Total	**3035**	**3141**	**3195**	**3249**

(FAO, 2010)

Table 5a: Management regimes of forest areas

Management Regimes	% forest land
Protected Areas	41
Government Reserve Forest outside of formal management regimes	34.4
Community Forests	2
Forest Management Areas	14
Biological Corridors	8.6

Source: Ball, 2009, based on DoF and MoAF 2009

The most recent data on protected area, NCD 2010, give an upward revised percentage of the national land area for Protected Areas and Biological Corridors. With the establishment of the Wangchuk Centennial Park in 2008, the largest National Park in Bhutan, the total area of Protected Areas has gone up to an astounding 42.71% and an additional 8.61% for Biological Corridors, bringing the total for Protected Areas and Biological Corridors to an impressive 51.44% as shown in table 6.

Table 6: Revised Percentage of Protected Areas and Biological Corridors

Protected Area	Establishment Year	Area [km^2]
Wangchuk Centennial Park	2008	4,914
Jige Dorji NP	1995	4,316
Jigme Singye Wangchuk NP	1995	1,730
Royal Manas NP	1966	1,057
Thrumshingla NP	2000	905.05
Sakten Wildlife Sanctuary	2003	740.6
Bumdeling Wildlife Sanctuary	1998	1,520.61
Phibsoo Wildlife Sanctuary	Not established	268.93
Khaling Wildlife Sanctuary	Not established	334.73
Toorsa Strict Nature reserve	Not established	609.51
	Total Protected Area	**16,396.43 (42.71%)**
Biological Corridors	Under process	3,307.14 (8.61%)
Royal Botanical Park Lamperi	2004	47
	Total	**19,750.57 (51.44%)**

(NCD 2010)

The 883,000 ha of forest in protected areas reflected in Table 5 indicate that approximately 54% of the protected areas is under forest cover, representing about 23% of the total area of Bhutan, deviating from the 676,514 or 26.3% of Table 4 Important to note nonetheless, is the importance that such a considerable percentage of the total forest cover is having legal protection under established parks, a fact very few countries in the world could ever be able to accomplish.

2.3 Trends in forest cover as impacted by landscape processes as drivers of forest change and forest degradation

In the following section a number of key processes, acting at landscape scale, are discussed that are thought to be main drivers of forest degradation and/or forest cover change

Tseri or slash-and-burn agriculture

Traditional slash-and-burn agriculture (tseri) has for centuries been practiced in Bhutan by farming communities. The periodic clearing of forest areas by burning of trees and undergrowth, combined with the collection of poles and timber and firewood, resulted in short-term good crop yields, benefiting from the peak in soil fertility of the forest soil and the nutrient surge from the burnt biomass. Tseri is particularly practiced in Pemagathsel, Zhemgang and Chhukha Dzongkhags, but has been banned since 2002 as a legal land title as it is considered to be an unsustainable agricultural practice that is not in lien with sustainable forest and land management principles. Shortening cycles of clearing reduce fertility and endanger sustainability. Data provided by CORRB, collected by the Regional Project on Shifting Cultivation indicate a sharp decrease in the total tseri area from 88,300 ha in 1989 to only 26,130 ha in 2000, a decrease of 70%. Tseri is still being practiced, but after the regulations of 2002 and the new Land Act of 2007, the practice is becoming less common as a result of the Government ban, and combined effect of labor shortage, wildlife pressure, alternative income options, promotion of sustainable land management alternatives and rural-urban migration trends. The decrease in tseri areas is resulting in an increase of forest cover, as many of the former tseri patches will ultimately, through forest succession stages, return to forest cover.

Table 7: Overview of decrease in tseri land area from 1984 to 2000

Year	Area (ha)	Source	Remarks
1984	40,640	RGoB, land records	
1983	115,000	Negi	
1989	88,300	LUSS LUPP	
1993	80,940	RGoB	25,216 hh with tseri in their thram
2000	30,459	RNR stats	
2000	26,130	PPD 2006	70% decrease since 1989

(Based on CORRB-ICIMOD 2009 and PPD 2006)

Tshamdro and livestock

Livestock traditionally in Bhutan has to graze and find its fodder to a large extent in the forest in a country with such extensive forest cover. The traditional land tenure of grazing land is named tshamdro, with a great variety ranging from high-altitude pasture land to sub-tropical broadleaf forests. In general tshamdro will induce a certain negative impact on forest quality by the intensive browsing of tree seedlings, soil trampling and compaction and lobbing of tree branches by herders as fodder for their herds. To lesser extent will tshamdro use and grazing result in net forest cover decrease, although in limited areas serious overgrazing of forest areas has resulted in severe land forest and ultimately land degradation, especially in these areas where winter grazing by yaks and summer grazing by cattle coincides, e.g. Sheytemi in Radhi, Trashigang. The figures for 2007, as reported by Dr. Pema Choephel 2009, indicate a total tshamdro area of 406,513 ha, roughly 1% of the total land area of Bhutan. The new Land Act of 2007 revoked all traditional tshamdro rights and envisaged a new lease system for grazing land to replace the old tshamdro grazing right. As of now, no new system has been introduced so that a status quo is continuing, with continuation of the old grazing practices in many forest areas. Overall livestock numbers are slightly decreasing over the last years, with the number of cattle heads decreasing (DoL 2009) from 312,063 in 2006 to 307013 in 2009 and yak numbers decreasing from 52,911 in 2006 to 38,690 in 2009, see table 8 and figure 2. The decrease in livestock population is partly the result of the policy to replace unproductive local cattle with improved breeds, aiming at enhanced dairy production and reduced pressure on the forest. The reduction in the yak population is more outspoken and is most likely the result of less interest of the younger generation to continue the cumbersome life of a semi-nomad and the attraction of other income sources. The focus on dairy production is combined with dairy group formation, introduction of improved breeds as jersey and improvement of the fodder base by fodder promotion and improved pasture development in a move towards stall feeding. These changes from the traditional herding of local cattle in the forest, to a more sedentary livestock management will help to decrease pressure on the forest and enhance resilience and forest regeneration.

Table 8: Total tshamdrog area in Bhutan

Dzonkhags	Tshamdrog (ha)	Dzongkhags	Tshamdrog (ha)
Tsirang	662	Punakha	17,569
Pemagatshel	3,162	Gasa	13,893
Samdrup Jongkhar	8,764	Zhemgang	18,775
Sarpang	365	Samtse	15,775
Trashi Yangtse	1,665	Haa	60,778
Mongar	7,142	Bumthang	26,671
Dagana	9,235	Chhukha	21,014
Lhuentse	9,108	Wangdue	50,719
Trongsa	21,687	Thimphu	77,317
Paro	1,767	Trashigang	40,445
Total			**406,513**

(RNR statistics 2007, as reported by Dr. Pema Choephel, 2009)

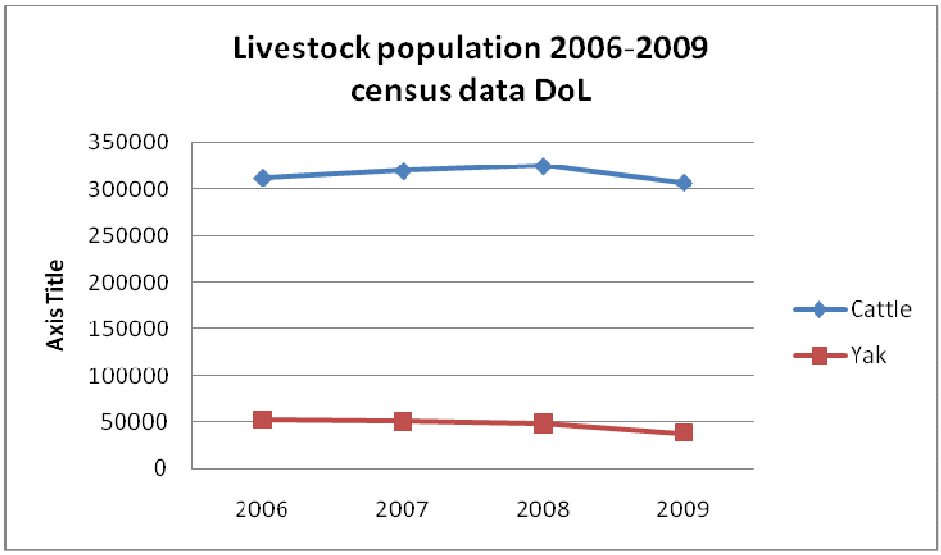

Figure 2: Livestock population 2006-2009 (census data DoL 2009)

Forest fire

Forest fires are a severe disturbance of the forest system and result in destruction of biomass and loss of flora and fauna. The data (see table 9) reveal no clear trend, but show a more cyclic character with years of very limited forest area affected (1,084 ha in 2003-2004) to more severe damage as in 1992-1993 (29,182 ha). The fire season in Bhutan is mainly in the winter period with very limited rainfall and very dry forest floor conditions, combined with often strong valley winds. The climate change scenarios predict more climate extremes in the years ahead, which could have serious implications for the severity and number of forest fires. Active forest fire prevention and initiatives as forest fire volunteer groups are needed to control the impact of forest fires. The impact on forest cover is seen as limited, but in years with larger forest areas affected, the impact on forest quality must be tangible, with loss in soil and water protection function and loss of valuable timber and firewood.

Table 9: Forest area affected by fire

Season	Area affected [ha]	Number of fires
1992-1993	29,182	84
1993-1994	2,241	36
1994-1995	19,628	56
1995-1996	10,812	62
1996-1997	9,853	48
1997-1998	6,487	72
1998-1999	13,536	112
1999-2000	13,455	104
2000-2001	9,326	81
2001-2002	5,858	64
2002-2003	2,170	46
2003-2004	1,084	40
2004-2005	3,186	67
2005-2006	7,832	37
2006-2007	22,512	47
2007-2008	2,567	10

(FAO 2010)

Leaf litter collection or sokshing

The practice of collecting leaf litter from the forest floor is regulated though a right of use granted for the practice to households. Sokshing is important to ensure sustained yields from agriculture and forms an important input of essentials nutrients to the top soil of dry- and wetland. Leaf litter is collected from both conifer forest (needles and litter) and broadleaf, especially oak forest (leaves and litter). The area of sokshing is limited with about 8,500 ha registered according to the records of the National Land Commission (NSB, 2007). The continuous removal of leaves, needles and litter results in serious impact on the nutrient availability of the sokshing forest with often stunted growth and limited regeneration. Soil fertility will decrease over time and the often bare forest floor is much more exposed to erosion processes. Sokshing will not affect forest cover extent, but will have a clear negative impact on forest quality.

Fallowing of agriculture land

A more recent land use trend is the fallowing of agricultural land, due to a complex of factors, amongst others, labor shortage, lack of irrigation water, off-farm income opportunities, rural-urban migration, wildlife pressure. Both dry- and wetland are left fallow, but accurate numbers of the area involved are scarce. A recent study by RDC Wengkhar, 2009, reported 3553 ha of wetland left fallow in the six eastern dzongkhags. The impact of forest cover and quality is limited, but a limited increase in forest cover might gradually occur if the land is permanently fallowed and vegetation succession is able to continue towards forest cover.

Infrastructure development

The rapid economic development of the last decades has resulted in an accelerated development of infrastructure as roads, transmission lines and urbanization. The growth of the farm road network over the last decade has been substantial and, apart from providing access to remote communities, has also had negative effects on the forest because of the corridors felled in previously untouched forests and the significant increase of landslides, erosion and other slope instability along the road alignments. The new roads in forest will give easy access to previously remote forest stands and encroachment, from collecting of NTFPs to illegal timber and firewood collection is common. For the construction of transmission lines and towers forest corridors have to be cleared, but the long-term impact is regarded as less destructive as the transmission alignments are not easily accessible and will not lead to further encroachment. Enlargement of settlements and urbanization with many new town plans being developed, means loss of a certain forest area. Encroachment into the surrounding the forest and related forest degradation are common. On the other side of the spectrum of urbanization is migration from rural areas, leading to less dependence on the forest where people have left, so the overall impact on forest cover and quality is complex to assess.

Firewood

Firewood (or fuelwood) consumption in Bhutan is very high. The Recent Integrated Energy Development Master Plan (IEDMP) of the Department of Energy, 2010, gives a comprehensive overview of residential, government and industrial demand for fuelwood, together with firewood demand projected, considering several growth scenarios (see table 10). For instance, the country consumed 724 597 tonnes of fuelwood during 2005, which accounted for 56.8% of the total primary energy supply and represent 90% of the energy used in the residential sector. Fuelwood represents 231 739 TOE (Ton equivalent of oil) while electricity production stood at 216107 TOE in 2005. The per capita firewood consumption in the residential sector is about 0.78 ton per annum, accounting for 68% of the total firewood consumption in the country. The IEDMP states that "Dependence of the residential sector on firewood is alarming, but with strategic planning, this dependency can be reduced to minimum by 2020." The report also indicates that: "Heavy dependence of the residential sector on firewood would be a cause of concern in the years to come.

Experience shows that because of electrification, firewood consumption reduces by about 30%–35%." The electrification effort, to have complete coverage by 2013 to all households, will reduce domestic demand of firewood, but especially in rural areas the communities will continue to collect the free resource firewood represents. The IEDMP further reports that: "With the sustainable yield for timber and firewood estimated at 1 565 540 tonnes/year, biomass would continue to remain an important source of energy for Bhutan." Looking ahead at projected demand for firewood the IEDMP explores 4 scenarios of economic growth and energy efficiency improvement: BAU-business as usual, EE-increased energy efficiency, HIG-high economic growth, HIGEE-high economic growth coupled with higher energy efficiency. It is striking to note that under all scenarios the firewood demand is projected to increase, which will further put pressure on the forest ecosystem and on the forest management to be able the substantial demand. The net impact on forest cover is most likely a continued pressure on the forest through firewood collection with limited negative effect on total forest cover and more pronounced effect on regeneration and forest quality, with a trend to more open forest. The projected increase in firewood demand is worrying and requires focused policy development to be able to meet future demand sustainable, coupled with and increased focus on energy efficiency and the development of alternative and renewable sources.

Table 10: Projected firewood demand (thousand tons) under different scenarios

Year	BAU	EE	HIG	HIGEE
2005	735	735	735	735
2010	840	645	801	617
2015	918	706	865	672
2020	1097	850	1091	859

(IEDMP, DoE-TERI, 2010)

Timber

Timber is categorized as commercial logs or rural construction timber and substantial amounts are needed to cater to the market demand. The Bhutanese construction technique requires considerable amounts of timber and the rapid economic development has been accompanied by a frenzied construction boom (Ball, 2009, reports on a projected urban population growth rate of 4.2% per annum). Timber is supplied mainly from Forest Management Units (FMUs), managed by NRDCL and from forests designated for the subsidized rural timber allotment, in line with the King's call for affordability, accessibility and availability (Ball, 2009). The demand for timber is thus steadily increasing as reflected in Table 11.

Table 11: Industrial roundwood removals

	1990	**2000**	**2005**
Total volume [m^3]	170,000	195,000	216,000

(Forest resource Assessment, 2010)

If we compare the actual removal with the potential production in FMUs it is clear that the market supply has problems to meet the increased demand. The annual allowable cut for FMUs, under operation, planned for and potential, is estimated for at approximately 160,000m^3 (FRDD, 2009 and Ball, 2009, citing Schindele, 2004). According to the same author the potential AAC inside and outside of FMUs combined amounts to 791,155m3. This implies that the market demand has been such that the AAC as estimated for Bhutan has been surpassed for a number of years and that the timber supply therefore can not be considered to be sustainable. This is in line with the comments of the management of NRDCL during the consultations, stating that they feared that within a number of years they will not be able to meet the market demand. Although the FMUs have a scientific based plan for sustainable management for 10-year plan periods, it appears that the implementation of the plans is not able to sustain continued yields from the FMU areas. NRDCL management mentioned that they see considerable loss of stock in their FMUs due to rural timber extraction and damage to the regeneration potential because of cattle grazing. This is combined with a sub-optimal management of the FMUs, not in sync with the initial well formulated management plans, aimed at sustainability of the stock.

All together this implies considerable stress on the forest, leading to deforestation of certain areas of FMUs and considerable degradation of forest in FMUs and other forest areas used for timber extraction. Timber extraction will lead to a trend to more open forest, with loss of biodiversity and deviating from the potential natural vegetation. The apparent trend of a stressed timber market, is reason for worry and the need to address this issue with focused government policies to address the market imbalance and to ensure a sustainable forest management, able to meet the market demand at a fair market price, in line with the real valuation of the commodity.

Table 12: Potential production of commercial timber [m^3]

Potential Production	2005	2008	2011	2014
FMUs under operation	55,454	58,242	58,242	58,242
FMUs in planning stage	3,500	18,000	20,099	20,099
Future potential FMUs	0	0	42,316	42,316
Total	**58,954**	**76,242**	**120,657**	**120.657**

Source: FRDD, 2099, as shown in Ball, 2009

Table 13: Annual allowable cut estimates for Bhutan as given by Ball, 2009

Type of forest	Total area by forest type [ha]	Average AAC in m^3/ha	Theoretical LRSY AAC [m^3]	Log production with a 25% reduction [m^3]
Hardwood	168,403	3.1	522,049	391,537
Coniferous/hardwood	11,252	2.79	31,396	23,547
Blue pine	26,137	1.3	33,978	25,484
Chir pine	16,591	1.7	28,205	21,154
Fir	4,433	1.3	5,763	4,322
Mixed coniferous	24,908	2.47	61,523	46,142
Total area	251,725		682,914	512,185
Conifer leading	88,322		160,864	120,648

Source: Ball, 2009, adapted from Schindele, 2004

Table 14: Commercial timber versus the subsidized rural timber production

Year	Commercial logs [cft]	% Production	Rural construction timber [cft]	% Production	Total production [cft]	Total production [m^3]
1997-01	1,896,000					
2005	2,369,932	32	4,994,701	68	7,364,633	208,512
2006	2,799,989	32	6,026,664	68	8,826,653	249,905
2007	2,496,371	35	4,562,468	65	7,058,839	199,854
2008	2,057,915					

Compiled by Ball, 2009, based on data from DoF, NRDCL and PPD

Other drivers of degradation or forest cover change

Apart from the series of drivers of change described above, other processes that act at landscape level do have influence on forest cover and quality. **Mining** is a limited activity in Bhutan with ongoing commercial exploration of talc and gypsum, dolomite, stone quarries, coal and marble. Although the area being mined is limited, and mostly confined to the southern foothills, the impact of mining operations is considerable. Besides the clearing of forest it often results in other negative impacts as dust, mining tailings, water pollution and noise. The construction boom, and especially the rapid hydropower development, has resulted in a sharp increase in demand for stone quarries. **Climate change** is a complex and multidimensional

process, but with definite impact for the forest ecosystems of Bhutan. The eastern Himalayas are predicted to be vulnerable for climate change effects and an predicted increase of global temperatures with 2 degrees might lead to shifts in the present tree and forest lines along altitudinal gradients. High-altitude pastures might be colonized by pioneering tree species and broadleaf forest could be able to spread its altitudinal range to higher elevations. The impact in uncertain and difficult to predict, but requires close attention.

Table 15: Summary of present and potential areas for timber production

Use/Type of Forest	Forest area [ha]	Forest area [%]
Total forest area	2,929,085	100.0
Forest area designated for timber production	1,946,723	66.5
Forest area currently available for timber production	**409,564**	**14.0**
a. Under management (FMUs)	169,991	5.8
b. Not covered by management	239,537	8.2
Forest area that could be brought under timber production	**572,798**	**19.5**
a. Forest around settlements with low potential	264,779	9.0
b. Degraded forest	32,356	1.1
c. Forest areas > 15km from road	69,479	2.4
d. Small forest patches < 100ha	59,196	2.0
e. Forest areas < 4000ha and >10km from road	70,187	2.4
f. Forest areas <1000ha and > 5km from road	76,801	2.6

(published by Ball, 2009)

Between 1990 and 2000, Bhutan gained an average of 10,600 hectares of forest per year, amounting to an average annual reforestation rate of 0.35%. Between 2000 and 2005, the rate of forest change decreased by 1.6% to 0.34% per annum. In total, between 1990 and 2005, Bhutan gained 5.3% of its forest cover, or around 160,000 hectares (FRA 2005). Although these numbers might suggest a steady increase in forest cover, it has to be stressed that these figures are based on rather rough estimates and extrapolations without a very good ground truthing base or validation by land cover mapping results. This forms another argument to have a regular and quality based forest cover mapping spatial inventory.

2.4 A complex pattern of forest cover increase and quality loss

The trend that seems to emerge is a complex one, with several drivers of negative change seem to become less outspoken (tseri, grazing, fallowing) and allow for forest cover to expand and quality to improve, or at least degradation pressure to ease. The extraction of timber and firewood at growing rates, surpassing the AAC, is having a definite impact on the forest cover and causes localized severe forest degradation. The imbalance in supply and demand of timber and firewood needs careful attention and policy interventions to enable future sustainable forest management, to safeguard the multiple functions of Bhutanese forests. Table 16 gives an overview of the different trends discussed and their impact o forest cover and forest degradation (or forest quality).

Table 16: Overview of processes at landscape level that impact forest cover area and forest quality
0: neutral, +: positive impact, -: negative impact, --: strong negative impact

Process at landscape level	Trend	Forest Cover Area	Forest Quality (degradation trend)
Grazing	Decrease in livestock population	0 / +	+
Tseri	Banned, being abandoned	+	+
Forest fires	Erratic	0	-
Fallowing	Increase in area	?	?
Fuelwood supply	Large demand	0 / -	- / --
Timber supply	Increased demand	0 / -	-/ --
Infrastructure development: roads	Strong increase	-	-
transmission lines	Increase	-	0/-
urbanization	Growing settlements and urban development	-	-
Climate Change: warming	Warming	+	?

3 Forest Carbon and Valuation

In Chapter 3 attention is given to what is known in studies on Carbon in Bhutan, how this knowledge is now still based on assumptions and global defaults instead of actual local measurements and a first attempt is made to estimate carbon and valuation for CFs, FMUs and protected areas.

The bottom line of the REDD+ mechanism is that one party agrees to another party to pay for the avoided emission of GHGs through conservation, sustainable management of forests and enhancement of forest **carbon stock**. The basic trading unit is therefore carbon, the basic element of our forest biomass, which ultimately might go up into the atmosphere as CO_2. The REDD+ mechanism, as all other Kyoto mechanism, tries to set a baseline or reference level of how much carbon is stocked in a certain forest area, the **carbon pool**. It is also tried to understand how much carbon annually will be stored in the growing biomass as an **increment**, reflecting the basic capability of growing trees and smaller vegetation to absorb and sequester carbon in its biomass. One therefore has to be able to measure or estimate with a certain accuracy the amount of carbon in the Bhutanese forests to be able to meet international guidelines set by IPCC and UNFCC. It is not the intention of this study to go into this rather complex matter in detail, but to assess broadly what we know of forest carbon in Bhutan.

The consultation with stakeholders and a rapid literature review reveal that there is outspokenly little known or published on forest carbon in Bhutan. Very few studies are named by the stakeholders and mostly refer to ongoing scientific studies, not widely accessible to many. The key publication on forest carbon is formed by the Forest Resource Assessments of 2000, 2005 and 2010, compiled by FRDD for FAO. In three separate chapter these Assessment account for the national volume of growing stock, how this can be expressed in a biomass stock and, finally, how this can be calculated as a carbon stock.

Growing stock

Based on the initial estimate of growing stock volumes as shown in Table 17, based on the per ha growing stock of 1989 multiplied with forest type area of 1999, volumes are calculated for subsequent years, leading to a volume of total growing stock of forest in 2010 of 650 million m^3, with 406 million m^3 of conifers and 244 million m^3 of broadleaved forests (see table 18).

Table 17: Growing stock in 1999 (per ha growing stock of 1989 multiplied with forest type area of 1999)

Forest types	Area (000 ha)	Volume (m^3/ha)	Total volume (000m^3)
Chir pine	279.17	83.90	23,422.36
Blue pine	136.38	43.60	5,946.17
Fir & Spruce	506.97	268.27	136,004.84
Mixed conifers	495.99	82.74	41,038.21
Conifers mixed with broadleaf	313.58	528.45	165,711.35
Hardwood	950.52	225.64	214,475.33
Total	**2682.61**		**586,598.26**

(FAO 2010)

Table 18: Volume of growing stock in the period 1900-2010

FRA 2010 category	Volume (million cubic meters over bark)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Total growing stock	535	592	621	650	n.a.	n.a.	n.a.	n.a.
…of which coniferous	194	300	353	406	n.a.	n.a.	n.a.	n.a.
…of which broadleaved	341	292	268	244	n.a.	n.a.	n.a.	n.a.
Growing stock of commercial species	214	237	248	260	n.a.	n.a.	n.a.	n.a.

(FAO 2010)

Dr. D.B. Dhital, involved with all 3 FRAs commented that these calculations were based on extrapolations, interpolations and assumptions and that only starting from the FRA 2005 some field data were incorporated. With clear scope for improvement, the FRAs give a rough approximation what amount of volume is standing and growing in our forests.

Biomass stock

As national data for biomass stock is not available the growing stock volume is used to determine, making use of global default factors, the total biomass stock (GPG, 2003. Good Practice Guidance for Land-use, Land-use Change and Forestry, IPCC). Global default factors are used for Biomass Expansion Factor (BEF), basic densities, root to shoot ratio and dead to live ratio. The above ground biomass can then be calculated by multiplying the growing stock with the basic density and BEF (see table 19). For the below-ground biomass only roots of 2mm or more are included and a root to shoot ratio of 0.392 is assumed.

Table 19: Above-ground biomass over the period 1990-2010

Category	Unit	1990	2000	2005	2010
Growing stock	Million m^3	535	592	621	650
Basic density	Tonnes/ m^3	0.459	0.446	0.446	0.446
BEF		1.87	1.84	1.82	1.80
Above ground biomass	Million tonnes	459	486	503	522

(FAO, 2010)

Combined with calculations, based on several assumptions and global default values, this results in the following table for total above- and below-ground biomass.

Table 20: Total biomass for the period 1990-2010

FRA 2010 category	Biomass (million metric tonnes over oven-dry weight)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Above ground biomass	459	486	503	522	n.a.	n.a.	n.a.	n.a.
Below ground biomass	171	181	187	194	n.a.	n.a.	n.a.	n.a.
Dead wood	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	**630**	**667**	**690**	**716**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

(FAO, 2010)

Carbon stock

Based on the biomass volumes, again making use of global default values, this time for carbon fraction, default values for litter, and default values for soil organic C stocks, the total carbon stock can be estimated. Three main steps are followed to do the calculation:

1. The biomass volume is converted to carbon, based on a default conversion factor (0.47)

2. Carbon in forest litter is estimated, based on default values (22 t/ha for conifers and 13t/ha for broadleaf
3. Soil carbon is estimated, based on assumption of occurrence of forest soil types (high to low in Soil Organic Matter content) and the areal coverage of these 3 forest soil types and an assumed soil depth of 30cm.

Table 21: Total carbon stock in above- and below-ground biomass, litter and soil

FRA 2010 category	Carbon (million metric tonnes)							
	Forest				Other wooded land			
	1990	2000	2005	2010	1990	2000	2005	2010
Carbon in above-ground biomass	216	228	236	245	n.a.	n.a.	n.a.	n.a.
Carbon in below-ground biomass	80	85	88	91	n.a.	n.a.	n.a.	n.a.
Sub-total: Living biomass	***296***	***313***	***324***	***336***	***n.a.***	***n.a.***	***n.a.***	***n.a.***
Carbon in dead wood	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Carbon in litter	49	55	58	60	n.a.	n.a.	n.a.	n.a.
Sub-total Dead wood and litter	***49***	***55***	***58***	***60***	***n.a.***	***n.a.***	***n.a.***	***n.a.***
Soil carbon	212	218	223	226	n.a.	n.a.	n.a.	n.a.
Total	**557**	**586**	**605**	**622**	**n.a.**	**n.a.**	**n.a.**	**n.a.**

(FAO 2010)

It is not surprising, but important to stress, how much carbon is stored in the forest soil (226 million m^3, which is 36.3% of the total carbon estimation and almost equal to the above-ground biomass! With all limitations, related to lack of actual field data, reliance on global default values and numerous assumption, extrapolations and interpolations, the FRA data are valuable as they provide a first approximation.

The only other source identified with forest biomass and carbon estimated for Bhutan is a recent ICIMOD study of 2009, in which the total forest biomass of Bhutan is estimated as 414.9 million m^3, equivalent to 195 million m^3 of carbon. This is clearly lower than the FRA assessment of in total 622 million m^3 of carbon, as presumably only the carbon in above-ground biomass is estimated. The total forest area used in the ICIMOD study, 2,334,000 ha is lower than the 2,682,600 used in the FRAs. Adjusting for the same area as used in the FRA the ICIMOD estimate would still be lower at 224 million m^3 versus the 245 million m^3 of the FRA 2010. Other assumptions used in the ICIMOD study refer to forest classes defined after canopy cover classes: very dense forest (VDF), moderately dense forest (MDF) and open forest (OF) with estimated distribution in Bhutan with VDF (81%), MDF (12%) and OF (7%).

Carbon stock in CFs and potential valuation

Schmidt and Temphel (2010) in a recent presentation estimated total carbon volume in community forests in Bhutan, stressing the fact that no actual analysis and assessment have been made of the potential as of now. The CFs in Bhutan now comprise of, divided over 268 CFMGs and 13,000 households, 32,200 ha, totalling 1.2% of the national forest cover. At an assumed annual increment rate of 1.5-3.0 t CO_2 / ha, in line with increment rates as measured for comparable forest types in Nepal Karky and Skutch (2010), this would result in an annual carbon sequestration of 50,000 to 100,000 t CO_2 / year. Assuming potential revenues (at a conservative market price of 2 USD per t CO_2 with market rates varying between USD2-5) this would amount to 100,000 to 200,000 USD / year, representing USD 7-14 per CFMG household per year. The compelling study of Karky and Skutch (2010) on the cost of carbon abatement through community forest management in Nepal, comparing 3 CFs under 3 management scenarios, concludes that carbon abatement through biological sequestration in CFs under potential REDD policy would be a low cost way to sequester carbon, under the condition that the communities continue to have continued access to the forest resources as intended under the initial CF management plans.

Carbon stock in FMUs and potential valuation

Data provided by FRDD on the 20 FMUs presently operated in Bhutan indicate a total FMU area of 188,676 ha, of which only 140,521 ha is forested. Increment rates for these 20 FMUs differ considerably from 0.38 to 2.68 m^3 / year, equivalent to an annual t CO_2 amount of 0.65 to 4.61. Assuming a middle value of 2 t CO_2 sequestration per ha per year (mean carbon sequestration rates for India (3.7 t / ha per year) and Nepal (1.88 t / ha per year) Banskota, Karky and Skutsch, 2007) this amounts to 281,000 t CO_2 sequestration for the forest cover of the FMUs, with a valuation (at USD 2 per t CO_2/ha) at USD 562,000.
This estimate is likely to be too optimistic as the sustainability of the FMU management is disputable and sustained increment rates will be problematic to maintain if the extraction surpasses the AAC consistently. For the complete FMU data see Annex 1. One could also consider to implement Improved Forestry Management (IFM) techniques and other silvicultural measures (such as pruning, thinning and plantation) to enhance sustainable management and be eligible for carbon credits for such a broader approach than strict annual increments under business-as-usual management. As the sustainability of the FMU's needs improved, as discussed under previous sections, such a broader approach could be interesting as it will enhance the sustainability, increase potential production levels and ultimately generate potentially more carbon credits.

Carbon stock in Protected Areas and potential valuation

The vast area of protected areas in Bhutan, 51.44% of which 42.71% protected areas (mainly national parks) and 8.61% biological corridors, represent a relatively large forest area under nature conservation protection in various management forms. Their conservation status ensures past and future sequestration of carbon in the forest cover of these protected areas and offers therefore an interesting volume of carbon, to be considered for valuation. If one considers, for example, the most recent National Park, Wangchuk Centennial Park, established in 2008, of 491,400ha, and assuming that about half of the park is made up of forest cover, this involves 200,000ha of forest. Under the Global Conservation Standard USD$0,25 is paid per ha and per year, valuating the Wangchuk Centennial Park forest cover at $50,000 per year, as compensation of reward for conserving the forest stock for global benefits. Although relatively limited, this amount would be of considerable use, especially as NCD officials clearly indicated to have funding problems to establish sufficient management staff in all protected areas.

Relation to Green House Gas (GHG) inventory

First or initial GHG Inventory, 2000 stated that: "Our estimate of GHG emissions in 1994 was (-) 5.89 tons of CO2 equivalent per capita, with Bhutan's GHG emissions in 1994 were CO2 = 228.46 Gg. Land use change and forestry, although it emitted a comparatively significant amount of CO2 in the same year, indicated a net CO2 removal of 3,549.5 Gg because of strong intake of CO2 through forestry management and plantations as well as abandonment of managed land." The declaration made by RGoB during COP15 in Copenhagen 2009 stated that: "The most recent estimates of annual GHG emission of Bhutan is around 1.5 million tonnes of carbon, against the sequestration amount of 6.3 million tonnes (draft GHG inventory report, 2000), leaving the country with a net of minus 4.7 million tonnes. This makes us perhaps one of the few countries, may be the only one country in the world to have a negative carbon emission," reads the declaration." The second national communication to UNFCC is planned to be published soon and the preliminary data indicate a strong increase in GHG emissions related to the relative strong growth of the economy the last 15 years, but an overall net sequestration due to the forest sink.

4 REDD+ and governance

In this Chapter governance issues are assessed related to the embedding of REDD+ in the Bhutanese government system. As REDD+ is about long-term commitments, governance must be ensuring a stable and conducive environment, able to deliver on the multilateral and bilateral commitments and with policies, laws and regulation that permit the development of REDD+ mechanisms. MRV is discussed, together with lessons to be learned from CDM experiences and the recently started PES pilots in Bhutan.

Institutional setting

Two agencies are pivotal for the development of REDD+ within the Bhutanese government system. The Watershed Management Division (WMD) of the Department of Forests and Park Services of the Ministry of Agriculture and Forests has the mandate within the RNR sector on climate change related issues. WMD is the focal agency for Bhutan for UN-REDD, in communication with UNDP, FAO and UNEP. The National Environment Commission (NEC) is the focal agency for Bhutan for the UNFCC and responsible for the national communications on GHG emissions and the adaptation and mitigation National Action Plans. The WMD intends to initiate the set-up of a REDD+ Technical Working Group and a Policy Committee and start development of REDD+ National Strategy and, and if needed, a policy and guidelines. Technical experts from the line agencies will have to feed the diplomats and delegations members to the CoPs on REDD+ issues and the Bhutanese position.

Legal conducive environment

The legal setting for REDD+ in Bhutan should be described as conducive. Article 5 of the Constitution of the Kingdom of Bhutan makes it clear that: "*Every Bhutanese is a trustee of the Kingdom's natural resources and environment*". The Royal Government is enjoined in the Constitution to conserve and improve the environment and safeguard the country's biodiversity. It is further directed to secure sustainable development while promoting economic and social development. (National Forest Policy revision Draft 2008). The Constitution charges the Government to ensure that a minimum of 60 % of Bhutan's total land area is maintained under forest cover for all time, a commitment unique in the world and setting an absolutely enabling environment to initiate REDD+ in Bhutan. The Forest and Nature Conservation Act of 1995 recognizes the traditional and cultural rights of the local people to forest use and thereby maintains their legitimate access to forest resources. Social Forestry is enabled through a National Strategy for Community Forestry Guidelines, a NTFP Guideline and a National Plantation Strategy for Bhutan. The visionary Gross National Happiness development strategy embraces environmental conservation as one of its 4 building pillars, as exemplified by the protected area status of more than 50% of the nation.

It has to be stressed however, that although the legal framework is good and advanced, there remains a large discrepancy between the intention of the plans, policies and acts and the actual implementation and enforcement in practice and on the ground. This is some reason for concern and will require time to enhance performance and improved monitoring of compliance with the RGoB system.

Other relevant policy documents are the Integrated Energy Development Master Plan (2010), with clear recommendations for a balanced sustainable firewood supply and an urge for improved energy efficiency, and the Sustainable Hydropower development Policy, Draft, 2008, that stresses the importance of watershed management and conservation of protection forest functions, essential for downstream water quality and quantity. The Hydropower Policy also states that 1% of the hydropower revenues should be ploughed back into watershed management activities, ensuring funding support for key sustainable landscape management interventions. The following article contains the essence:

Integrated Sustainable Water Resources Management (ISWRM)

12.4 In order to utilize water resources in a sustainable manner for hydropower generation, it is important to protect water catchment areas by promoting sustainable agricultural/land use practices and nature

conservation works. The MoA in collaboration with MoEA shall work out the modalities for integrated sustainable water resources management. A minimum of 1% of royalty energy in cash shall be made available on annual basis to MoA for this purpose.
Estimated electricity revenue for 2010 is roughly 6,000 million ngultrum, which would imply 60 million available for ISWRM. The planned hydropower generation by 2020 is 10,000MW, implying a 6-fold increase of revenue stream, bringing the 1% provision up to almost USD10 million annually.

Coordination and negotiation position / choices

Coordination between Bhutanese stakeholders and key institutions should not be a matter of concern, apart from the fact that many responsibilities converge on few human resources within the RGoB institutions, putting constraints on time and staff availability for REDD+ mechanism and piloting development. Choices in the diplomatic arena should be based upon technical sound advice from the forestry sector and it is recommended to involve forestry staff in the diplomatic delegations of the CoPs and other multinational and bilateral organizations such as UN-REDD. As long as the details of the REDD+ mechanism under a new UNFCC post-Kyoto, post-2012 agreement are not known, it will be difficult to make long-term commitments on the compliance market. The voluntary market though, will offer possible options for piloting to build experience. Testing on the ground how the actual implementation works out, how global funds can be channelled to local communities, protected area management teams or FMUs, will be essential to be better placed to evaluate which forms of forest carbon mechanisms are best suited for the Bhutanese reality and conditions. Based on the factual experiences, generated by future trials, it will be easier to come to balanced choices once the compliance market will also be launched and the voluntary market will have evolved.

Monitoring, Reporting and Verification (MRV)

In all UNFCC mechanisms, the monitoring, reporting and verification (and validation) of the commitments made by the seller of credits with the buyer, form a complex framework of checks-and-balances to ensure that reduction emissions are actually accounted for and verifiable. For REDD+ this means that all reduced emissions through conservation, sustainable forestry management and enhanced carbon stock management are to be transparent, measurable and following procedures and guidelines in line with global codes of good practices. MRV essentially refers to the compliance market and will only be effective form the moment REDD+ starts to become a formal mechanism under UNFCC. Preparations though should be started to enable available knowledge on procedures, data collection and compilation methods, reporting standards and verification and auditing procedures. The voluntary market allows for both parties to come to agreement what kind of guidelines will be followed, but the voluntary market standards make use mostly of eligibility criteria as formulated under compliance regulations and will be an appropriate way of getting familiar with international standards. MRV will require considerable efforts and costs related to staffing, capacity building and fees for accredited verification/auditing institutions. Concerned parties within Bhutan will have to be responsible for certain steps of the information gathering, methodological compliance and suitable reporting standards.

CDM case to learn from

REDD+ is still an evolving mechanism, but Bhutan is already building experience with the Clean Development Mechanism (CDM) under the Kyoto protocol. A small hydro-electrical installation at Chendibje is a CDM project, facilitated by DoE, and DGPC has been awarded CDM status for the Dagachu hydropower project, under construction in Dagana Dzongkhag. DGPC management made clear that the CDM mechanism is complicated, costly, time-consuming, manpower-intensive, cumbersome, but ultimately worthwhile to build capacity and knowledge. The clear benefit is that considerable hard currency amounts (4-5 million euros annually) are expected to be received after generation commences from 2013-14. DGPC intends to develop all upcoming hydropower projects under CDM, as they are considered as trans-boundary projects, replacing fossil fuel emissions in India, qualifying the projects' additionality.

PES experience and analogy

The WMD, in close collaboration with FAO, has started to initiate Payment for Environmental Services (PES) projects in Bhutan. PES relies on a national buyer of services, supplied by natural resource management groups or communities or responsible institutions. A pilot has started in Mongar Dzonkhag, wherein the City Corporation pays an annual fee to a CF management group for their conservation efforts in an upstream watershed area to ensure water quantity and quality over time. The set-up and commitments in such a PES scheme are very comparable to a REDD+ set-up, with as main difference that the buyer is global and that the service is perceived to be global as well. The experiences in the PES piloting will be very instructive and helpful in considering benefit-sharing approaches and capacity and monitoring issues. As the knowledge is built in-house at the WMD, it can be easily translated into REDD+ relevant knowledge building.

5 Feasibility

Is REDD+ feasible in Bhutan? That is the main topic of Chapter 5, with attention to the costs and possible benefits of REDD+ for Bhutan, to what extent is the country able to make long-term commitments and is the effort necessary worthwhile, if one considers the actual benefits and alternatives?

Is there a question of feasibility?

Some of the stakeholders consulted were surprised by the question if REDD+ is feasible in Bhutan. They stated that REDD+ is being piloted in the neighboring countries and seems feasible there and on top of that, RGoB has expressed its interest it receiving potential future benefits from the REDD+ mechanism by joining the UNREDD programme as observer nation. Why should one doubt feasibility? The high forest-low degradation (HFLD) status of Bhutan, makes classic REDD, through afforestation and reforestation (A/R), not an option. REDD+, with its focus on conservation, SFM and carbon stock enhancement seems much more fitting with the Bhutanese conditions and the understanding is that the country should be eligible for REDD+ activities. Nevertheless, there remains a valid question if the future benefits do weigh up to the costs that have to be made to get the financial credits. Credits do come at a cost, both financially and in terms of staffing, time and efforts.

Cost-benefit analysis (qualitative and quantitative)

A cost-benefit analysis (CBA) forms an accepted and widely-used way of weighing monetary costs versus the benefits they bring about. A full monetary CBA is not yet possible as the financial details of the funding mechanism are still unclear and evolving. A more qualitative CBA however would give some insights in the balance of the analysis towards beneficial or less attractive. In the following section a number of arguments are identified that argue in favor or against REDD+ adoption in Bhutan.

Advantages:

- **Money for good custodianship / global benefits**
  Bhutan and RGoB have built a legacy of good custodianship of natural resources, initially based on Buddhist principles and framed in the GNH concept and enacted in the Constitution and the broader legal framework. REDD+ is aimed at offering the opportunity to financial reward precisely these countries that have been able to conserve forests (and thus carbon), sometimes at the cost of less rapid economic development. As a unique country with a carbon negative balance by sequestrating considerable CO_2 volumes, Bhutan should be eligible for global rewards for it global good practices.

- **Co-benefits / multiple benefits**
  The sustainable management of forests and landscapes through conservation efforts have many more beneficial effects as they safeguard sustainable access to natural resources to communities, enabling food security and rural livelihoods. Furthermore, these good practices also contribute to biodiversity conservation and will protect the soil and water conservation function of forests and other sustainably managed landscape elements. It is an example of convergence of the three Rio Conventions, where climate, biodiversity and desertification and land degradation perspectives result in far more than just one dimensional benefits. The benefits will be multidimensional and have therefore more value than "just carbon money". Benefits will also be not limited to on-site forest quality and cover, but will have impact off-site, by safeguarding downstream discharge quality and quantity and ultimately even trans-boundary benefits, as the Bhutanese rivers flow into India and Bangladesh from their upstream forested catchments.

- **Rewarding local communities (livelihoods)**

REDD+ would allow for financial rewards to reach these communities that actually do the on-the-ground activities that result in sustainable management of forest resources. If members of a CF management group implement the CF management correctly, there will ultimately be a sustainable forest growth and conservation of carbon stock, while allowing them to collect the resources for own use sustainably. Additional payment for these "custodian services" will be of good value for rural households that have very little other cash-generating opportunities.

- **Co-funding of Conservation, CF and SFM**
  Financial rewards for conservation, SFM and carbon stock enhancement could be considered as co-funding of these good management practices. Budgets available for conservation and SFM are limited and any additional income stream to support sustainable management of natural resources will be valuable to actually implement the plans as they are intended.

Disadvantages:

- **Investment in MRV, knowledge building**
  The present state of knowledge and capacity is such that considerable investments are needed to lift the information level to such a level that the country can supply reliable, accurate and verified data. This will require considerable time and effort of numerous staff members. As RGoB institutions are under-staffed, this will not always be easy. It will also be a long-term process, such as the NFI, that is estimated to be finalized only by 2016.

- **Potential of Bhutan limited because of small size**
  Bhutan is a small country compared to its giant neighbors and most other world nations. Although the forest cover percentage is high, the actual area of forest is limited and the financial incentives to be collected are therefore relatively limited. The costs however will be relatively high for a small country as Bhutan as procedures, guidelines and eligibility criteria will be equal to all nations, large or small. The investment to reap benefits will thus be high compared to large nations.

- **Better focus on 1% hydropower revenue plough back**
  One could argue that it is very cumbersome to make use of a very complex, lengthy and costly process to be able to benefit from global funds for local actions. It involves outsiders to verify compliance and audit national procedures and data. Why go through such a complicated process while the hydropower plough back provision, of 1% of the hydropower revenue, represents a local mechanism, with a local buyer of environmental services totally in line with the REDD+ mechanism? With foreseen growth of hydropower output to 10,000MW by 2020 this is not an illusion, but a local source to be tapped, with considerable cost benefits.

Questions

In addition to the advantages and disadvantages of committing to the REDD+ scheme there remain a number of serious questions to be asked relating to eligibility of proposed activities in relation to processes as described under UNFCC, referring to our ability to commit to long-term engagement, linked to:

Permanence

Permanence relates to the long-term commitment and assurance that forests, thus carbon, will remain untouched and sustainably protected over a committed time period. Are we able to effectively protect the forests within a National Park, without any logging or extraction by local communities, without any cross-border encroachment, without any infrastructure development for economic high-value enterprises?

Leakage

Leakage means that a certain resource, for REDD+ meaning biomass/timber, safeguarded in a certain area, based on REDD+ commitments, will be extracted outside of the project areas. The net effect will be thus annihilated, as is the case for community members of a CF, who commit to the management plan of their CF, but collect timber, firewood and other NTFPs from outside of the CF. Assurances that this will not occur are not easy to make and have to be considered carefully.

Additionality

Additionality is the premise that a project that wants to be eligible for REDD+ status should not already be planned for, implying that the activity is new and brings additional benefits, above the BAU, business-as-usual scenario. This is difficult for Bhutan to achieve. With its Constitution, its conservation legacy and rich forest cover, it is difficult to prove that any activity will be additional. There is actually hardly any area available to add forest cover. Only the + or ++ of REDD, with inclusion of past conservation, proven SFM and enhancement of existing carbon stock, will open up projects to become eligible.

Governance

Although the overall governance framework was assessed to be favorable in the past chapter, one has to consider if long-term commitments can be assured and that benefit-sharing mechanism can be able to bring global funds, via a transparent financial and monitoring mechanism to local communities. Trials will have to prove that this can be done without serious constraints and that decentralized capacity is sufficient.

Overall balance of the CBA

- **The qualitative CBA** seems positive as the REDD+ would be a catalyst to build the knowledge base on the forest ecosystem, which is a necessity beyond the carbon market, and will serve many more objectives.
- **The quantitative CBA** is less certain, but if geared towards multiple benefits and linking the funds to the communities, tends to give a green light for REDD+, under the premise that piloting should prove the actual benefits.

6 Towards readiness: capacity and knowledge

Enabling REDD+ to be an effective mechanism for Bhutan a considerable amount of effort has to be put into capacity building to raise the knowledge level of forest ecosystems considerably. This Chapter looks into some of the key areas of interest and identifies some fundamental activities to be carried out.

Building a forest science base

In Chapter 2 it was discussed that a considerable effort is needed to build the science base of the Bhutanese forest ecosystem. Too little is known with adequate accuracy about the exact forest cover, the spread and properties of the different forest types and needed local details to asses carbon stock for the forest types of Bhutan, including carbon density, increment rates and below-ground biomass, including soil organic matter of the forest soils.

National Forest Inventory

The Forest resource Development Division, FRDD, is, amongst others, for the systematic inventory of the national forests. The existing inventory data are inadequate and outdated, but a new National Forest Inventory is being designed and will be implemented starting from 2012. It is intended to incorporate sufficient inventory data of above-ground and below-ground biomass and carbon meaurements and software is being designed, coupled with a GIS. The four year survey will take another 4 years to be completed with almost 3000 survey points spread over 20 Dzongkhags. This enormous undertaking will be essential to raise the science base of the forest of Bhutan, Not only regarding species, biodiversity, growing stock and other silvicultural properties, but also included will be proper estimates of carbon, following international guidelines and forest type mapping. The NFI points will be georeferenced, allowing for an easy GIS linkage and building of a system of permanent plots for frequent increment estimates. The present NFI schedule will require additional funding in addition to funds pledged by the Bhutan Trust Find (BTF). WWF has expressed interest to support the NFI, following a similar support in Nepal. Other donors are clearly welcomed for this crucial project. The NFI offers also a splendid opportunity to systematically build the national soil data base and enhance the compilation of a national soil map. Technical collaboration with NSSC is strongly recommended.

Carbon measurement: from global defaults to site specific forest type data

Chapter 3 discussed in some detail that our present understanding of carbon stocks and increment rates are very limited and generalized and mainly based on assumptions, interpolations and extrapolation, combined with global default values, as reflected in the FRAs of 2000, 2005 and 2010. Capacity building should be aimed at building local competence to measure and estimate biomass and carbon in accordance with globally accepted good practices, so that our understanding of the forest types allows for application of local values instead of global defaults. A recent SAARC training on forest carbon measurement and estimation with FRDD staff involved is a good example of focused training activities that will enable to bring the knowledge level to a more advanced stage. Additionally, specific scientific research would help to build understanding of specific forest types and forest properties. The Regional Forestry Research Center at Yusepang should have a clear role into dedicated research on SFM, looking into carbon measurements and characteristics of certain forest types, and watershed management. They are already involved with water accounting and recently also have initiated carbon measurements related to the CF of the Mongar PES pilot.

Quick and dirty

The nature of the NFI is such that it will take until 2016 for the inventory to be completed and most likely even longer before the information can be properly analyzed. It is absolutely necessary to have access to

better carbon data earlier, and therefore it is needed to initiate smaller scale projects to estimate carbon for the main forest types in different regions and elevations in Bhutan. A nested approach could be followed, even in the context of the NFI, so that the main forest types are already covered to some extent in an early phase of the actual inventory. It would also be necessary to carry out baseline surveys in potential pilot project areas. A recent development has been the use of LIDAR, an airborne radar system, that has been applied to estimate above-ground biomass and, with ground trothing, carbon. A trial has started in the Terrai of Nepal, to assess accuracy in mountainous terrain, which would be interesting to follow to assess applicability for Bhutan. Other Remote Sensing based analyses should be looked into, as they would offer quick options to assess forest properties and monitor changes over time, making use of sequential image interpretation.

IPCC Criteria and emerging global standards

In the context of the UNFCC Kyoto protocol mechanisms considerable effort has been put into developing globally accepted guidelines for measurement and determination of project eligibility. IPPC has developed criteria for eligibility, divided into 2 tiers of accuracy, from global and generalized, to local and exact. The criteria are:

Tier 1: global default values, highly generalized and maybe very different from actual on the ground situation
Tier 2: based on national-level inventories with typical values for forest types
Tier 3: site specific (a CF), measurements in permanent plots

Bhutan will have to work to advance from the present state of knowledge, barely sufficient to qualify for tier 1, to a more advanced state of data accuracy defined as tier 2 or even tier 3.

Compliance market and voluntary carbon market

The compliance market, and the whole industry of verification and auditing companies surrounding it, has come up with a wide variety of guidelines for projects to register and become eligible under the UNFCC mechanisms. For REDD+ some new standards are emerging related to MRV, but as long as the precise conditions of the compliance mechanism still have to determined, it is the voluntary carbon market that has started to pilot guidelines for pilot projects. The compliance market system is very much based on the experiences with CDM and JI under the Kyoto Protocol, but it remains to be seen how this market will develop over time and if it will be ever appropriate for the Bhutanese setting. Some of these emerging standards are:

- Voluntary Carbon Standard (VCS)
- Climate, Community and Biodiversity Standard (CCBS)
- Climate Action Reserve (CAR) - Forest Project Protocol
- American Carbon Registry (ACR) - Forest Carbon Project Standard
- VER+ Standard
- CarbonFix Standard
- Plan Vivo Standards
- SOCIALCARBON Standard
- Global Conservation Standard (GCS)

VCS and CCBS are appearing most frequently in literature and references and have the added benefit that they also look into co-benefits or multiple benefits such as community involvement and biodiversity. The Global Conservation standard provides incentives for forest conservation and protection of existing forest carbon stock and might therefore be a viable option for protected areas.

Partners for support

A number of potential partners for support to REDD+ in Bhutan have been identified during the stakeholder consultation process. These partners are thought to be able to offer guidance, advice and technical and

financial support to the key agencies in Bhutan that presently are mandated for climate change: NEC as national focal agency, responsible for compilation of climate change related data, national communication to UNFCC and key institution in international negotiation and developing action plans on adaptation and mitigation and vulnerability assessment, related to climate change, and the Watershed Management Division of the MoAF, as institution to look into watershed management development and REDD+ and PES opportunities.

SAARC

The SAARC Forestry Center in Taba, Thimphu, has initiated earlier work on forest carbon sequestration and is supporting REDD+ readiness activities, e.g. through a recent training course in Deradhun, India on forest carbon measurement and estimation for SAARC members. The SAARC Forestry Centre expressed interested to give focused support to capacity building activities and the sharing of experiences amongst regional SAARC members will be effective.

UNDP/UNEP/FAO: UNREDD programme

The tripartite union of UNDP, UNEP and FAO have established the UNREDD programme to enhance capacity of developing countries aspiring to start REDD projects. As Bhutan has become an observer nation, it should proactively try to seek the benefits of this multilateral platform to learn from evolving projects and experiences and to tap into capacity building support and other funding opportunities.

WWF/RSPN

WWF has a young climate change program and intends to replicate the support it gives the NFI in Nepal, together with Finnish ODA support, to the NFI in Bhutan. This would be geared towards capacity building and support form Nepali resource persons in carbon measurements. WWF has also actively supported the piloting of REDD within CFs in Nepal and would be interested to expand this into Bhutan. RSPN focuses in its projects on science-based knowledge development and has included climate change in its portfolio for some years now. A staff member was involved in the national delegation to COP16 and they have shown keen interest in REDD+ to launch in Bhutan.

SNV-WMD-FAO

The WMD is presently partnering with SNV on REDD+ development in Bhutan, initiating the first national REDD seminar in June 2010 and developing and actively supporting this present feasibility annex scoping study. FAO is supporting the WMD with the related PES piloting, building relevant knowledge on benefit-sharing and community linkage, monitoring and involvement. NEC, as the focal agency for UNFCC has the mandate for communication with UNFCC.

Helvetas/SDC

These Swiss ODA organisations are actively supporting social forestry development in Bhutan, through its support to the PFMP of SFD, and might be interested in additional support to REDD development, especially if the present support period would be extended.

Other donors

Although other bilateral donors are in the process of terminating their support programs in Bhutan, their recent bilateral programs mostly have a climate change component, such as DANIDA in its JSP. ADB and World Bank as multilateral donor agencies have also more pronounced climate change elements in their support programmes and should be considered for potential support.

EU

The EU intends to support Bhutan through the Global Climate Change Alliance (http://www.gcca.eu/).

Beyond the science and knowledge base: institutional readiness

Although the build-up of the forest science base will be pivotal to be able to comply to international requirements for potential funding, there are other aspects that need to be addressed to prepare for eventual REDD project roll out. The key institutions that will have to take a lead role in the initiation, monitoring, reporting and evaluation of Bhutanese REDD+ projects, namely WMD and NEC, will need to boost their capacity to be able to carry out these additional asks. Apart from the technical knowledge that will need to be built, it might require additional staffing, especially for WMD, as the development of new projects for REDD+, and the related technical and policy working groups, will require substantial guidance and time. Therefore capacity building should be regarded in a broader context, wider than just building technical know-how, but critically assessing if there is adequate staffing available to be able to deliver.

7 Options for learning-by-doing

Trials to assess in more detail if REDD+ projects are viable in Bhutan are thought to be essential to build experience and local capacity and offer the opportunity to assess with more conviction if the REDD+ mechanism fits the national conditions. This Chapter identifies 3 distinct pilot possibilities.

Pilot projects to learn-by-doing and build local experience with a local mechanism

Following "the proof of the pudding is in the eating" principle, it is essential to assess, plan and initiate a number of REDD+ pilot projects to assess how the mechanism could be applied to a typical Bhutanese context, to build local capacity and, ultimately, to build experience to come to more definite evaluation if REDD+ should be scaled-up in Bhutan and if the benefits are actual substantial and real. Pilots will also offer an opportunity to test institutional arrangements, consider governance issues and to trial benefits-sharing mechanisms to bring the global funding to community and household level. Pilots will also enable building relations with partners on the voluntary market to befit from their international experience and advice. The following pilots are suggested in random order:

Community Forests

CFs are thought to be a good trial platform as they already offer an organized and established community with a certified CF management plan and committee. CFs are rapidly growing in number, with now almost 300 CFs in Bhutan covering 32,200 ha reaching 13,000 households. Community involvement is guaranteed and the CFs are known for being rather conservative in their extraction from their CF stock, leading to good increment rates and related carbon stock enhancement. The CFs will be an easy pilot to ensure multiple benefits for local livelihoods, conservation and biodiversity. As the CFs are mostly relatively small in area it would be an option to aggregate a number of CFs in a Dzongkhag to reach more household and at the same time build a better economy of scales and learn from the set-up with geogs and Dzongkhags involved in the institutional set-up. Plan Vivo would be a possible partner/ standard, having applied the aggregation approach in different countries. Good lessons could be learned from CF trials going on in Nepal (ref. Karky and Skutsch, 2010 and Banskota, K., Karky, B.S, and Skutsch, M. (eds.), 2007).

A National Park

The conservation of forest carbon is explicitly named under REDD+ and as more than half of Bhutanese territory is under protected area status there is ample scope for trialing REDD+ in a National Park or other protected area. An option could be to pilot according to the Global Conservation Standard, with payments for the conservation of forests, not for annual increments. The REDD+ funding could be seen as a reward for prior conservation efforts and continued protection of large intact primary forest areas with high biodiversity value (Bhutan is among the top 10 biodiversity spots in the world). Revenues could be used for community support and park management enhancement.

Forest Management Units (FMUs)

The FMUs are the last trial option suggested. The FMUs are in principal designed to have a long-term sustainable management plan for 10 years, which can be extended. In practice however it has been observed, as discussed in Chapter 2, that implementation is often not sustainable as the AAC is regularly surpassed and the standing stock impoverished by uncontrolled rural timber allotment extraction and grazing damage, resulting in limited regeneration and leaving often insufficient stock to continue sustainable extraction and with clear forest opening and degradation as effect. There is thus good scope for improvement of forest management towards standards that were initially aimed at in the FMU plan, leading to SFM and better stock enhancement. Improvement of the management of the FMUs would also be instrumental in improving the present apparent imbalance between timber supply and demand in the long

run, although on a shorter term this might imply decrease of production volume and an increased imbalance between demand and supply of timber and fire wood.

Landscape and Market Approaches

The Bhutanese landscapes, with its mountainous watersheds, offer a good opportunity to follow a landscape approach, making use of the natural ecosystem boundaries and structure. In such an approach certain landscape elements as forests with a distinct function and management, as community forests, protected area forests or FMUs, are chosen as pilot areas, but seen as part of a larger system as upslope and downslope relations and upstream and downstream interactions reflect the nested setting of these landscape elements. The benefits of a chosen forest system are thus not only limited to the global carbon sequestration effect and potential climate mitigation, but have leverage through multiple benefits for the broader landscape and the communities making use of the natural resources it contains.

As the compliance market is still under development and might take considerable time before taking off, it is presently the voluntary market that offers the first opportunities to develop pilots to try out carbon benefits for Bhutanese forest systems. The voluntary market offers a relatively broad array of choices to test and trial and see in practice what suits best under the Bhutanese conditions. If eventually a national level compliance market would evolve, and if Bhutan would be eligible, the lessons from the voluntary market trials will be very valuable.

8 Key Findings and Recommendations

In this final Chapter 8 the key findings are wrapped up, followed by an overview of recommendations to improve the forest system knowledge base, build capacity and prepare for an institutional set-up that is able to gain experience with dedicated REDD+ trials in Bhutan.

Key Findings

- The present knowledge base on forest cover, forest degradation, carbon stock and carbon fluxes needs to be brought to a higher science-based level. The planned NFI will offer an immediate opportunity to build a nation-wide data base of forest typology and carbon stock. It should be combined with more rapid and focused research to establish carbon baselines for certain forest types, CF's, FMU's and protected areas. A nested approach could be used without the immediate need to cover the whole country and would imply to start with voluntary carbon standard projects.

- Trends in forest cover seem to indicate an environment in which most drivers of forest degradation and even deforestation are becoming less important. **Grazing pressure** is slowly reducing because of falling livestock population, cattle and yaks, linked to government policy to promote improved breeds and socio-economic changes within the pastoralist communities. More focus on dairy groups and stall feeding, together with improved pasture and fodder development are seen as positive for the regeneration capacity and resilience of the forest. The **tseri** ban has resulted in a marked drop in tsheri practice and a considerable area of tseri land will slowly turn into forest. No clear trend in **forest fires** is observed with an apparent cyclic and random frequency and area affected, ranging between 1,000 to 22,000 ha yearly in the last decade. The likelihood of more frequent climate extremes would lead to higher risk of forest fires and requires a close monitoring and prevention strategy. **Fallowing** of agricultural land is clearly on the rise due to a complex of factors linked to livelihood strategies, off-farm employment opportunities, rural-urban migration, wildlife pressure, labour shortages and irrigation problems. More fallow land ultimately will be favourable for forest cover.

- Trends in the main drivers of forest degradation seem overall rather favourable, as most of these drivers of forest cover change and forest quality change have reduced over recent time, except for timber and firewood extraction. These both show an imbalance in the supply/demand balance, leading to unsustainable management and forest degradation, and with the supply side having only limited growth potential to match an increasing market demand, this imbalance is threatening to become more explicit and having further negative impact on forest cover and forest quality.

- New approaches should be considered for rapid carbon estimates, as LIDAR, which would be very suited for the Bhutanese terrain, although on-going trials in the Nepalese Terai have to be evaluated if they indeed are suited for more mountainous terrain conditions.

- Linking with and learning from regional experiences as in Nepal and through SAARC are thought to be strategic and critical to gain relevant exposure and raise our technical confidence.

- An approach aimed at multiple benefits, combining carbon sequestration with clear benefits for biodiversity, livelihoods and communities, is most apt for the Bhutanese conditions, and is enabled by a very conducive policy, legal and historic setting.

- Benefit-sharing mechanisms, bringing global funds down to the community, are essential for real ground-level impact.

- The qualitative CBA seems positive as the REDD+ would be a catalyst to build the knowledge base on the forest ecosystem.

- The quantitative CBA is less certain, but if geared towards multiple benefits and linking the funds to the communities, tends to give a green light for REDD+, under the premise that piloting should prove the actual benefits.

- Although the precise funding mechanisms for REDD+ are still uncertain after COP16, it will offer Bhutan a means to be credited for its past and ongoing efforts in conservation and sustainable forest management. The limited forest area of the country however, and the therefore relatively small carbon stock and fluxes will only enable limited global funds to reach Bhutan.

- The costs to become eligible though a targeted effort, with considerable time, staff and money needed, will be considerable. The experience of the related CDM process for hydropower projects in Bhutan to register, become eligible, set a baseline and be verified and validated learns an important lesson that credits do not come at no cost. A quantitative cost-benefit analysis should incorporate the real costs to be made to get any benefits. The net initial benefit might be limited, but the broader gain in enhanced knowledge of our forest ecosystem and multiple benefits to be gained from are thought to give a net positive balance.

- As concluded after the first REDD+ seminar in June, a National REDD Advisory Committee and a Technical REDD Working Group should be set-up to guide the REDD readiness process. These bodies will develop a National REDD Strategy, setting out the intention and possible pathways over time and formulate a REDD Policy. The groups will have the responsibility to give technical and policy guidance to the Bhutanese negotiators to the COPs and the representation in the UN-REDD Framework.

Recommendations

It is recommended to:

- Build our scientific knowledge base on forest carbon stock and flows, through forest type mapping, focused forest type research and the roll out of a detailed and nationwide NFI.

- Enhance our capacity to have a detailed inventory and capacity to apply internationally accepted guidelines for carbon measurement following agreed eligibility criteria, moving from global default values towards forest type specific properties, and ultimately, permanent plots. The upcoming NFI should be designed in such a manner that appropriate biomass and carbon measurements are carried out in line with international guidelines, so that per forest type distinct biomass and carbon properties can be assessed.

- Create a REDD+ Technical Working Group and Policy Committee and start development of REDD+ National Strategy and, and if needed, a policy and guidelines.

- Start pilot project identification and preparation including selection of specific CFs, FMUs and NP's, Dzongkags and geographic location to have a representative selection of the Bhutanese landscapes and forest types and to identify potential partners and modalities.

- Feed the decision makers with accurate technical information and advice through the REDD working group and/or policy group- It is crucial here that WMD staff and forest officials are involved to brief and advice policy makers and international negotiators.

- Seek international HFLD REDD+ alliances; take actively part in the international climate change debate and present Bhutan as a country for piloting REDD+

- Learn from / engage in SAARC or regional REDD+ pilots (CF/WWF/NFI etc.) as being developed in India (NFI), Nepal (WWF-NFI-CF) and Bangladesh (Sundurbans).

- Learn-by-doing by trialing/piloting REDD+ projects in CF / NP FMU and/or at a landscape level with emphasis on expanding knowledge base and linkage with multiple benefits and benefit sharing to local communities, allowing for testing governance systems at ground level and benefit sharing mechanism to bring carbon cash to the communities, which should be the ultimate objective. The voluntary carbon market will be the first modality to follow to trial and start piloting different projects, in anticipation of formalization of a new global commitment period Post-Kyoto.

- Ensure earmarking of any carbon $ as green/forestry/community $ and let the money thus be used and reserved for these specific destinations and not to be absorbed by the treasurer for the national budget. Accordingly, it would be recommendable to use standards that recognize communities, biodiversity conservation and look for multiple landscape and community benefits.

- Initiate a resource mapping of biofuel for Bhutan by DoFPS and DoE, as an improved understanding and eventual improved use of biofuels in Bhutan would be able to make use of the waste products of timber processing, reduce the dependency on fossil fuels and enhance fuel efficiency to reduce forest pressure.

- Initiate studies on forest soil carbon as vital part of the carbon pool. Although this is already partly covered in the newly designed NFI methodology, underground biomass is not yet incorporated and represents a clear knowledge gap to be filled.

- Consider policy development to tackle emerging firewood and timber supply / demand clash as this is main driver of forest degradation by unsustainable extraction and one of the main concerns to ensure permanence of carbon stock

- Critically assess the 1% hydropower 1% plough back funds as additional funding mechanism for in-country NFI, scaling-up and upstart cost coverage support, together with broader, landscape-scale, watershed management forestry and sustainable agriculture practices.

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Annex 1: Overview of key information of the 20 FMUs as of July 2010

Information on Existing FMUs - location, area, gross vol ha^{-1}, AAC etc. (Operating as on July 2010)																	
Sl. #	Name of units	Dzong-khag	Total FMU area (ha)	Forested area (ha)	Forest area cover (%)	Avg.Gross Vol ha^{-1} (m3)			Annual Allowable Cut (AAC) - m3				Plan Period	Forest Type	Annual Incre-ment (in m3/ha)	Gross oper-able area (ha)	Net Operable area (ha)
						Conifer	BL	Total	Commer-cial	Rural	Rural cum Comm.& other Users	Total					
1	Dawathang	Bumthang	17,536.72	10,413.51	59.38	172.62	15.65	188.27	-	-	-	14,000.00	1/7/2000-30/6/2010	M/ Conifer		8,528.32	5,836.02
2	Karshong		4,715.77	2,000.00		316.74	12.55	329.29	3,535.00	1,500.00		5,035.00	Nov. 2009 - Oct.2019	M/ Conifer	2.57	1,940.00	1,554.00
3	Metapchhu	Chukha	10,761.85	9,710.99	90.24	-	146.15	146.15	3,316.00	375.00	440.00	4,131.00	1/5/2007-30/4/2017	H/ wood		4,995.15	3,624.00
4	Haa East	Haa	6,951.92	5,690.50	81.86	246.27	22.06	268.33	1,000.00	900.00	-	1,900.00	1/7/2004-30/6/2014	M/ Conifer		3,790.70	1,532.16
5	Lon Chhu		12,567.01	8,665.36	68.95				5,000.00	700.00	1,000.00	6,700.00	1/01/2010 - 31/12/2019	M/ Conifer	2.63	3,848.80	2,957.10
6	Sele La		9,157.00	8,066.72	88.72	350.98	-	350.98	8,886.00	3,000.00	-	11,886.00	1/1/2011-31/12/2020	M/ Conifer	2.22	5,017.50	3,828.60
7	Korila	Mongar	13,839.89	11,473.83	82.90	8.49	160.63	169.12	2,650.00	1,350.00	-	4,000.00	1/11/2006-31/10/2016	H/ wood		4,933.85	3,352.33
8	Lingmithang		10,578.60	4,581.60	43.31	179.40	322.71	502.11	7,000.00	2,000.00	-	9,000.00	1/2/2008-31/1/2018	M/C-H/W	0.38	4,636.30	3,854.68
9	Paro-Zonglela	Paro	16,150.00	12,319.10	76.28	147.18	21.53	168.71	To be decided	To be decided	To be decided	11,900.00	1/4/2002-31/3/2012	M/ Conifer	1.62	10,798.00	8,101.00
10	Bitekha		7,259.70	4,257.60	58.65	280.85	33.32	314.17	4,200.00	1,800.00	-	6,000.00	1/8/2006-31/7/2016	M/ Conifer	2.45	4,257.60	3,386.70
11	Chamgang-Helela	Thimphu	4,692.85	4,388.62	93.52	131.56	59.32	190.88	650.00	1,350.00	-	2,000.00	1/1/2003-31/12/2013	M/ Conifer		2,303.00	1,843.00
12	Gidakom		13,100.00	9,105.00	69.50	176.05	73.92	249.97	5,000.00	2,100.00	400.00	7,500.00	1/4/2002-31/3/2012	M/ Conifer	1.83	4,296.00	3,437.00
13	Dongdechu	Trashi yangtse	4,856.00	4,771.00	98.25	173.15	290.64	463.79	7,973.00	1,407.00	-	9,380.00	1/7/2001-30/6/2011			2,529.00	2,403.00
14	Chendebji	Trongsa	8,123.93	6,332.01	77.94	133.19	65.59	198.78	800.00	300.00	-	1,100.00	1/4/2007-31/3/2017	M/ Conifer	0.82	2,745.70	2,284.44
15	Khotokha	Wangdue	9,407.48	8,500.96	90.36	236.04	87.44	323.48	7,500.00	1,900.00		9,400.00	1/11/2009-31/10/2019	M/ Conifer	1.41	–	–
16	Gogona		8,080.40	4,490.00	55.57	264.37	58.48	322.85	6,900.00	1,000.00	-	7,900.00	1/4/2005-31/3/2015	M/ Conifer	1.35	4,490.00	3,675.60
17	Nahi		7,645.00	5,311.18	69.47							10,000.00	1993 - 2002	M/C-H/W			
18	Wangdigang	Zhemgang	9,585.00	8,494.00	88.62	-	305.70	305.70	2,755.00	797.31	-	3,552.31	1/3/2005-28/2/2015	H/ wood		1,684.00	1,130.00
19	Rongmanchu	Lhuntse	6,401.00	5,667.00	88.53	67.47	300.18	367.65	3,965.00	612.00	-	4,577.00	1/7/2007-30/6/2017	H /wood		4,807.00	3,215.00
20	Khaling Kharungla	Trashi/ gang	7,265.40	6,281.94	86.46	13.87	310.64	324.51	1,697.00	1,009.00		2,708.00	1/11/2009-31/10/2019	H/ wood		920.17	795.46
TOTAL			**188,675.52**	**140,520.92**	**74.48**	**2,898.23**	**2,286.51**	**5,184.74**	**72,827.00**	**22,100.31**	**1,840.00**	**129,961.31**				**76,521.09**	**56,810.09**

Annex 2: Meetings with stakeholders for REDD+ feasibility study, Thimphu, December 7-16, 2010

1	**B.B. Chettri**	**Head Social Forestry Division**
2	**Dr. Dhital**	**Specialist, Forest Resource Development Division**
3	**Dr. Sonam Wangchuk**	**Nature Conservation Division**
4	**Karma Sonam**	**Planning and Policy Division/MoAF**
5	**MD**	**NRDCL**
6	**SAARC Forestry Center, Taba**	**Dr Sangay Wangchuk, Chador Tshering and Passang**
7	**Kinley Tshering**	**FRDD, Chief Forestry Officer**
8	**Karma Tshering**	**WMD, Chief Forest Officer**
9	**Dasho Karma Drukpa**	**Director of Forests, DOFPS**
10	**Karma Rapten**	**Unit Head UNDP Environment Program**
11	**Phurba Lhendup**	**WFF, Freshwater and Climate Change Program**
12	**Dr. Kinley Tenzin**	**Director, Yusepang RDC**
13	**Tshering Dorji**	**NSSC-SSU**
14	**Chencho Norbu**	**Director, Department of Agriculture**
15	**Sithar Dorji and Jigme angchuk**	**Department of Livestock, Deputy Chief Livestock**
16	**Dasho Chhewang Rinzin**	**MD, Druk Green Power Corporation-DHI**
17	**Kaspar Schmidt and KJ Themple**	**SFD-PFMP**
18	**Mewang Gyeltshen, Chief Engineer**	**Department of Energy, Renewable Energy Division**
19	**Dr. Lungten, Dr. Moktan,Chencho**	**CORRB**
20	**Lam Dorji**	**RSPN, Executive Director**
21	**Dasho Ugyen**	**Secretary, NEC**