Ready for REDD?

Taking Stock of Experience, Opportunities and Challenges in Nepal

Edited by:

Krishna P. Acharya, Resham B. Dangi, Devesh M. Tripathi, Bryan R. Bushley, Rishikesh R. Bhandary and Bhola Bhattarai

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List of Abbreviations

AFOLU	Agriculture, Forestry and other Land Use
AOSIS	Association of Small Island States
CDM	Clean Development Mechanism
CDM EB	Clean Development Mechanism Executive Board
CER	Certified Emissions Reduction
CFs	Community forests
CFUG	Community Forest User Group
COP	Conference of Parties
d.b.h.	Diameter at breast height
DoF	Department of Forests
EUA	European Union Allowances
FCPF	Forest Carbon Partnership Facility
ha	Hectare(s)
IPCC	Inter-Governmental Panel on Climate Change
LDC	Least Development Countries
LULUCF	Land Use, Land Use Change and Forestry
MFSC	Ministry of Forests and Soil Conservation
MVC	Most Vulnerable Countries
NAPA	National Adaptation Plan of Action
REDD	Reducing Emissions from Deforestation and Forest Degradation
RWG	REDD Working Group
tCER	Temporary Certified Emission Reduction
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Voluntary Carbon Standards

Preface

Forests play a key role in climate change as both sinks and sources of carbon dioxide. It has been estimated that deforestation and forest degradation contribute up to 20 percent of global emissions of carbon dioxide annually—more than the entire transportation sector—and that standing forests sequester about 20 percent of global carbon dioxide emissions. Moreover, forests are thought to provide a more cost-effective means of reducing global carbon dioxide emissions than other sectors. Thus, if incentives could be provided to curb the deforestation and forest degradation plaguing many tropical countries,then forests could have a net positive impact on carbon sequestration and thereby contribute substantially to mitigating climate change. This is exactly what REDD (Reducing Emissions from Deforestation and Forest Degradation), a new mechanism currently being negotiated under the United Nations Framework Convention on Climate Change (UNFCCC) climate talks, would do.

Forests are also inextricably linked to the livelihoods of people in Nepal and other developing countries. Thus, REDD offers the promise of not only mitigating climate change, but also of reducing the incidence of poverty, bolstering local livelihoods, and supporting other co-benefits like biodiversity conservation and ecosystem services. However, there are also many challenges to its effective implementation in Nepal. These include technical, ecological, social, institutional, political, and economic issues. As the country has been focusing on broad-based sustainable development, any REDD mechanism should be designed and implemented according to the principles of social, economic and ecological sustainability. By reviewing current experience, capacities, opportunities and challenges in the context of Nepal, this book aims to inform policy makers, practitioners, civil society representatives, and the general public about the potential and prerequisites for implementing REDD in a socially equitable, economically viable and ecologically beneficial manner.

Defining the shape of REDD

The ongoing climate negotiations are actively considering REDD as a means of mitigating global climate change by preserving and sequestering carbon in forests. This emerging mechanism would compensate developing countries, and their communities, for their forest conservation and regeneration efforts.

Considerable progress has been made on REDD negotiations in recent months and it seems increasingly plausible that a general consensus on a global policy framework for REDD may be reached by the end of the December 2009 Conference of Parties (COP-15) climate talks in Copenhagen, or at follow-up talks in 2010.

In Nepal, the government, donor agencies and some civil society organizations have embraced the promise of REDD, fast-tracking national policy development and instigating various piloting and awareness-raising activities in order to get "ready for REDD". They recognize that this emerging mechanism presents an opportunity for Nepal and its forest-dependent communities to reap significant benefits and to play an active role in climate change mitigation. In fact, REDD could acknowledge the important role that forests and the communities that protect them already play through carbon sequestration; and also provide incentives for both governments and local stakeholders to bolster their forest conservation efforts.

Nepal has also invested considerable energy in lobbying for the mechanism at the international level, and for the conceptual evolution from RED, to REDD, to REDD+(+). The specific shape or scope of REDD has strong implications for Nepal's ability to benefit from the new mechanism.

REDD+ refers to 'avoided deforestation' plus 'forest enhancement'. RED(D) was initially conceived an 'avoided deforestation' mechanism and was supported by countries with significant forest cover and high rates of deforestation (e.g. Brazil, Indonesia, Papua New Guinea). Globally, Nepal does not score particularly high on either of these criteria. However, Nepal is often touted as an international example of successful community-based forest management, especially in the Middle Hills region where deforestation has been steadily reduced over the past couple of decades. In many instances, the condition of these forests is being continually enhanced, thus contributing to a steady increase in carbon stocks. As a result, Nepal has lobbied for the inclusion of "forest enhancement" (i.e., REDD+) to make it more competitive in a global carbon-trading scheme. In the international arena, the meaning of "REDD+" is often expanded to include both forest enhancement and social and biodiversity co-benefits, in addition to avoiding deforestation and forest degradation.

REDD++ is a relatively new proposal advanced by some countries, with no clear international consensus yet on its viability or desirability. It would incorporate all emissions from different land uses and land use change,

including afforestation, grasslands and agricultural lands. It is unclear yet whether REDD++ would work to Nepal's advantage. However, the complexity of measuring, monitoring and recording carbon emissions and/or stocks in other types of land use would certainly pose additional technical and institutional challenges and increase transaction costs.

Experience, challenges and opportunities for REDD

Nepal has many attributes that are conducive to effective engagement with an international carbon trading mechanism like REDD. These include an extensive network of experienced local forest management institutions; a supportive legal and policy framework for the devolution of forest management; strong ongoing donor support for initiatives in the forestry sector; significant biophysical potential for reducing deforestation in the sub-tropical Terai (plains) region; continued forest enhancement in the Middle Hills region; growing experience and capacity in measuring and monitoring forest carbon stocks; and significant opportunities for reducing poverty and strengthening livelihood resilience, preserving biodiversity and critical ecosystem services, and promoting adaptation to climate change.

Despite these attributes and synergies, however, there are significant challenges and risks for effective engagement with REDD in Nepal. Key technical and ecological challenges include ensuring the permanence and additionality of carbon stocks, preventing leakage, and setting an appropriate historical baseline or reference scenario for assessing reductions in deforestation and forest degradation. Establishment of an effective system for monitoring, reporting and verifying (MRV) of carbon stocks could also prove difficult. Furthermore, a strong focus on carbon could present risks for preserving biodiversity;and ensuring the ecological integrity of forests would require additional transaction costs for REDD.

There are also profound social and institutional issues. Adopting a national institutional framework to ensure equity, efficiency and accountability in verifying and compensating for carbon gains could prove difficult given current governance issues in the forestry sector. It is critical to develop clear benefit-sharing and governance mechanisms that ensure the equitable distribution of carbon payments among all relevant stakeholders and within local communities. While much of the focus for REDD has been on community forests, equity issues also apply to other types of local forest management, such as leasehold forests, religious forests, collaborative forestry

and buffer zone community forests. Failure to include these in a national REDD program could heighten social and political tensions. REDD could also threaten the livelihoods of indigenous peoples, the poor, and other forest-dependent and marginalized communities who rely heavily on forests for their livelihoods, by diminishing their access to vital forest products for both subsistence and commercial uses.

Political, legal and economic barriers are also substantial. The government of Nepal is currently preoccupied with maintaining political stability and consensus, forging a federalist system, and writing a new constitution. Persistent political rivalries pose an ongoing challenge to effective governance in all sectors at the national and sub-national levels. Lack of coordination among government ministries for policy development also presents a challenge. Furthermore, while forest policies in Nepal are very supportive of community-based forest management in principle, tenuous tenure regimes and a lack of clear ownership rights remain an obstacle to the ability of communities to claim full benefits from their forest resources, including carbon. Last, but not least, Nepal's ability to benefit from a mechanism like REDD depends not only on its own technical, ecological, social, institutional, political and legal assets, but also on the final shape that REDD takes in the international negotiations, and its resulting competitiveness in a global carbon market vis-à-vis other countries with significant carbon stocks and/or deforestation rates, such as Brazil and Indonesia.

Lessons for future research and action

These challenges for implementing a REDD scheme in Nepal point to some opportunities and directions for future research and action.

This volume provides insights on the experience, challenges and opportunities for implementing REDD in Nepal. The chapters present evidence from empirical studies and analyses highlighting the experience and challenges of monitoring and measuring deforestation (Chapters 8 and 10), forest degradation and carbon stocks (Chapter 6); the implications of REDD for local livelihoods (Chapters 4 and 5) and associated costs an benefits (Chapter 2); the potential value of carbon and its ability to compete economically with other important uses of forests and to offset deforestation and forest degradation (Chapter 3); risks related to the resource rights and land tenure of local communities and indigenous peoples (Chapter 5); institutional considerations for ensuring the equitable sharing of benefits among actors at

all levels, and within local communities (Chapter 7); and the implications of international policy processes (Chapters 1 and 3), and global carbon markets and mechanisms(Chapter 9), for Nepal's ability to benefit from REDD.

Although these chapters reveal that there is already some experience and capacity for evaluating the technical, ecological and livelihood implications of REDD, there is also a need for more extensive and robust studies—especially for measuring forest degradation—and for more studies focused on institutional, governance, market and financing issues and implications in particular. For instance, the role of the private sector in REDD is scarcely mentioned in existing studies and policy dialogues. Furthermore, while much of the research and writing on REDD has focused on community forestry as the logical vehicle for REDD in Nepal (including many of the chapters in this volume), the focus needs to be expanded to include other areas. While community forestry is undeniably the hallmark of Nepal's forestry sector—and has been effective in slowing or reversing deforestation trends in some areas, especially in the Middle Hills—it covers only about one quarter of Nepal's forests. Thus, although community forestry may represent a comparative advantage for Nepal in terms of REDD, the remaining three quarters must also be included for a comprehensive, national-level program to succeed.

The studies also reveal that research has been limited in the Nepali context. Most of the technical studies that estimate carbon inventories have based their methodologies on other studies that were done in contexts quite different from Nepal. Though it is laudable that researchers have maintained methodological rigor, there is a need to have more Nepal-specific estimates that can inform policy. Developing local capacity and appropriate methodologies for measuring and valuing carbon are important stepping-stones to building a comprehensive system of payments for valuable ecosystem services that will provide not only climate change mitigation, but also lasting benefits for rural livelihoods, biodiversity and ecosystem services.

Even though there are substantial political challenges, the ongoing constitution-writing and climate policy formulation processes offer Nepal a major opportunity to build institutions that are efficient, yet flexible and adaptive. As regulatory and institutional processes must be able to react to the rapid developments of the REDD process, a review of the current government processes is needed. The REDD policy formulation and implementation process will test the ability of the government and the community forest user groups—together with other stakeholders—to devise

a fair, flexible and effective mechanism that is able to generate significant emissions reductions and distribute the associated benefits in an efficient and just manner.Moreover, while REDD does offer numerous potential benefits for Nepal's forest-dependent communities and forest conservation efforts, these benefits need to be carefully assessed in light of current capacities, international policy developments and global carbon markets.

This volume contains works covering various dimensions of REDD "readiness" and has also uncovered areas that need further research like Monitoring, Reporting and Verification (MRV). REDD is a very dynamic mechanism that features prominently on the agenda for COP 15. Thus we can expect some major policy developments to take place toward reducing emissions from deforestation and forest degradation.

A Nepali version of this volume will be subsequently released featuring updates after the Copenhagen Climate Talks. Through the publication of both an English and a Nepali version, we hope that we will be able to reach a broader audience in Nepal and beyond.

Chapter 1

REDD, REDD+ and Co-Benefits

- *Ugan Manandhar*[1]

Abstract

The largest terrestrial natural sinks of the world are now getting a great deal of recognition for their contribution to helping combat climate change. These sinks act as a huge source of GHG emissions and contribute nearly 30% of global emissions, out of which two thirds result from deforestation and forest degradation. This sector has not gained much recognition since the 1992 Rio Earth Summit, despite the fact that every year more than 13 million ha of forest area is lost, resulting in higher concentrations of CO2 in the atmosphere than those coming from other fossil fuels based transport sector.

The coming years before 2102 at the UNFCCC negotiations will see debates on REDD and REDD+ issues in both the post-Kyoto regime and the national frameworks relating to policies, co-benefits and benefit-sharing mechanisms. Forest ecosystems can help us combat climate change at a large scale and thus REDD/REDD+ strategies must be guided by high quality research, ground realities and the geo-political context of nations. This chapter focuses on REDD, REDD+ and co-benefits.

1.1 Introduction

REDD is primarily about reducing atmospheric carbon dioxide emissions as an element of a comprehensive approach mandated by the Bali Action Plan. The Bali Action Plan, a decision adopted at the Conference of Party meeting in Bali, Indonesia in December 2007 (COP 13), explicitly mentions the need to address REDD to mitigate GHGs:

Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries;

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and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries.

With recent developments, REDD+ has drawn more attention towards activities related to the conservation and sustainable management of forests and to enhancements of forest carbon stocks. The proposed mechanism started with:

- RED: Reducing emissions from deforestation, then moving to;
- REDD: Reducing emissions from deforestation and forest degradation, and finally;
- REDD+: Reducing emissions from deforestation and forest degradation, plus forest enhancement.

With the negotiations now focused on REDD+, this mechanism is expected to present new opportunities to help conserve natural forests at a global level. However, unless environmental safeguards are strongly enforced to achieve real emissions reductions, REDD+ could lead to the conversion of natural forests into plantations.

Deforestation and forest degradation are ongoing issues that are firmly entrenched in Nepal and around the world. Deforestation is not a result of irrationality, ignorance or stupidity as people receive, or expect to receive, real benefits from deforestation and unsustainable forest harvesting. Considering the size of the global carbon pool in forests, and its potential climatic effects on natural and anthropogenic emissions, the management of forest carbon must be an important element of any international agreement on climate change. Economists have argued that the conservation of tropical forests will be difficult, unless people who use these forests are compensated for the environmental services their forests provide to the world community (Pearce 1996). In this regard, the Kyoto Protocol has proven ineffective, due to the absence of a mechanism that compensates avoided deforestation and the lack of incentives to reduce carbon emissions through improved forest management.

Land use, land-use change and forestry (LULUCF) activities are a major source of carbon emissions and active contributors to global warming. The Intergovernmental Panel on Climate Change (IPCC) estimates that 1.6 billion tons of carbon are released into the atmosphere annually from land-use change. A major share of these emissions can be attributed directly to tropical

deforestation (Denman *etal.* 2007). This represents about one fifth of the current global carbon emissions, exceeding emissions from the fossil-fuel-intensive global transport sector.

Avoided deforestation was not accepted as an eligible Clean Development Mechanism (CDM) activity in the Marrakesh Accords. This is primarily because of the difficulty of addressing and estimating the extent of leakage. Additionality, and setting appropriate baselines were also seen as critical obstacles. Finally, the fear of avoided deforestation generating credits that would crowd the carbon market and discourage mitigation in other sectors also played a role in its exclusion (Aukland *et al*. 2003; Forner *et al*. 2006; de Jong *et al*. 2007; Skutsch *et al*. 2007).

In response to calls from a number of parties to revisit deforestation in the climate change agenda, in Montreal at the Eleventh Session of the Conference of the Parties (COP11), in December 2005, launched a two-year process to explore a mechanism for reducing emissions from deforestation in developing countries. This process has focused on documenting and exchanging relevant scientific, technical and methodological considerations and experiences, including policy approaches and positive incentives. The proposal for a post-2012 international agreement that includes avoided deforestation in non Annex-I countries is now undergoing public scrutiny.

Deforestation and forest degradation result from various causes, most of which originate outside of the forestry sector. Understanding these causes is crucial to identifying appropriate incentives to curb deforestation while also providing benefits to people whose livelihoods depend on forests. As mentioned above, the Bali Action Plan included “enhanced cooperation on policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries” (REDD). REDD has consequently been mainstreamed into negotiations for the post-Kyoto regime. In the current discourse, various options for the design of REDD are on the table. The World Bank launched a forest carbon fund for development of the REDD initiative called the Forest Carbon Partnership Facility (FCPF) at the COP 13. Nepal, along with 37 other countries, has been selected to participate in the FCPF mechanism, through which the facility will implement and evaluate performance-based pilot incentive programs. Besides theFCPF and the similar UN-REDD Programme, voluntary carbon markets are also likely to implement avoided deforestation projects under REDD.

The purpose of this chapter is to provide a partial answer to the question of how REDD and REDD+ can help support forest conservation, save protected areas and achieve co-benefits like poverty reduction and biodiversity conservation.

1.2 REDD+ and Conservation

Conservation, as used in the UNFCCC context, means actions to prevent land use activities that cause the conversion of forested lands into other uses, or the depletion of carbon stocks in ecosystems. Conservation is not only pertinent to countries with high rates of deforestation, but it is also important for countries with high forest cover and low deforestation rates.

Conservation can be achieved through the following measures:

- Establishing and managing protected areas and connectivity corridors
- Recognizing and supporting conservation actions by forest dependent communities including indigenous peoples and community-conserved areas
- Land stewardship agreements and conservation easements
- Payments for provision of the ecosystem services generated by protected ecosystems, including water supply and the provision of wildlife habitat, among others.

The debate on REDD+ is still ongoing in the climate change negotiations. The objectives and scope are yet to be defined for REDD+ in COP 15, as the intersessional meetings were not successful in doing so. Whether the proposed mechanism will have a broad mandate to include LULUCF or AFOLU is still being negotiated.

Conservation is being recognized by the REDD+ mechanism, but it should further provide adequate scope and impetus for the effectiveness of conservation efforts; underpinning that it is a necessary component of the relationship between biodiversity and climate change mitigation.

The attention of policy-makers and the public has now been attracted by the possibility of significant international transfers of funds under a post-Kyoto agreement to finance REDD+. This is one major attraction. The funds could come through either a specific fund-based mechanism under the UNFCCC

under the authority and guidance of COP, or a flexible mechanism combining a fund-basedand market-based approach developed through experiences and lessons learnt.The market could be a so-called "*sustaining financing mechanism*" in the long run. This ongoing debate asks policy-makers to carefully weigh the costs and benefits of having a national-level REDD+ program or a sub-national, project-based program. Policy makers also must consider the impact on indigenous and local peoples and design ways for community-based projects to benefit.

Estimates of the potential global value of REDD+ payments depend mainly on the underlying assumptions. Assuming a conservative carbon value of $10 per ton of carbon dioxide (CO2e), estimates include a net present value of $150 billion (Chomitz *et al*. 2007) and annual revenue of $2.3-12 billion (Ebeling 2006; El Lakany *et al*. 2007). But with more positive assumptions about the carbon price ($10-20/t CO2e) and deforestation reduction rates (20-50 per cent), estimates for annual REDD revenues are at $7-23 billion (El Lakany *et al*. 2007). Hence the REDD+ program could be a significant source of sustainable finance.

Forests provide a number of valuable goods and services to society. The fact that they can act as a sink and source for atmospheric carbon dioxide puts more weight to the fact that standing forests must be valued and conserved. However, high returns from alternative land uses,the lack of remuneration for forest ecosystem services, land grabs, as well as poor public policies and governance,presents a challenge for the protection of forest ecosystems and provides incentives for deforestation.

Policy-makers must understand the drivers of deforestation and degradation to formulate appropriate responses, and the general public must recognize the dual role of forests in mitigation and adaptation. The government must also play a supportive role in laying the groundwork for REDD+ implementation by addressing critical technical issues, such as the baseline year, additionality, permanence and leakage.

The Stern Review (2006) on the economics of climate change noted that REDD could be a cost-effective route to address climate change. The argument for inclusion of forests in a future climate agreement is twofold: forests are the largest source of emissions not included in the current Kyoto agreement, and the costs of reducing forest-related emissions compare favorably with the costs of reductions in other sectors.

1.3 REDD+ and Co-benefits: Awin-win scenario?

Yes, REDD+ could be a win-win.

REDD+ has been embraced by environmentalists, not only because of its potential to reduce deforestation in the tropics but also because of its strong biodiversity co benefits. However, a REDD+ system also bears the risk of negative social consequences, particularly for indigenous people. This section discusses the potential benefits and risks associated with REDD+.

Benefits

- *Climate* benefits: As natural sinks, forests reduce up to 20% of global emissions; they strengthen adaptive capacity of the ecosystems and aids adaptation.
- *Biodiversity* benefits: Could prevent the loss of habitat and strengthen biodiversity conservation outcomes.
- *Social* benefits: Can support traditional livelihoods and cultural values associated with forests; and build capacity for sustainable forest management.
- *Livelihood* benefits: Carbon revenues can substantially reduce the poverty incidence; Complementary activities like NTFP collection, sustainable timber harvesting, and eco-tourism could be carried out.
- *Miscellaneous ecosystem services benefits*: Rainfall regulation, water quality and regulation, soil conservation, reduced disease risk, reduced fire risk, maintenance of pollinator populations.

Risks

Social risks

- Loss of control of forests to governments
- Risk of elite capture of benefits
- Evictions/expropriations
- Unequal/abusive contracts
- Reduced access to land for cultivation
- Increase in food and other commodity prices
- Corruption, lack of accountability and transparency
- Potential social conflicts due to rearrangement of power and wealth

Environmental Risks

- Forests are only valued for their carbon stock value
- International leakage may occur if not all countries participate in REDD

Negotiators should remain cognizant of these associated risks and benefits, while designing the REDD+ mechanism.Maximizing benefits and reducing riskscould be achieved through:

- Including forest-dependent people in the design process of a REDD+ mechanism;
- Developing a stringent mechanism to include safeguards;
- Respecting customary and traditional tenure and use rights;
- Requiring free, prior, and informed consent from local and indigenous communities;
- Including 'pro-poor' provisions;
- Developing a market for REDD+ projects with exceptional social benefits

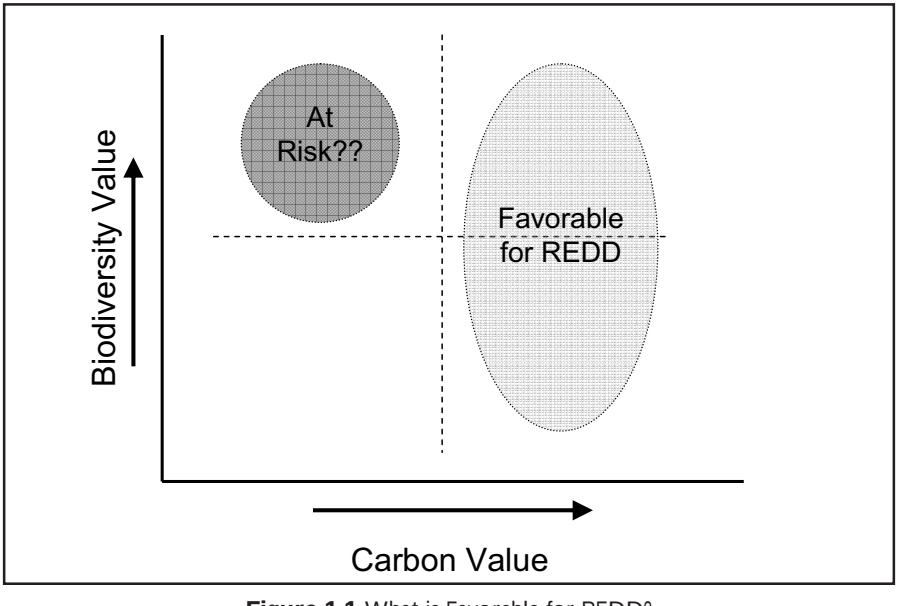

Figure 1.1 What is Favorable for REDD?

1.4 Recommendations for successful REDD+ implementation

Information dissemination at both the national and local levels is crucial for generating interest and participation in the REDD+ design process. As Nepal does not have many of the requirements of immediate REDD+ implementation, upfront financing must be made available. The World Bank has already taken a step forward in this regard through its FCPF program. Technical assistance is needed to gain an understanding of forest-related emissions in Nepal. By strengthening national and local institutions, Nepal will be in a stronger position to implement REDD. However, as this and other chapters argue, there are some institutional gaps that need to be addressed.

Nepal is one of the least developed countries (LDCs) and people depend on forests for a wide range of goods and services. Therefore, any REDD+ mechanism must be pro-poor. Furthermore, tenure and access rights need to be clarified so that potential conflicts are prevented. Broad-based participation in the design and implementation of REDD+ is needed to protect the rights of the people and for their overall support. This can be strengthened through a transparent and accountable process that regards equity as a fundamental pillar. As the REDD+ mechanism is still under negotiations, only pilot projects have been operating. Since we do not have complete information on the implications of providing incentives to reduce forest related emissions, we must maintain a high degree of flexibility in the REDD+ architecture. This flexibility can be maintained by periodically reviewing the mechanism and its impacts and using broad definitions for land-use types so that unanticipated areas can be incorporated if there is a need.

1.5 Conclusions

A REDD+ agreement will have ecosystem impacts with broad implications. Significant co-benefits can be achieved if proper safeguards are kept in place. Hence, REDD+ can play a strong role in not just mitigation, but also in adaptation, by increasing the resilience of ecosystems. As REDD+ is a new concept whose architecture is still being developed, new policies need to be introduced while old ones must be updated and brought in line with the new mechanism.. The government can play a major role in guiding the implementation and operation of a REDD+ mechanism. An effective, efficient and transparent governance structure should be created to ensure maximum benefits. This governance structure must be able to address the associated risks while ensuring that it is still an efficient mechanism for reducing carbon dioxide emissions.

Chapter 2

A Quick Review of Potential Benefits and Costs of REDD in Nepal

- *Resham B. Dangi*[2] *and Krishna P. Acharya*[3]

Abstract

The contribution of forests in removing carbon from the atmosphere and holding it in forest biomass is referred to as mitigation, while enhancing the resilience of people and ecosystems is referred to as adaptation. This indicates that forests are not just collections of carbon sticks. REDD (Reducing Emissions from Deforestation and Forest Degradation) has emerged as an incentive mechanism for developing countries to invest in forest management activities to abate emissions. The various costs involved may not allow all forests to be economically viable for REDD. This chapter attempts to assess the scope of REDD in Nepal based on the prevailing carbon stocks and the potential costs involved in the future.

2.1 Overview of forest carbon stocks

Reduced Emissions from Deforestation and Degradation of forests (REDD) is an emerging market-based approach under the United Nations Framework Convention on Climate Change (UNFCCC). It is estimated that the forestry sector is responsible for 17.4 percent of global GHG emission (Nabuurs *et al.* 2007). An oft-quoted estimated figure of emissions from deforestation globally in the 1990s is about 5.8 $GtCO_2$ per year (TERI 2008). The ongoing deforestation and forest degradation in the tropics has made a substantial contribution to increasesin GHG emissions from terrestrial ecosystems. By curbing this trend, we could substantially reduce future atmospheric levels of carbon dioxide.

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REDD can be an effective incentive for developing countries to invest in forest management activities to enhance the carbon sequestration potential of natural forests. Additional carbon sequestered in forests through specific management interventions can be sold in the carbon markets. Therefore, effective measures to reduce the current rate of deforestation and degradation are prerequisites to participation in a global carbon market. Since carbon credits are issued on the basis of carbon captured, this process bears no risk to the production potential of the forest or its health. Realizing this advantage, many developing countries have been involved in the REDD readiness process through different funding mechanisms. Nepal is one of the countries supported by the Forest Carbon Partnership Forestry (FCPF) program of the World Bank to enhance its readiness to participate in REDD.

Nepal is broadly divided into five physiographic regions. These include the low-lying Sub-tropical Terai (including the Siwalik hills), the middle mountains, high mountains, and the snow covered high Himalayas (LRMP 1986). The major land-use categories include forests, agriculture, grasslands and others. The area occupied by forested land (FAO 2002) is about 29 percent of the total national territory (DFRS 1999). The forest conditions, vegetation types, and production potential of forests are very heterogeneous both across and within the physiographic regions. Forests can be sub-divided into four broad categories based on the global ecological zones of the IPCC Guidelines(2006).

The average growing stock of Nepal varies from 81 to 172 m^3 Ha^{-1} (Amatya *et al*. 2002) and the average biomass growth is estimated to range from 0.59 to 2.34 MT d.m. per ha per year (WECS 2001). The average carbon in aboveground biomass is estimated to be around 76 metric tons per ha for Terai forests, 37 metric tons per hafor the Middle Mountains, and 57 metric tons per haasthe national average (Oli and Shrestha 2009). Since this estimate excludes soil carbon, the estimated total forest carbon stock needs to be properly adjusted. The default values given in the IPCC guidelines indicate that the highest biomass stock is intropical rainforests (300 metric tons d.m. per ha) and the lowest in Boreal woodlots (15 metric tons d.m. per ha). Comparing these global values of biomass stock to the national average is important to understand the scope of REDD in Nepal.

A recent pilot study done in western Terai has estimated the average forest carbon stock to be around 231 metric tons per ha. The carbon stocks in trees above ground, below ground and in soil organic carbon (SOC) have been

estimated to be about 68, 18, and 143 metric tons per ha,respectively (Gurung 2009). This clearly indicates that the share of SOC is almost 60 percent of the total forest carbon stock. This data is in line with other pilot study results like the WRI(1994) quoted in MoPE;the 2004 estimate of carbon stocks in the Annapurna Conservation area ofabout 77 tons per ha;and the 52.5 and 66.25 metric tons per ha for above ground biomass quoted by Baskota *et al*. (2006)and Rana(2006), respectively, in the community managed hill forests of Nepal.

Since Nepal has not yet developed a national emissions reference scenario or baseline for forest carbon stocks, the available data from pilot study reports have been taken as the source of basic information for a quick assessment of REDD's scope in Nepal. There is no doubt that all forests do have some potentialto sequester carbon from the atmosphere, but the sequestration capacity varies according to vegetation type and spatial location. Forests having either low carbon uptake capacity or high opportunity costs may not be economically viable for REDD. Therefore, this chapterattempts to critically review the potential benefits and costs of different forest types and concludes with policy recommendations for developing a national REDD strategy in Nepal.

2.2 Potential benefits of REDD

Carbon sequestration for climate change mitigation offers one example of a positive global externality (Kant and Berry 2005).Forests can fix and maintain carbon (mitigation) and contribute to enhancing the resilience of people and ecosystems (adaptation). In the last three decades, the world has realized that the "trees are not forests and forests are much more than trees" (Kant 2004).If we are to consider the potential risks of climate change in developing countries, we must also realize that a forest is not only a bundle of trees or carbon sticks; it is also one of the most cost-effective adaptation measures for forest-dependent rural communities.

Like many other developing countries, Nepal allocates a large share of her public funds to agricultural development and other social development sectors like health, education, and law enforcement. Adequate funds are not available for forestry development. Developing countries are under a high threat of deforestation and forest degradation, because of this underinvestment in forests. To reduce these threats, developing countries need to assess alternative funding sources. REDD could be a potential alternative source of revenue as

long as carbon accounting and monitoring processes are affordable and feasible.

Additional carbon sequestered in forests due to reductions in deforestation and forest degradation can be estimated with the help of remote sensing and GIS techniques. However, such estimation is complex for forest degradation due to two important reasons: lack of a common definition as to what degradation entails; and methodological issuesconcerning its monitoring and measurement.

Though REDD has only recently emerged as a new climate change policy option, it also enhances the potential of forests to deliver multiple benefits including, but not limited to, biodiversity conservation, improved resilience of ecosystems, environmental services, livelihood improvements, and good governance.Better management of forests will also contribute to reducing the risk of natural disastersandthe loss of life and physical property from forest fires. Therefore, the success of REDD will depend on the effectiveness of forest management interventions in curbing the current rate of deforestation and forest degradation.

It is also evident that the sustainable management of forests (SMF) could be instrumental in reducing carbon emissions, enhancing carbon sequestration, and increasing the supply of forest biomass.Since a well-managed forest helps to reduce soil erosion, improve watershed conditions, increase fresh water supply, and enhance the potential for provision of other essential ecosystem services, forests are vital safety nets for climate change adaptation. These functions illustrate that adaptation and mitigation are not only interlinked, but also mutually supportive.This indicates that REDD could be an option that is an additional bonus to SMF. However, it is difficult to estimated the benefits of REDD until the COP 15 decisions are unveiled in late December 2009.

2.3 Various costs associated with REDD

There are various types of costs described in the economics literature: three categories by Alexander *et al*. (2008) and Pagiola *et al.* (2009); and five categories by Boucher (2008). In this chapter, costs have been discussed under four categories based on their relevance to carbon emissions reductions and carbon removal enhancement.

(a) Opportunity Costs: This includes the foregone profits from replacing a forest production system by alternative land-use practices. In our case, the foregone revenue includes the potential of receiving revenue from other best alternative land-use practices including agriculture, settlements and animal husbandry. It is a general practice to compare the net present value (NPV) of two competing land uses, such as agriculture vs. forestry production, over a duration of 30-40 years. The net opportunity cost is estimated by subtracting the NPV of forests from the NPV of agriculture. Since carbon stocks are held in the forest biomass, the opportunity cost is divided by the quantity of carbon stocks. The value thus obtained gives the estimated payments required per tons of carbon sequestered in the forests to compensate for the opportunity cost of maintaining the forests instead of choosing the alternative land use systems. These costs comprise the largest portion of REDD-related costs.

(b) Implementation costs: These include costs involved in planning, land management, and forest management. The government also needs to prepare a REDD strategy and an institutional setup to promote readiness for REDD implementation. All expenses related to readiness and implementation are included under this expenditure. These costs make direct contributions in reducing emissions or enhancing removal of carbon from the atmosphere.

(c) Transaction Costs: This includes all costs involved in brokerage, verification, certification, insurance and reserves. Countries with large contiguous forests can supply large quantities of carbon to the market. Transaction costs will increase if forests are small, fragmented, and located in areas with difficult topography. Poor negotiation skills will also increase this cost. This expenditure does not directly contribute to carbon sequestration by the forests.Buyers will be more interested in big suppliers for two basic reasons—assurance and reasonable carbon price.

(d) Administrative Costs: This includes expenses for regulatory actions, forest patrolling, controlling leakage, and documentation. These costs directly contribute to emissions reductions and atmospheric carbon dioxide removal. This cost increases if property rights over forests and governance are poor.

2.4 Factors influencing the costs

Carbon sequestration costsare sensitive to changes in the following factors:

(a) **Forest management regime**: Intensive forest management requires a high level of investment. The implementation and administrative cost structure changes along with the intensity of management interventions. These costs are relatively low in community-managed forests compared to government-managed forests because of the high level of involvement of local people in community managed forests.

(b) **Incidence of forestproduct harvesting**: Short and repeated harvesting increases the cost of carbon sequestration. Forests located near villages are repeatedly used by local users to satisfy their needs. Consequently, forests located in difficult terrain, protected areas, and far from the settlements have limited or specific product harvesting and have low administrative costs as a result.

(c) **Forest types:** The rate of carbon sequestration is high for fast-growing tree species. The carbon sequestration cost will be lower in these species compared to slow-growing tree species. Therefore, lowland forests can sequester more carbon on average than the high mountain forests in a given time period. As the lowland forests have fast-growing tree species, the average cost of carbon sequestration is less than in higher altitude areas.

(d) **Change in relative prices offorest products**: If the market price of wood products suddenly increases, then the expected revenue from the sale of wood products can surpass the expected revenue from carbon trading. In this situation, the opportunity cost of carbon sequestration will go up.

(e) **Change in the relative prices ofagricultural commodities**: If there is a sudden price hike in agricultural products, then the expected revenue from the agriculture land use will exceed the revenue from forest land use. Hence, the opportunity cost and the administrative costs of REDD will substantially increase.

(f) **Discount rate**: An increase in the discount rate will increase the marginal cost of carbon sequestration.

2.5 Discussion

As Simula (2009) suggests,a program to reduce the impacts of deforestation and degradation on climate change would depend on accurate and precise estimates of emissions resulting from land-use changes and how these emissions change over time. Carbon credit buyers will expect the use of a robust methodology of carbon accounting and monitoring. Developing countries like Nepal, where the national forest inventory data and technical capacity are poor, and periodic accounting of changes in forest cover, biomass stocks, carbon emissions and carbon removals are limited, would require a substantial amount of investment. The current annual budget available to the forestry sector is inadequate to carry out these tasks.

There is a high level of deforestation in the lowland forests of the Terai and the Inner Terai, due to population expansion and economic development. Since these forests contain high-value commercial tree species, illicit felling, timber smuggling, and forest encroachment are common problems. The entire region is also well suited for agricultural production and is regarded as the food basket of the nation.

Infrastructure development, especially the construction of rural roads inside the forests, has substantially increased the rent value of land. There is great pressure on such lands to capture the additional land rent. Competition between the two production systems—forestry and agriculture—will continue in lowlands unless revenue from forest land use is sufficient enough to cover the rent made by the agricultural land-use system. If the current trend is not averted, forest degradation will continue due to the high rate of forest encroachment, forest fragmentation, and exploitation of the forest for wood products.If these forests are not properly managed, the potential of the forests to produce valuable timber will fall off in the future and there is great risk of converting these forests into their best alternative land uses. This may happen due to the trade-off between high opportunity costsof maintaining forestsvis-à-vis the high valueof land for agriculture, especially in light of Nepal's persistent food security problem.

Figure 2.1 can be used to support the above-mentioned interpretation. It is obvious from the figure that the various costs will have a substantial impacton profit margins from REDD. Since this figure is a general framework, a more specific one can be developed for different forest types based on physiographic regions, topography, road access, the extent of forests, stand structure, and forest health.

As we have argued earlier, degraded forest patches in the lowlands are under high risk of conversion into other land-use systems. Therefore, these forests need immediate restoration and rehabilitation activities. For this, a substantial amount of the public budget will be required in the future if these forests are to be managed under REDD. As illustrated in Figure 2.1, most of the lowland fragmented forests are represent by the area left of point C where profit from REDD will be just enough to cover the cost. Beyond point D there is no rent available from carbon trading. Hence, maintaining forests for REDD beyond this point is not profitable. However, big contiguous forest blocks of lowlands are represented by the area to the left of point B. These forests have potential for both REDD and for commercial purposes as they can produce high profit margins.

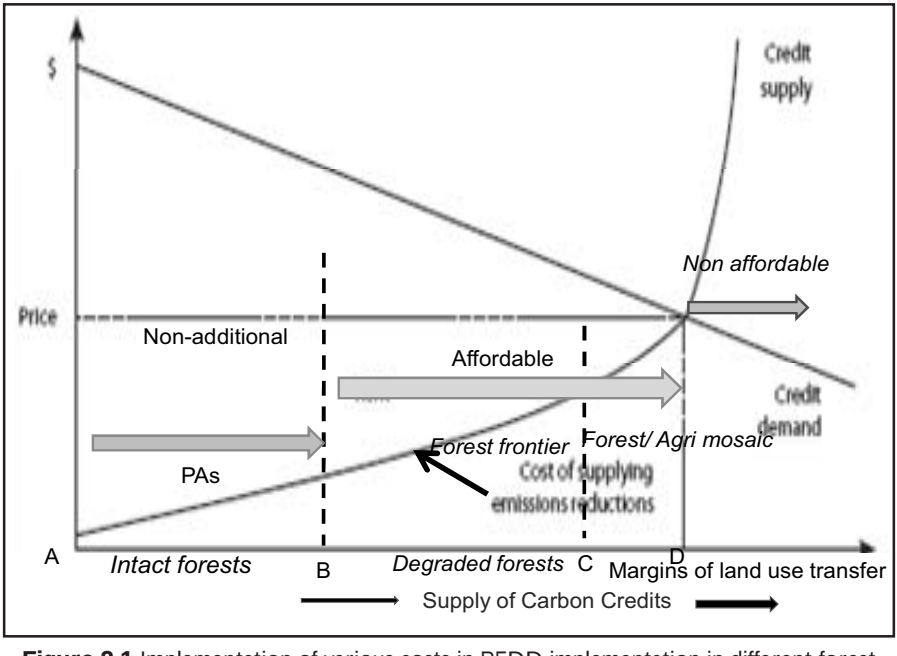

Figure 2.1 Implementation of various costs in REDD implementation in different forest types of Nepal *(Source: Lobowski 2008).*

Due to their difficult physiographic conditions, mountain forests are unreachable and are characterized by slow-growing tree species. Forests located on steeply sloped mountains are difficult to access and are not suitable for growing agricultural crops. The remoteness and low human pressures have allowed forest blocks to remain intact in the mountains. These forests are less vulnerable to deforestation due to their limited alternative uses. Since these forests are occupied by endemic flora and fauna species, they are also important

for biodiversity conservation. As a result of the limited land use options, the opportunity cost of REDD in the mountain region is low. However, carbon accounting and monitoring costs are high in these forests. In our above figure, these forests are represented by the area close to point B.

Middle hill forests are under heavy pressure tosatisfy local demand for forest products. Almost 70 percent of the forests in the mid-hills are under community forests (CF). Almost 20 percent of the CFs are smaller than 10 ha; 50 percent of the CFs are smaller than 50 ha; and almost 90 percent of the CFs are less than 200 ha in size. This clearly indicates that the transaction costsof REDD would be substantially high due to the many small CF units. The administrative and implementation costs, however, will be lower than in government-managed forests.

Furthermore, the opportunity costs would be lower than that of lowland forests' for two vital reasons. First, fertile forested lands have already been converted to agriculture lands and residual forest areas are not appropriate for commercial farming. Second, local users are involved in managing accessible forests for local use. REDD implementation in these forests is possible, but the available rent will be low due to high transaction costs. These forests are represented by the area between point B and C in Figure 5.1. Therefore, implementation of REDD on a small-scale could bear the potential risk of shifting the pressure for meeting local demands of forest products to the nearby forests,resulting in leakage.

As shown in Figure 2.1, forests representing the area between A and B will produce the maximum rent. This area includes forests from protected areas (PAs) and intact forest blocks outside the PAs in lowlands and PAs and intact forest blocks in the high mountains. Since PAs are not considered additional, these forests will only qualify for REDD if the COP-15 negotiations endorse the forest conservation through REDD+.

Nepal has made policy submissions in favor of a nested REDD approach. Initial learning from elsewhere indicates that the national approach will generate credits at low costs but equity issues might emerge due to weak governance. It is argued that a sub-national approach would be effective in cases where governance is weak, but transaction cost per unit of carbon credit will go up. As a result, a market-based REDD approach will offer less benefits to CFs. CFs could benefit more from a voluntary market under fair trade conditions. Using the voluntary market, however, still does not eliminate the

risk of elite capture among and across CFs due the differences in the level of knowledge, skills, capacity and governance.

From the above discussion, we can conclude that effective implementation of REDD will demand a robust carbon estimation and monitoring methodology. There is a need for up-front initial investments in national forest inventory and capacity building. If Nepal is committed to adopt tier 3 (earlier submission to SBSTA) for measurement, reporting and verification (MRV), a substantial amount of funds will be needed. If we critically assess the expected benefits from REDD,tier 2looks more appropriate for Nepal.

2.6 Conclusion

The majority of Nepal's population lives in rural areas and uses bio-fuel as the major source of household energy. By changing the current consumption patterns to more sustainable options, not only would we reduce the pressure on forests for fuelwood, but we would also reduce carbon dioxide emissions to the atmosphere. Countries like Nepal that depend primarily on forest-based energy sources need to enhance the productivity of the forests for sustainable supply of bio-energy. Appropriate silviculturalpractices must be adopted to enhance the growth of forests. Sustainable management of forests is also important to sustain the agricultural production system in Nepal. The low allocation of public funds tothe forestry sector has made the implementation of SFM projects difficult. The REDD mechanism has emerged as an opportunity to contribute to the integrated forest development of Nepal.

Poverty alleviation is one of the prime concerns. Resilience of vulnerable people and ecosystems should be improved to reduce the risks associated with climate change. Low carbon development (LCD) could be an alternative option to benefit local communities through creating more jobs in the green sectors and adopting climate-friendly and more efficient technologies. This can only be implemented through a set of national policies on carbon emissions and regulations on carbon intensive products.

In recent years, it has been observed that poor people living in rural areas have become very vulnerable to natural disasters. This is particularly so in the western region of the country where the incidence of both natural disasters and poverty are high. Because of these natural disasters, people are more dependent on forests for their survival. Our focus should be on improving the

productivity of forests and maintaining the resilience capacity of local ecosystems. The adoption of SMF will enhance both mitigation and adaptation efforts.

Though all forests have the potential to sequester carbon, the sequestration rates are different for different types of forests. The potentiality of forests to hold carbon is determined by the harvesting cycle and the removal scale. Forests managed for the supply of consumptive goods have frequent removal of forest biomass, thereby causing the amount of additional carbon sequestered over a time interval to be lower than that of forest with limited access for short harvesting periods.

Forests located in the high mountains have low potential leakage rates. This makes these forests attractive for REDD projects provided that transaction costs (MRV and brokerage) are low. Most of the accessible forests in the mid-hills are managed by communities. These forests are also suitable for REDD,as long as users form a group to deal with buyers in the voluntary market. The large tracts of intact forests in the lowlands are also suitable for REDD, but they require intensive management. The fragmented forests along the agricultural and settlement frontiers have high opportunity costs and are thus not efficient for REDD.This chapter has shown that there are many costs associated with REDD and it is advised to assess the REDD potential of different forests before developing a baseline and national system for Nepal.

Chapter 3

Implications for community forest policy under the proposed REDD policy

- Bhaskar S. Karky[4], Margaret Skutsch[5] and Kamal Banskota[6]

Abstract

Biological sequestration of CO_2 by community forests assists in reducing atmospheric CO_2. Nepal has been successful in implementing community forest management (CFM) in the Himalayan region. This has led the government to try to link community forestry with the emerging global carbon policy for the post-2012 period. To this end, Nepal is trying to prepare for a Reduced Emission from Deforestation and Degradation (REDD) policy with support from the World Bank's Forest Carbon Partnership Facility. However, adding value to existing CFM by managing carbon requires new national policies. The ownership of carbon from community forests is still unclear. There must be a single desk in the country that coordinates all carbon credits to reduce potential conflict among government ministries. With the country adopting a federalist structure, the existing rights of the forest user groups must be maintained. At the international level, REDD policy must be written so that it allows CFM to be included in national carbon trading regimes. In practice this means that REDD policy must award credits not just for reduced deforestation and reduced forest degradation, but also for forest enhancement. The proposed REDD policy must also devise a suitable baseline methodology that captures forest degradation and the diversity of forest conditions in Nepal.

3.1 Introduction

At the Conference of Parties to the UNFCCC to be held in Copenhagen in December 2009, a new treaty to mitigate climate change will be adopted to

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replace the Kyoto Protocol after it expires in December 2012. As agreed in the Bali Action Plan's Decision 2/CP13, the international community is now engaged in a debate to formulate a new framework for inclusion of the forestry sector, so that it may play a more profound role than it has under the Kyoto Protocol. There is a strong move now to find ways to reduce CO_2 emissions from terrestrial ecosystems by reducing deforestation and forest degradation rates in the tropics. This falls under a new proposed policy called Reduced Emission from Deforestation and Forest Degradation (REDD) in developing countries (Gullisom *et al.*2007: 985-986).

While discussions continue at the international level, the implications of this policy for people whose livelihoods are dependent on forest resources needs to be carefully considered. Many local communities in developing countries depend on forests for both subsistence and commercial products that directly support their livelihoods, and their activities may be threatened if national governments choose to protect forests for carbon credits by fencing them off and prohibiting access by local people. These communities have been engaged in managing and conserving forest resources to meet their subsistence needs. They will be affected by REDD if their national governments decide to participate in this policy. If carbon credits or other forms of payment are issued, questions will arise as to whether, and how, their past, present and future efforts to reduce deforestation and degradation will be rewarded.

Community forest management (CFM) could be a cost-effective way of reducing emissions under REDD (Skutsch *et al.* 2007). However, making such a mechanism work for the benefit of both the credit buyer (from the industrialised world) and community groups (from developing countries), who might be among the possible sellers, is a challenging task. In subsistence economies, community-managed forests typically provide a number of tangible benefits for communities. Policies such as REDD need to safeguard local community rights and interests in this regard. If they are ignored, communities may not be willing to participate in such international programmes, or they may end up losing out if the national governments decides to participate in REDD.

This paper focuses on the case of Nepal, which has had a long and relatively successful history of community forest management. It highlights the role that Nepal's CFM plays in climate stabilization, presenting data on how much carbon is saved by activities of the forest management groups (CFUGs), and analyses policies related to community forest and carbon trading. The objective

of the paper is to identify a number of potential difficulties that could emerge if CFM is to be rewarded for carbon under the REDD policy.

3.2 Policy on Reduced Emission from Deforestation and Degradation (REDD)

The REDD policy was originally conceived as an instrument to reward average reductions in rates of deforestation at national level (Santilli *et al*. 2005), but has developed into a broader mechanism that may also include curbing forest degradation and forest management activities of various types which result in enhanced forest stocks. In the discussions regarding formulation of the policy, the need for a social welfare dimension and respect for the rights of indigenous peoples has been recognized. Although the associated rewards system for carbon has not yet been fully worked out, there is a strong move towards a market-based system in which Certified Emission Reduction Credits (CERs) will be traded, in a similar way to credits under the Clean Development Mechanism of the Kyoto Protocol. As some countries have also been arguing for a fund based mechanism, it is possible that a hybrid system will be devised. Whether and how CFM will be recognized under REDD is not known at this stage. This probably will not be an issue that is decided by international parties to the UNFCCC but at the national level. Nevertheless, it is important that the potential role of CFM is fully recognized at UNFCCC level, and that the international policy is written in a manner that is conducive to its inclusion.

The World Bank is already providing support for REDD through the Forest Carbon Partnership Facility (FCPF) with a target funding of US$ 300 million to jump start REDD policy in developing countries. The fund provides grant support to prepare institutions and to build capacity for REDD related projects like establishing emission reference levels and monitoring systems and for adopting strategies to reduce deforestation. The FCPF may be regarded as a precursor and a stimulus to REDD in the same way that Activities Implemented Jointly (AIJ) operated prior to the first commitment period on an experimental phase before the Clean Development Mechanism was fully introduced.

Nepal participated in FCPF's call for submission of a Readiness- Project Idea Note (R-PIN) in early 2008. Largely based on Nepal's experience with CFM, the R-PIN was selected by the World Bank in July 2008 along with R-PINs from 13 other tropical countries. Thus, Nepal may be able to implement a prototype of REDD in the short term if its gets selected to participate in the

Carbon Finance Mechanism of the FCPF. If it does, it could be an opportunity for Nepal to gain experience and build capacity to operationalise a national REDD programme, involving community forest users in this experiment. The experience from FCPF may be valuable for the development of REDD policy under UNFCCC, and the case of Nepal will be useful for demonstrating the value of CFM in this regard and for illuminating any policy issues that may be involved.

3.3 Community forestry policy in Nepal

Although communities have managed forests in Nepal for as long as the area has been inhabited, CFM as a programme came into being in the 1980s as the government recognized that this was the best way to halt rampant degradation and deforestation. This process was shaped by the democratization process of the last thirty years in Nepali politics, and donor funding has stimulated a process of devolution in the forestry sector. For this reason, "the power to enact legislation, write manuals and shape the practice of forest management on the ground is more diffuse and less concentrated in Nepal's forest administration…." (Blaikie and Springate-Baginski 2007:8).

Nepal is in fact a leading country in institutionalizing the concept of CFM in national forest policy, with about 35% of the total population of the country managing around 1.1 m ha or 25% of the national forest (Kanel 2004). This decentralized policy is based on grassroots-level forest management institutions called Community Forest User Groups (CFUGs), which are the hallmark of Nepal's community forestry policy. These CFUGs have joined together to form the National Federation of Forest Users Nepal (FECOFUN). FECOFUN advocates for community forestry user grouprights, locally, nationally, regionally and internationally, and is an autonomous, non-partisan, socially inclusive, non-profit organization, as well as Nepal's largest civil society organization with more than 14,000 CFUGs as members (FECOFUN 2008).

However, despite the success of CFM in the Nepal, at the national level, deforestation and forest degradation continue. Based on the FAO Country Report (2005: 10) data, Nepal has an annual deforestation rate of -1.63% from 1990 to 2005 which is higher than for most other countries. Between the same period, shrubland also increased by 4.05% annually, indicating a conversion of forested land into degraded forests. This clearly calls for CFM to expand into areas that are being degraded and REDD may have an important

role to play in this regard. However, to date, the carbon impacts of CFM have not been measured. In a research project carried out in three sites, the growth of forest biomass under community management was monitored over a period of four years. The results of this study are presented below.

3.4 Carbon impacts of community forest management

The measurements at the three sites show that, from a climate change perspective, community forestry results in avoided deforestation, avoided forest degradation and enhanced biomass growth. Using IPCC (2003) methodology, field survey data on biomass change over four years at three different sites in the mid- and high hills of the Himalayan region (Table 3.1) shows that the mean carbon pool size of a community managed forest (excluding litter and herbs, shrubs) is 504.31 tCO_2 per ha including soil organic carbon (SOC) up to 1m depth. Before being brought under CFM, these forests were losing biomass. The forest is now maintained by CFUGs by deploying strict protective measures, mostly in the form of restricting the rate of harvesting of firewood and fodder to sustainable levels. In addition to halting deforestation and degradation, these management strategies result in increased growth of biomass. The annual mean increment rate for carbon sequestration was found to be 7.04 tCO_2 per hectare per year excluding SOC.

Table 3.1 Average CO_2 pool size and yearly incremental growth rate in 3 community managed forests in Nepal over a three-year period.

Biomass Category	Carbon Pools	Mean Carbon Pool Size (tCO_2 per ha)	Mean Annual Increment (tCO_2 per ha)
Above Ground	Tree Biomass	157.89	6.23
	Herbs, Shrubs, Grass	NA	NA
	Litter	NA	NA
Below Ground	Tree Biomass (root system)	19.73	0.81
	Soil Organic Carbon (to 1 m)	326.7	NA
Total		504.31	7.04

Source: Karky 2008

These figures provide an indication that CFM is an effective instrument in both reducing emissions and increasing carbon sinks in Nepal. The questions that arise from these findings are as follows:

- Should communities whose forest management efforts result in annual increases in carbon stocks be rewarded for this?
- Would payments to communities for carbon-stock increases encourage these communities to manage their forests even more carefully to increase the stocks even more, and would it encourage more communities to participate in CFM?

To answer these questions it is first necessary to address some policy issues related to community forestry in general.

3.5 National-level policy issues

Overlapping rights over forest products at national level

Ownership of forest carbon is not clear. The Forest Act 1993 is a major legal instrument that devolved responsibility for forest management to the local level. The Forest Act 1993 acknowledged the CFUGs for the first time and gave them usufruct rights, while the state maintained the ownership of forest land. A further improvement was made to this act by the Forest Regulation 1995 which stated that CFUGs could have their own wood-based industry once they crossed the sustained-yield threshold. This permits them to sell any surplus. The Forest Act 1993 guarantees non-interference from the government forest office in the operation of the CFUG and in the management of the community forest as long as the CFUG complies with the Forest Act and the Regulation and follows the CFUG's Operational Plan (Bhatia 1999: 12).
However, in the Forest Act, there are some grey areas where the rights over forest products overlap with other Acts as shown in Table 9.2. With the new prospect of carbon trading, rights and ownership are even more ambiguous.
In the prevailing forestry practice, and as guaranteed by the Forest Act 1993, CFUGs have usufruct rights over forest resources as well as the responsibility for forest management and conservation, through the District Forest Office. However, as shown in Table 2, there are areas where this contradicts with other Acts, which could result in disputed ownership if carbon trading is introduced.

Table 3.2 Overlapping rights regarding forest products in Nepal

Forest Products	Forest Act 1993	Local Self-Governance Act 1998	Nepal Mines Act 1966	Water Resources Act 1992	CDM Policy for Nepal (A/R)	R-PIN (FCPF)
Fuelwood, dried timber, twigs, branches, bushes	User Group	VDC				
Herbs, NTFPs	User Group	DDC				
Mines (stone, sand, soil, natural elements)	User Group	VDC and DDC	Gov't of Nepal			
Prohibited herbs	Gov't of Nepal					
Resin	User Group, Gov't of Nepal					
Drift wood (in rivers)	User Group	DDC				
Straw, grass	User Group	VDC				
Water resources	User Group	VDC, DDC	Gov't of Nepal	Gov't of Nepal		
Natural heritage	User Group					
Carbon credits					Gov't of Nepal: MOE (UNFCCC-DNA)	Gov't of Nepal: MOFSC (REDD Cell)

Source: Belbase and Regmi 2002

The lowest administrative unit in Nepal is called the Village Development Committee (VDC). Above it is the District Development Committee (DDC) as the apex of local government; there are 75 DDCs in the country.

The Local Self Governance Act (LSGA) 1998 under Section 58(d) and (e) gives the VDC the right to sell forest resources to generate income from the VDC area. The LSGA 1998 in Section 68 1(c) and (d) further stipulates that natural heritage including forests and forest resources falling within the VDC area are the property of the VDC. Belbase and Regmi (2002:14) claim that "it is unclear if community forests would also be considered as VDC property, as the legislation appears to imply (by explicitly stipulating that the VDC has full rights over the forest granted by the prevailing forest laws and government of Nepal)".

In the matter of ownership over mined products (e.g., material found in the forest area such as quarried stone, sand, soil, and most other natural elements with the exception of oil), the Forest Act 1993 gives ownership to CFUGs, while the LSGA 1998 gives ownership to the VDC and DDC, and the Nepal Mines Act 1966 gives ownership rights to the government of Nepal. Similarly, regarding water resources in the community forest area, the Water Resources Act 1992 assigns ownership to the government of Nepal.

Carbon trading is in its infancy and there is a lack of clear policies governing it. The Designated National Authority (DNA) of the UNFCCC is the agency that provides oversight to make sure that carbon trading projects meet the sustainable development requirement. This authority extends to the coverage area of CDM and includes afforestation and reforestation projects. However, under the World Bank's Forest Carbon Partnership Facility (FCPF), forest projects fall under the Ministry of Forests and Soil Conservation. This shows the need for inter ministerial coordination for institutional readiness to facilitate forest carbon finance.

The ownership rights of CFUGs have not been delineated in either the DNA's scope of work or the Ministry of Forests and Soil Conservation's projects. The Operational Plans of CFUGs have not yet included carbon management in their programmes. This means that at the community level, the ownership of carbon is not clear. It is not yet known whether and how the UNFCCC REDD policy will recognize the ownership of forest carbon at local levels, although this will probably be regarded as a matter for national governments to decide. How the government will recognize carbon ownership claims from community managed forests is therefore a key issue to be negotiated internally that can be guided through the future forest carbon finance mechanism.

Overlapping rights over coordinating carbon trade

One of the major obstacles is the lack of an appropriate institution to coordinate CFM and carbon trading. In order to coordinate with the CDM market, the government of Nepal made the Ministry of Environment (MOE) responsible to function as the Designated National Authority to the UNFCCC in December 2005. All CDM projects and matters related to the global climate treaty are coordinated by the DNA through the MOE. The DNA has an 11-member steering committee to ensure inter-sectoral coordination and to provide guidance on CDM matters. There is one member from the Ministry of Forest and Soil Conservation (MOFSC) represented in the steering committee of the DNA.

A fundamental problem with this is that the DNA in Nepal was formed with the sole objective to coordinate CDM projects with the UNFCCC. UNFCCC REDD is however outside this mandate.

Furthermore, in Nepal CFM falls under the MOFSC while expertise on the UNFCCC climate treaty and GHG inventory lie with the MOE and the DNA. Forestry related expertise and specifically CFM related data and regulations are monitored by the Community Forest Department of the MOFSC. Only the DNA officials attend the UNFCCC related SBSTA and COP meetings. Consequently, when Nepal made two submissions on REDD to the SBSTA in February 2007 and March 2008 relating to Nepal's views on community forest and climate policy, they were made by DNA through the MOE.

The UNFCCC focal point is MOEwhile the World Bank collaborates with the MOFSC for the R-PIN. In future, when and if REDD deals with national-level baselines and a national-level payment system, there could be conflicting interests between the MOE and MOFSC over control and monitoring of carbon trading in the forestry sector.

Federal structure

Nepal became the newest republic in the world by declaring itself a Federal Democratic Republic in May 2008, and is now in the process of writing a new constitution. Some argue that the new constitution will pave the way for more decentralized policies giving more regional autonomy. Considering that the proposed REDD policy will be implemented at national level, with payments made centrally, attention needs to be given to how these will be distributed among regions, given the differences in forest ecology between different regions. It needs to be seen on what basis Nepal will be divided i.e.

geographical, social and/or ethical factors and then how REDD resources will be allocated between such federated states. The political ecology of forest management under a federated structure will influence its compatibility with REDD global carbon policies. FECOFUN has already voiced its concern that when Nepal is divided into federated states, the existing CFUGs and their rights should not be taken by the state governments. Establishing the rights of the CFUGs and their political relationship with the state governments is important in shaping the future of CFM, especially when there is value addition in forest resources through carbon revenue.

3.6 International-level policy issues

At the global level, there are two main policy uncertainties that need to be addressed if community forest management is to participate in REDD. The two issues are related to methodology and uncertainty in carbon accounting methods and baselines as discussed below.

Uncertain carbon accounting criteria

Under REDD, the way in which carbon is accounted will be a key criterion that will determine whether community forest users will be able to participate in REDD or not. The COP 13 decision on REDD (2/CP13) has explicitly mentioned addressing emissions from deforestation and degradation, but it is not yet clear if forest enhancement will also be rewarded.

CFM contributes to reducing emissions from activities taken to 1) avoid deforestation, 2) avoid forest degradation (reduce removal of woody biomass) and from 3) enhancement of biomass by implementing protective measures. For Nepal, of these three, forest enhancement – increasing the stock and the sink in managed forests – is the most important in terms of carbon preserved in community managed forests.

If communities are to earn financial rewards, those from avoided deforestation and avoided degradation would be small in comparison to those from enhanced forest biomass. Furthermore, avoiding deforestation is easy to account for as it can be measured in area terms. Forest biomass enhancement is accounted by recording the incremental biomass based on the IPCC Good Practice Guideline (IPCC 2003). But measuring degradation is more complicated as forest degradation refers to unsustainable removal of woody biomass by local communities for meeting their sustenance needs without decreasing the forest

area. So, to claim what is saved by reducing degradation requires a special carbon accounting method that considers historical harvesting rates and compares these to harvesting rates under current management practices. The UNFCCC has not yet come up with a definition for forest degradation, much less with a methodology to measure it.

Uncertain baseline construction

In addition to the issue of appropriate carbon accounting methods, the question of baselines is uncertain under REDD. A national reference scenario (baseline) has been proposed that could be operationalised within the country, with smaller baselines at regional levels that add up to the national baseline. How the baselines will be determined for deforestation and degradation and how these will be combined are major concerns that REDD policy needs to address. What is clear is that credits will be allocated to each country solely on the basis of its overall achievements, taking into account both gains and losses compared to the national reference scenario.

Deforestation and forest degradation reference scenarios will have to be established using two different methodologies because of the inherent differences in these activities and in the data required and available. A deforestation reference scenario can be based on remotely sensed imagery over a historical period that shows changes in the area covered by forests, and using statistical (secondary) data on carbon stock in different types of forests to calculate the change in terms of tons of carbon. The reference scenario may be projected into the future either by using very simple assumptions (linear continuation of past patterns) or more sophisticated approaches (relating the past changes to particular drivers, and using predictions of these drivers to forecast forest areas likely to be lost in the future under 'business-as-usual' conditions). The technical problems involved in establishing deforestation reference scenarios can be solved relatively easily, as the methodology for accounting for deforestation can follow Chapter 3 of the IPCC Good Practice Guideline (IPCC 2003).

The forest degradation reference scenario, on the other hand, is much more difficult to establish because most degradation cannot be detected from remotely sensed imagery. There is no current or historical record of the spatial pattern of forest degradation (which areas are being degraded and the amount of biomass lost) because of lack of forest inventory data in most developing countries. Furthermore, the Good Practice Guideline 2003 (IPCC 2003) provides no clear recommendations for methodology for assessing and quantifying forest degradation rates.

3.7 Conclusion

Nepal has very high rates of deforestation and degradation denoting its potential to qualify for REDD. The CFM sector has contributed to the sustainable management of forests in about 1.1 m ha or around 25% of the total national forest area. Without the CFM policy, deforestation and degradation probably would have been much higher. So CFM policy could be the entry point for REDD, contributing to the expansion of sustainable forest management practices in areas with high deforestation and degradation rates. From this analysis, it is now clear that there must be changes made at different levels to allow the mechanisms of the emerging climate treaty to work together with CFM. First, ownership of carbon from community managed forests must be spelt out clearly in national legislation and these rules must not contradict with other Acts. Carbon management and ownership must also be included in each CFUG's Operational Plan. Secondly, there must be a single desk that will coordinate credits for CDM AR, the World Bank's R-PIN and the proposed UNFCCC REDD programme, thereby eliminating conflicts of interest between agencies. Thirdly, the existing rights of the community forestry sector should be maintained and further strengthened in the new federal structure of the country, as this is necessary to create a conducive environment to implement REDD within the country.

At the international policy level, REDD must be written in such a way that CFM can be included at the national level. In practice, this means that REDD policy must award credits not just for reduced deforestation and reduced forest degradation but also for forest enhancement. The proposed REDD policy must also come up with a suitable baseline methodology that captures forest degradation.

It is time to analyze CFM in the broader context of the global climate treaty. This paper comes at the right time as global leaders will meet this December in Copenhagen to discuss a global climate treaty. At the national level, Nepal is restructuring its political and administrative system, and has to reconsider how to manage CFM under a new federal structure. This is the ideal time to highlight the issues of local forest users in the wider context of climate change and carbon trading so that global climate agreements can be designed so that CFM with its demonstrated effectiveness in mitigation can be used by countries under the emerging UNFCCC REDD policy.

Chapter 4

Bringing Peoples' Perspectives: Making REDD Effective in Nepal

- Bhola Bhattarai[7]

Abstract

Climate change has captured the public attention on an unprecedented scale. While some of the specific impacts of climate change are still being questioned, the role of humans in contributing to climate change has been fully recognized in scientific, policy and public circles. Now the international community is attempting to forge consensus on issues such as who should be responsible for mitigating climate change, by how much, and who should pay for it. One of the mitigation mechanisms being discussed is Reducing Emissions from Deforestation and Forest Degradation (REDD), which proposes that developed countries be allowed to compensate developing countries for their forest conservation and regeneration efforts, as a part of meeting their mitigation obligations. This chapter discusses the social, economic and legal implications of REDD for community forestry in Nepal and presents a vision for sharing carbon payments at the national level.

4.1 Introduction

Climate change is the direct result of an increased atmospheric concentration of greenhouse gases (GHGs). These GHGs are emitted from a wide variety of sources like fossil fuel based transportation, industrial complexes, agricultural land, and deforested and degraded land. The focus of this chapter is on reducing emissions from deforestation and degradation.

Deforestation and forest degradation have been estimated to account for up to 20% of total annual GHG emissions. Changes in forest cover and carbon stocks have been particularly prominent in developing countries, and especially

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in the least developed countries (LDCs). As these countries continue to grow, their deforestation and degradation rates have only increased. If these rates are not checked, the contribution of deforestation and forest degradation to GHG emissions will continue to rise and will have far reaching consequences for livelihoods and ecosystem services in general.

A new mechanism called Reducing Emissions from Deforestation and Forest Degradation (REDD) has now been incorporated into the climate change negotiations agenda and is included under the mitigation section of the Bali Action Plan. Recently, interest in the potential to use this mechanism to address deforestation and forest degradation has been high. As has already been mentioned, deforestation and forest degradation account for a substantial portion of the total global emissions profile, so any overall mitigation strategy that does not take this sector into account will not be complete. Furthermore, REDD has the possibility of contributing substantial emissions mitigation with low costs, and of promoting numerous co-benefits related to biodiversity and livelihoods.

The increasing pace of deforestation and forest degradation in developing countries is alarming. While this provides clear evidence of the need to take immediate action to address these issues, we must also understand that forests are under extreme pressure to deliver resources. Forested land is constantly being encroached upon and converted into agricultural land and other uses, posing a serious challenge to its sustainable management. This is only indicative of the extent to which people depend on these resources. Much more research is required to better understand the nexus between livelihoods and forests, and the specific forces driving deforestation and degradation.

Much of the current debate on REDD has centered on how to provide the necessary incentives to mitigate greenhouse gases and to increase participation in this process by different stakeholders. Some of the questions being asked are: How do we reduce deforestation rates? How do developed countries contribute to this process? How is revenue sharing done inside the country between the concerned stakeholders? And what will be the overarching mechanism? These critical questions are being discussed both nationally and internationally.

4.2 What is REDD?

REDD is a mechanism through which the abatement of greenhouse gases from deforestation and forest degradation can be achieved through a series of incentives. These incentives are provided by developed countries to developing countries for taking actions that reduce forest-related emissions. This mechanism recognizes the historical role that developed countries have played in causing climate change, as well as their higher level of resources for pursuing the mitigation of GHGs. As there are many stakeholders in the REDD process, a lot of interest has been generated about the architecture of this mechanism. In Nepal's case, some of the key stakeholders are the community forests, indigenous and local communities, the local and central governments, and civil society at large. Some of the major issues that have emerged in the international arena include:

- The need to obtain prior and informed consent of concerned indigenous and local communities in line with ILO 169 and the UNDRIP Convention;
- Recognition of the ownership and access rights of local and indigenous communities over forest resources (i.e., the state should play the role of a facilitator and provide policy guidelines under a comprehensive and strategic framework);
- The imperative of establishing revenue-sharing mechanisms through a multi-stakeholder group process (i.e., the primary beneficiaries of carbon-related revenues must be the actors that have played the strongest role in halting deforestation and degradation);
- Simplification of modalities for carbon trading (As carbon trading is a new and technical area) in order to minimize transaction costs and maximize efficiency;
- A need for recognition that REDD must not only benefit countries that have only begun to reduce deforestation and degradation now—but also those that have successfully already initiated actions to conserve and regenerate forests in the past;
- Ensuring the participation of, and guaranteeing benefits for, women, Dalits, indigenous and local communities, youth and other marginalized stakeholders.

The aforementioned points are only some of the key issues that need to be addressed. Scientists and technical experts, negotiators, and non-governmental organizations have been working hard to ensure that a proper REDD mechanism is designed so that GHG mitigation is carried out while providing the strongest benefits to relevant stakeholders.

International negotiations on REDD have been underway and have taken a few strides in 2009, with numerous inter-sessional that were held between the UNFCCC's annual Conference of Parties (COP) meetings. When the parties meet this December in Copenhagen, it is likely that a general framework will be agreed upon for REDD. We can anticipate this mechanism to come into force only after 2012, that is, after the first commitment period of the Kyoto Protocol is over. As the level of preparedness is low, some countries will need some extra time after 2012 to build the necessary capacity to implement such a mechanism. However, they should do whatever they can now to prepare for REDD, with support from donor organizations.

4.3 Why REDD for Nepal and where?

Though Nepal's forest cover and deforestation and degradation rates have been high historically, local communities have been playing a major role in conserving forests for the past several years. These efforts have been instrumental in checking deforestation and degradation. As a result, voices are being raised to press for the recognition of community forests' role in climate change mitigation. Because carbon stock enhancement has been considered to be a key aspect of this debate, REDD has morphed into REDD+, with the plus indicating carbon stock enhancement, rights of community people, biodiversity conservation, livelihood benefits and other associated social capitals particularly in the context of community and participatory forestry. A REDD mechanism alone, without its "+" component, may not be adequate to reward those community forest user groups who have significantly contributed not only to revitalize the degraded forest but also reduce poverty through conservation. Therefore, Nepal should advocate for REDD+ to harness benefits from the evolving REDD mechanism so as to ensure that the benefits goes to the historically good doing communities in conservation.

The World Bank, through is Forest Carbon Partnership Facility (FCPF) program, has provided USD 200,000 for REDD 'readiness'. This fund has been provided under the expectation that it will help to improve the capacity

of necessary institutions to implement a REDD framework in the days to come. The Ministry of Forests and Soil Conservation has established a REDD-Forestry and Climate Change Cell to oversee this task. A working group has been formed to implement these activities. In this forum, suggestions from the civil society and concerned stakeholders are given due importance. The REDD Working Group has been focused on forming the Readiness Plan under the World Bank's FCPF initiative.

4.4 REDD and Civil Society Institutions

Civil society groups have formed the Civil Society REDD Action Group. This group has been building internal capacity, formulating position papers, and providing input and suggestions to the government, among other things. Community Forest User Groups have been a key player in using the media to sensitize the public to issues about climate change. Similarly, community forest user groups (CFUGs) and NEFIN have been working to increase their reach and capacity. Through a collaborative pilot project of FECOFUN, ICIMOD and ANSAB, action research is being conducted in three different watersheds to better understand carbon trading opportunities that can arise from a REDD mechanism.

The role of civil society institutions has been wide-reaching. These institutions have been working with local groups to build capacity and raise awareness, while also providing advice and inputs to the government and attending

Box 4.1 – REDD Pilot Project

ICIMOD, FECOFUN and ANSAB have been running pilot projects in Gorkha, Dolakha and Chitwan districts. These pilot projects are being carried out in the Ludikhola, Charnawati and Kayarkhola watersheds. The project areas include around 20,000 hectares and involve about 182 CFUGs in total. After CFUGs express their interest to the district FECOFUN office, FECOFUN organizes awareness-raising and capacity-building activities so that these CFUGs can participate in the program.

This pilot project has been illustrating both the social and technical challenges in implementing a REDD system. Operational plans that are formulated by the CFUGs are also being discussed to identify how these plans can be synchronized with a national level REDD framework. By holding discussions at different levels—village, district and national—the project aims to build an inclusive method so that the views of different stakeholders are well represented.

negotiations to put their views forward in international forums. It is believed that these activities will create an environment that is conducive to local communities, indigenous groups, women, Dalits, and forest dwellers to achieve the maximum benefits from REDD.

4.5 Distribution of REDD benefits

Two highly debated issues in the REDD process have been monitoring, reporting and verification (MRV) and the distribution of REDD benefits. This section will present a vision for a benefit-sharing mechanism. As the sharing of benefits from REDD is a sensitive area that needs careful consideration and incorporation of the views of different stakeholders, consultations need to be held and the output of these consultations must be reflected in the mechanism that is created. The role of different institutions in formulating this revenue-sharing mechanism must be clarified. People in different parts of the country are under differing impressions regarding the roles of the government and civil society organizations.

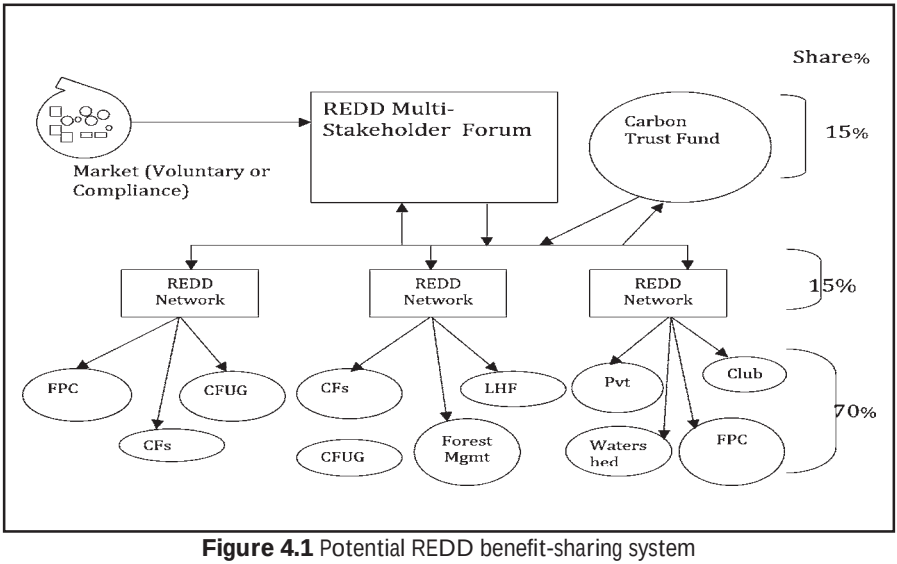

Figure 4.1 Potential REDD benefit-sharing system

In this proposed mechanism, a multi-stakeholder forum would be established to oversee the entire process. This forum would have the authority to establish different cells for technical, financial, and administrative assistance, as per their requirements. We also recommend the formation of a separate REDD

Carbon Trust Fund that would manage the carbon payments through a transparent and accountable process. REDD networks would be established, using existing networks where possible. These networks would involve local forest managers. The network would be inclusive and would represent local and indigenous groups, women, Dalits and forest dwellers. These stakeholders would all play an important role in benefit sharing. These networks are also expected to play a coordinating role amongst different stakeholders. Forest managers at the village level would not just generate interest and mobilize user groups for REDD implementation, but would also be instrumental in ensuring that REDD benefits reach those who are the most vulnerable and impoverished. These groups could also take up other activities apart from forest conservation like alternative energy promotion and educational campaigns.

Even though the exact architecture of the REDD mechanism may not be finalized until a few years down the line, it is still necessary to do an analysis of existing institutions and their capacities. The following must be kept in mind while formulating a REDD mechanism:

- Active participation of stakeholders right from the preparation phase needs to be generated
- Forest dependent communities need to be closely consulted with and programs must only be formulated after their views have been taken into account;
- The benefit-sharing mechanism must recognize the role of local and indigenous communities in forest conservation;
- Consensus must be forged amongst different stakeholders to take this forward; and
- Different aspects of REDD like effective policy formulation, transparent decision-making processes, equitable participation, and prior and informed consent must be ensured.

4.6 New directions for REDD

It is high time for all of the concerned stakeholders - e.g., CFUGs, forest managers' associations, government and non-governmental organizations, etc. - to engage in serious dialogue about how best devise a REDD mechanism. For this mechanism to yield benefits to local and indigenous communities,

women, and Dalits, they must express their concerns and actively participate in the policy formulation and project preparation phase. Policy makers need to concentrate on how to allow benefits to reach the village level in the most efficient manner. Similarly, non-governmental actors must come together to decide how to best support the government during international negotiations. They must also continue to carry out awareness and capacity building initiatives. Government officials must also realize that their goals will be fulfilled only when the goals of local and indigenous communities are met.

Chapter 5

Indigenous peoples and REDD: Challenges and Opportunities in Nepal

- Pasang Sherpa[8], Nima Lama[9] and Pasang D. Sherpa[10]

Abstract

59 indigenous nationalities comprise 37% out of the total population in Nepal. Historically, indigenous peoples have a very special relationship with forests, water and land resources, which provide important cultural, spiritual and religious symbols in their lives. However, after the Forest Act in 1993, their ownership has been transferred to the government. Thus access by indigenous groups to natural resources was constricted. If a scheme for Reducing Emissions from Deforestation and Degradation (REDD) is designed and implemented with concern for the rights of indigenous peoples over their access to the forest, they would contribute to the reduction of emissions and carbon sequestration through their traditional indigenous customary practices of forest management. However, if a REDD scheme is developed without their free prior informed consent and participation, it would not only threaten their livelihoods but also violate their rights secured by the UN Declaration on the Rights of Indigenous Peoples, and limit the scheme's potential for reducing emissions.

5.1 Introduction

Nepal is a secular, multicultural, multilingual, multi-ethnic and multi-religious country of the Himalayan region. Geographically, Nepal is divided into the high Himalayas, the high mountains, the middle mountains, the Siwalik (low

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hills) and the Terai (plains) regions. Despite its small size, Nepal contains tremendous biological, sociocultural and ethnic diversity (Bhattachan 2008).

The Government promulgated the Act of National Foundation for Development of Indigenous Nationalities in 2002 and identified 59 indigenous nationalities and defines indigenous peoples as "a tribe or community having its own mother language, traditional rites and customs, distinct cultural identity, distinct social structure, and written or unwritten history" (NEFDIN 2002). Out of the estimated 300 million indigenous peoples in the world, 8.27 million live in Nepal, comprising approximately 37 percent of the country's total population (CBS 2001). The 2001 National Census identified only 43 out of 59 indigenous peoples (listed in Table 5.2). This underestimation is most likely due to classification errors. For example, two or more groups have been lumped together while some groups have been included in the category of unidentified caste/ethnic groups. Some argue that certain groups have been excluded altogether (NEFIN, 2005). As a result, the exact number of indigenous nationalities is still not determined. Table 5.1 shows the list of Indigenous peoples living in different regions of Nepal.

Classification of indigenous peoples in Nepal

The Nepal Federation of Indigenous Nationalities (NEFIN) has divided indigenous nationalities into five groups based on literacy rates, occupation, land ownership, and population. Table 5.2 shows this categorization.

Table 5.1 Indigenous nationalities of Nepal

Mountain (18)	Bara Gaunle, Bhotia, Byanshi, Chairotan, Dolpo, Larke, Lhomi (Shingsawa), Lhopa, Marphali Thakali, Mugali, Siyar, Sherpa, Tanbe, Thakali, Thudam, Tin Gaule Thakali, Topkegole, Walung.
Hill (24)	Bankaria, Baramo, Bhujel/Gharti, Chepang, Chhantyal, Dura, Gurung, Hayu, Hyolmo, Jirel, Kushbadia/Patharkatta, Kusunda, Lepcha, Limbu, Magar, Newar, Pahari, Phree, Rai, Sunuwar, Surel, Tamang, Thami, Yakkha.
Inner Tarai (7)	Danuwar, Kumal, Bote, Raute, Darai, Majhi, Raji
Tarai (10)	Dhanuk, Dhimal, Gangai, Jhangad (Urau), Kisan, Meche, Rajbanshi (Koch), Satar (Santhal), Tharu, Tajpuriya

Source: NEFDIN 2002

Table 5.2 Classification of indigenous nationalities in Nepal

Endangered Groups	Bankariya, Kusunda, Kushbadia, Raute, Surel, Hayu, Raji, Kisan, Lepcha, Meche
Highly Marginalized Groups	Santhal, Jhangad, Chepang, Thami, Majhi, Bote, Dhanuk (Rajbansi), Lhomi (Singsawa), Thudamba, Siyar (Chumba), Baramu, Danuwar
Marginalized Groups	Sunuwar, Tharu, Tamang, Bhujel, Kumal, Rajbansi (Koch), Gangai,Dhimal, Bhote, Darai, Tajpuria, Pahari, Dhokpya (Topkegola), Dolpo, Free, Magal, Larke (Nupriba), Lhopa, Dura, Walung.
Disadvantaged Groups	Jirel, Tangbe (Tangbetani), Hyolmo, Limbu, Yakkha, Rai, Chhantyal, Magar, Chhairotan, Tingaunle Thakali, Bahragaunle, Byansi, Gurung, Marphali Thakali, Sherpa.
Advanced Groups	Newar, Thakali.

5.2 Natural resources and identity of indigenous peoples

Historically, indigenous peoples have a very special relationship with natural resources. Natural resources are not only the basis of the livelihoods of indigenous communities, but they are also interlinked with their cosmology and life systems. These resources have deeper cultural meanings: indigenous derive their sense of identity by living in certain areas and using location-specific natural resources.

Natural resources, like land, forests and water, provide important cultural and religious symbols for the indigenous peoples of Nepal like the Rais and Sherpas. Daniggelis (1997) posits that “Farmers’ symbolic relationship with the jungle (forest) is laden with cultural meanings and woven into their oral tradition [and are used to] describe the cosmological system.” (Daniggelis 1997: 109). He also gives the example of origin myths from the Rai community that shows the importance of plants and animals in the metaphysical system. Furthermore, these myths contain numerous references to the “jungal” and it is clearly evident that nature is an inseparable part of their cosmological understanding.

Indigenous peoples like the Chepangs need their own traditional land to bury dead bodies. Similarly, Bote, Majhis and Rajis worship fish and boats using

certain plants from the forest. These examples show the inextricable link between nature, indigenous peoples and their livelihoods. As natural resources form such an important component of their culture, any disruption in access to natural resources has deep-seated implications for their identity and sense of self.

Local institutions of property ownership often differ from the mainstream legal system. In many cases, these groups have been using and managing natural resources without any formal property ownership—through traditional understandings and customary practices. As the relationship between indigenous peoples and natural resources has been ongoing for generations, they feel particularly committed to managing these resources under their own methods and systems. However, since indigenous peoples have faced political, economic and legal interventions, the continuation of their traditional practices and natural resource management methods has been challenged and many have discontinued them (Uprety and Adhikari 2006) argues that such changes have violated their rights and have relegated indigenous groups to marginalized actors.

5.3 Livelihood strategies of indigenous peoples

Indigenous peoples of Nepal are engaged in different traditional and non-traditional occupations. Table 5.3 shows the basic livelihood strategies of different indigenous groups.

Table 5.3 Livelihood strategies of indigenous peoples in Nepal

Indigenous Groups	Foraging	Horticulture	Pastoralism	Agriculture	Industry
Raute, Kushbadia	+	-	-	-	-
Kusunda, Bankariya, Chepang	+/-	+	+/-	-	-
Thami, Raji, Hyayu	+/-	+	+/-	-	-
Majhi, Bote, Musahar	+/-	+	-	+	-
Jirel, Larke, Siyar, Tangwe	-	-	+	+	+/-
Walung, Topke, Thudam, Lhomi, Sherpa, Holmo, Dolpo, Bhote, Lhopa, Mugali	-	-	+	+	-
Gurung, Byansi	-	-	+	+	+
Limbu, Lepcha, Yakkha, Rai, Sunuwar, Surel, Tamang, Pahari, Free, Baramo, Bhujel, Dura, Chantyal, Magar	-	+/-	-	+	-

Danuwar, Durai, Kumal, Mache, Kisan, Santhal, Rajbansi, Tajpuria, Dhimal, Gangai, Jhangad, Tharu, Dhanuk	-	--	-	+	-
Chairotan, Tin Gaunle Thkali, Barha Gaunle	-	-	+/-	+/-	+
Newar, Thakali, Marphali Thakali	-	-	-	+	+

Source: IIDS 2002, Note: + means main strategy, - secondary strategy, +/- some groups or group members are involved in this strategy.

Table 5.3 clearly shows that Raute and Kusbadia still depend largely on hunting and gathering. These groups do not generally hoard or accumulate property and they exchange the products they produce through a barter system. This makes it difficult for them to adjust in a setting where legal institutions do not take these considerations into account.

Rautes forage in the hills of certain western regions and Kushbadiyas wander in the western Terai areas to barter their products with food or sell them to meet their daily needs. They are uneducated and are ruled by their own customary laws. Kushanada and Bankariya have abandoned their hunting and gathering nomadic ways of life. Though they have adopted permanent settlement, they are still highly dependent on forest resources. As they also usually have no evidence of land ownership, their livelihoods have become threatened as well. In addition, they have not been able to fully adapt to a non-nomadic lifestyle, especially to new agricultural innovations. Similarly, indigenous peoples living in the Himalayan region rely on animal husbandry and trade for their livelihood, while indigenous peoples from the mid hills depend mainly on agriculture. Indigenous peoples from the Terai depend on agriculture as well, which sometimes takes the form of dry farming.

5.4 Indigenous peoples, land and resources

The ownership of natural resources, especially land, has always symbolized wealth, power, social prestige and security for indigenous peoples. However, indigenous peoples are usually marginalized from by such ownership systems. For example, 80 % of the indigenous people are ‘marginal cultivators’ (with less than 1 acre) or small cultivators (having 1-2 acres) (IIDS 2002). A large number of indigenous peoples have no land to claim as their own and live as wage laborers. These figures show that the majority of indigenous peoples are deprived of land ownership in Nepal. As a result, they tend to experience heightened food insecurity and threats to the preservation of their cultural identity.

The territorial unification of Nepal has resulted in the loss of traditional rights of access to natural resources of indigenous peoples. Their unique relationship with the land and natural resources has not been recognized. Communally owned land—according to the traditions of the Tamang, Dunuwar, Sunuwar, Majhi, Chepang, Hayu, Sherpa, Kumal, Lepcha, and Rai—was known as the *Kipat* system. *Kipat* included not just the land but the natural resources included in it as well. This system defined the territorial rights of the indigenous people and local communities. The Land Reform Act in 1964 did not recognize the Kipat system and thereby denied access to these lands and the resources they contained (Caplan 2000). In the earlier days, indigenous peoples owned the forests they lived in. However, as a result of the Forest Act of 1993, this ownership has been transferred to the government. As a result, access to natural resources like forests, lakes, rivers and riverbanks has been restricted. Thus indigenous peoples like the Raute, Bankariya, Chepang, Kusunda, Tharu, Danuwar, Santhal (Satar), Bote and Majhi have been deprived of their tradition of living in the forests.

5.5 REDD and Indigenous Peoples

The emergence of the concept of Reducing of Emissions from Deforestation and Forest Degradation (REDD) has already raised concerns about the implications for indigenous peoples. The REDD readiness scheme in Nepal is financed by the World Bank under the Forest Carbon Partnership Facility (FCPF) mechanism. There is high chances of such institutions to serve the interest of developed countries like USA, UK and others primarily and that of the Government of Nepal, whose laws and rules govern the operation of the World Bank in the country and least concerned with the rights of the indigenous peoples who live in and rely on the forest. Sherpa (2009: 52-3) states,

> Carbon financing is often identified with the interest and rights of the wealthy countries to the companies to the extent that even their continuous polluting of the environment is condoned, and rarely punished. In the process, they exploit the developing and under-developed countries by locking them into un-equal and long-term contracts detract detrimental to the interest of these nations. This is also regarded as the latest and crude form of neo-colonialism.

The National REDD Forest and Climate Change Cell under the Ministry of Forest and Soil Conservation (MFSC), is working on different components of a Readiness Plan Proposal (RPP) to facilitate REDD implementation once

the mechanism takes effect. Although there is also a representation of indigenous peoples along with the representations from the donor agencies, non government organizations and government organizations, the workshop is always designed through a top-down approach. Unless the ever practiced design is altered and extend the space for the adequate involvement of the indigenous groups in the design and implementation process, indigenous rights will not be protected. In such a case, such approach may sow the seed of conflict in the mind of indigenous peoples once they find themselves with the great risk of sustaining their livelihoods. Therefore, concerning the reason of conflict in the past 10 years in Nepal, the Government of Nepal should now realize the historical blunder for suppressing the indigenous knowledge, language and culture in the name of unification of the nation (Awasthi 2004). Thus respect the rights and ensure their full participation in the decision making bodies that would severely impact on their lives remain only in papers.

Although Nepal has already signed for United Nation Declaration on the Rights of the Indigenous Peoples (UNDRIP) and ratified ILO Convention 169 in 2007, the fate of indigenous peoples for securing their traditional land, resources and their free and prior consent for developing any national policies and programs is still not in practice. This is clearly in violation of the spirit of ILO 169 and UNDRIP. Tauli-Corpuz (2009) presents the high risks of REDD/ REDD + for indigenous peoples in the governance that would exclude the indigenous peoples from decision making process due to highly centralized, top-down management of forests… corruption and embezzlement of international funds by national elites (p. 74-75). Therefore, although REDD has already been explicitly mentioned in the Bali Action Plan, negotiations are bound to affect the access rights of indigenous communities to forests. Barnsley (2009: 3-4) states:

> Indigenous Peoples have voiced a number of grave concerns. First they were not adequately consulted in the design of the Forest Carbon Partnership Facility (FCPF). It is vital that they should be consulted in relation to any particular projects under the facility that might affect them, and that any such project fully take account of and recognize any Indigenous rights that may be affected… There is some concern about the fact that it is mostly the government and the private sector entities that have caused deforestation and it is these same entities that are likely to now benefit from the facility.

This calls for a radical departure from the top-down decision-making system and asks for an inclusive approach to making decisions about natural resources, which have direct implications for the identity and livelihoods of indigenous peoples.

5.6 Conclusion

If REDD is designed and implemented with the support and participation of indigenous peoples, with their rights duly recognized and respected, the mechanism can make an even greater contribution to emissions reductions and carbon sequestration. Indigenous peoples would be encouraged to continue and promote their traditional practices that can act as safeguards to ensure sustainable forest management. This will also have a direct positive result for the livelihoods of indigenous peoples.

If the REDD mechanism is designed properly, it would help to strengthen the implementation of international agreements to which Nepal is a party, UNDRIP, ILO 169, and existing national laws and policies on indigenous peoples rights. This could be an opportunity to push for the development of legislation to protect indigenous peoples' rights to their forest and carbon in the absence of such laws.

The REDD scheme is also a great opportunity for raising the awareness of indigenous peoples on sustainable resource management. At the same time, this is also an opportunity for indigenous people to share their traditional knowledge of sustainable forest management so that it can be applied to a broader setting.

However, the present, top down and highly centralized management system may exclude the indigenous peoples' participation in the decision-making processes. This will underscore the important role that indigenous peoples have in providing safeguards through their traditional practices. Furthermore, not including indigenous people in the process can threaten the livelihoods of these communities if access to forest resources is restricted, because the livelihoods of traditional indigenous people who are forest dwellers—like the Chepang, Raute, Raji, Bankariya—depend on forest resources.

Blocking indigenous cultural values over the resources and compensating them with money from carbon trading will not work. It is imperative to restore to them their sense of ownership over the resources for sustaining their traditional values, culture, skills and knowledge while developing REDD implementation framework without which the REDD mechanism is bound to fail. If the indigenous rights over the resources are recognized and fully engaged in the development relevant policies and programs implementation, their involvement would not only sustain their traditional livelihoods but also fulfill the global goal of emissions reductions.

Chapter 6

Understanding Forest Degradation in Nepal

- Krishna P. Acharya[11], Resham B. Dangi[12] and Phil Shearman[13]

Abstract

Forests provide a wide range of provisioning, regulating, cultural and other supporting services for human well being. These are collectively known as ecosystem services. The sustainability of forest ecosystem depends on sustained management, efficient utilization and effective protection measures against deforestation and degradation. Current global discussions on forest degradation have been focused on reduction of emissions from sources and removal enhancement from sinks, i.e. carbon services. In Nepal, the role of other environmental services–like water harvesting, soil conservation, and biodiversity conservation—are also equally important for sustaining rural livelihoods and maintaining environmental conditions. For these reasons, it is imperative to develop a common understanding about forest degradation among forestry professionals, policy makers, and politicians. This will be helpful in developing appropriate public policies to address the forest degradation problem. This paper aims to review past forest resource assessment methodologies and their findings on forest degradation. Finally the paper concludes by comparing potential methods for assessing forest degradation in Nepal.

The need for accurate differentiation of the determinants of forest quality has been recognized since the first forest resources assessments were conducted in the early 1960s. All subsequent forest resource assessments have identified criteria and indicators for investigating forest degradation. But many of these criteria have been different, resulting in the surveys being largely incompatible. Forest degradation has been generally understood as a reduction in the production capacity of commercial timber volume. Changes in tree canopy cover were used as a key criterion in these assessments. This

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was assessed through the measurement of canopy closure, number of trees per unit area, growing stock, regeneration capacity, stand maturity, lopping, species dominancy, grazing, and soil surface erosion. The assessment tools included field surveys, satellite images, aerial photography, ground checks and/or a combination of these methodologies.

These approaches neither recognized ongoing degradation within the canopy of 'high stocking' forests, nor the degree of understory degradation. In addition, tradeoffs with other kinds of ecosystem services were not considered. This paper argues that the assessment of forest degradation should be based on the resultant outcomes of all kinds of forest services rather than the accounting of individual services. The use of high resolution satellite imagery, combined with field surveys is a suitable approach for such assessments. Finally, the paper argues that forest services should be understood comprehensively to prevent the emergence of new drivers of degradation.

6.1 Introduction

Forests are an integral part of the farming system in Nepal. Farmers require access to forest products such as leafy biomass for fodder and animal bedding, fuelwood for energy, and timber for building and agricultural implements (Mahat 1987; Gilmour and Fisher 1991; Malla 2000). In the high altitude Jumla area, it was estimated that maintaining one hectare (ha) of paddy land requires up to 50 ha of forest and grazing land (Whitemand 1980). Similarly, in the middle hills, Wyatt-Smith estimated that 3.5 ha of forest are required to maintaining one ha of agricultural land (Wyatt-Smith, 1982). In 2006-07, fuelwood derived from forests constituted 84% of the total Nepalese energy consumption (WECS 2007). Similarly, about 42 percent of the fodder requirement for livestock production is derived from forests (WECS 2007; Pandey 1982). In addition, a number of forest products such as high value medicinal and aromatic plants are facing excessive and unsustainable harvest pressure and degradation (MoEST 2008). The forestry sector contributes 9.5% of the national gross domestic and about 27.5% when indirect services are included. Of concern is the fact that over 28 percent of the country's forests are estimated to be in degraded condition (DFRS 2008; MoEST 2008).

The Ministry of Forests and Soil Conservation and its departments have undertaken several forest resource assessments since the 1960s. The scope of these resource assessments has ranged from national level studies to site-

specific community-level research. These inventories have differed in their objectives and methodology. There are two key areas that determine whether different forest inventories or resource assessments can be compared with one another for the purposes of measuring forest change over time. Firstly, the processes that cause deforestation and degradation, such as logging, clearance by smallholders or slash and burn agriculturalists, and harvesting of fuelwood and non-timber forest products, are not detectable in coarse or moderate resolution imagery, and they occur heterogeneously across the landscape (Tucker and Townshend 2000, Asner *et al*. 2005, Grainger 2008). An area of forest that has had the edges encroached on by agriculture, or that has been hollowed out by logging can appear to be intact forest in moderate or coarse resolution imagery, when in fact substantial change has occurred. A high resolution spatially accurate boundary between what is forest and what is not forest is essential for detecting such incremental or small scale forest change. The spatially heterogeneous nature of forest change is also not captured well by mapping the boundary between forest and non-forest using only a sample of imagery covering the area being mapped (Tucker and Townshend 2000, Grainger 2008). Adequately and accurately measuring deforestation and degradation requires that the forest boundary in all forest assessments being compared be mapped using wall-to-wall, high resolution imagery or aerial photography (Tucker and Townshend 2000, Grainger 2008).

The second key determinant of whether different forest assessments or inventories can be compared to measure deforestation and forest degradation are the definitions of ‘forest’, ‘deforestation’ and ‘degradation’ used by each assessment. Some inventories define ‘forest’ as “closed canopy”; others define ‘forest’ using a threshold of canopy cover. The FAO (2005) defines forest as possessing at least 10% to 30% canopy cover. However, under the Marrakesh Accords countries have the ability to constitute these definitions to suite their specific forest types and conditions. Nonetheless, accurately measuring deforestation and degradation requires the comparison of forest assessments that use the same definition of forest. Similarly, forest degradation may be defined in several different ways, including changes in canopy cover, loss of biomass, and loss of biodiversity. Measurement of forest degradation also requires a consistent definition of what is meant by degradation across the different inventories or the forest assessments being compared.

This paper reviews the various forest inventories that have been conducted in Nepal. In addition, two economic studies in Nepal were evaluated. This paper aims to discuss the major findings of different methodologies that have been used, and to offer an approach that could potentially be utilised for

future assessments of forest degradation. It also critically assesses to what degree each inventory or assessment can be compared with one another to measure deforestation and degradation in Nepal, with respect to the resolution (high vs. moderate vs. low), coverage of the mapping (wall-to-wall vs. sampling), forest definition, and definition of degradation.

6.2 Datasets

This section presents a brief summary of the 5 forest resource assessments, and two economic studies of forest resources in Nepal.

1. ***Forest Resources Survey Office (FRSO), 1963/64.*** The forest resource survey office conducted the first forest inventory during the period of 1963-67 using 1953-58 (Indian photography) and 1963-64 aerial photography. It used visual interpretation of aerial photographs using a sampling strategy, and mapping combined with some field inventory. The land categories include forest, cropland, grassland, urban areas, water, badly eroded land and barren land. The forest land was subdivided into commercial and non-commercial forest. The inventory concentrated only on assessing the extent of existing forest area, and growing stock/ha up to 10 cm top diameter. It did not cover high altitude forest areas.

2. ***Land Resource Mapping Project (LRMP), 1978/79.*** The LRMP was jointly implemented by the Government of Nepal and Kenting Earth Sciences Limited Canada with financial support from the Government of Canada. The objectives were to develop appropriate forest land use maps based on forest types, composition, and structure and land degradation status. The project was implemented between 1977 to 1984. The forest resource assessment was made through the combined use of aerial photographs (1977-79), extensive ground truthing, land surveys and topographic maps. This assessment used wall-to-wall coverage in both high- and low-altitude forests. The study mapped forests and scrubs separately and within their forest classification, four density classes were delineated (0-10%; 10-40%; 40-70%; 70-100%). Additionally, each forest zone was defined according to the dominant forest type (coniferous, hardwood, or mixed) and the presence of various dominant species. The resolution of the aerial pictures was approximately 1:12,000 allowing the creation of landcover maps at both 1:25,000 and 1:50,000 scales. These landcover maps remain the only national, wall-to-wall assessment

of Nepal's forests, and could be used as a baseline against which change in forest cover and degradation can be measured. It also holds the potential for creating a provisional biomass surface record for the country.

The LRMP was definitive about the limitations of comparing its results with that of the 1964 work done by the FRSO: "*Different boundaries and classifications do not allow this study to be compared with the Forest Resources Survey Data based on the 1964-1965 aerial photography*".

3. ***Master Plan for the Forestry Sector (MPFS), 1989.*** The Master Plan for the Forestry Sector (MPFS) was generated by the Ministry of Forests and Soil Conservation. The data were essentially based on LRMP information and forest inventory data from the Forest Survey and Research Office. The aim was to update resource information changes that occurred during the intervening period of LRMP, but it was essentially based on LRMP data.

4. ***National Forest Inventory (NFI), 1994.*** The National Forest Inventory (NFI) was started in the early 1990s and completed in 1998 with a base year of 1994. The program was implemented by the DFRS with support from the Government of Finland. The NFI used a combination of satellite image analysis of Landsat imagery, aerial photographs and field measurements in four different surveys, each using different techniques. The satellite imagery was of high resolution, but only covered part of the Terai region. In the Siwaliks and other lowland areas, District Inventories that employed wall-to-wall delineation of forest cover from aerial photos were employed. The majority of the country, termed the 'Hilly Area' was sampled using aerial photography collected in 1989-1992. This photography was coarser in resolution than that used by the LRMP and MPFS mapping. An examination of the scale of mapping suggests a resolution of about 1:50,000. Coarser survey measurements were used in hill forests compared to that used in flatter terrain. The point sampling of these photos was used to derive forest area statistics over the hilly area through extrapolation.

   The definition of "Forest" used in the NFI entailed a crown cover of less than 10% and an area of less than 1 hectare. It also included temporarily cut areas that '*will be replanted*'. Their definition of 'shrub' (not scrub) was similar to forest '*except well defined stems cannot be found*'. What is a well defined stem? This was perhaps the 'achillies heel' of the hills

inventory. Put simply, the visibility of stems in 1:12,000 photos is substantially better than in 1:50,000 photos. Vegetation classified by the LRMP as low canopy-over forest, was more likely to be classified as shrub in the DFRS 1999 work, simply because of the scale issue. The other main issue with the classification of vegetation in the DRFS (1999) assessment into two classes is that 'forest' is the same (statistically) whether it has a 100% crown cover or an 11% crown cover. Clearly, from a biomass perspective, forests need to be categorized with a greater degree of accuracy.

The DFRS (1999) stated, "*Comparison of the results of this inventory to ones made previously is difficult because the definitions used and the administrative boundaries differ. However, the only previous inventory that is somewhat compatible is that from the 1970s as this did sampling over the whole country*". This is a doubtful statement. The LRMP used wall-to-wall classification; the DRFS (1999) was a pastiche of different survey types from different dates, but predominantly was a low-resolution sampling exercise. They cannot really be compared. But of course they have been due to the lack of alternative data.

5. ***Forest Cover Change Analysis of the Terai Districts (DoF), 2005.*** The study presents the extent of forest cover and annual rate of change in 20 Terai districts. It was commissioned by the Department of Forests. The forest cover change was estimated by analysing satellite images from different time periods, supported by ground verification. Image interpretation and classification was undertaken at a high resolution and 'wall-to-wall'. The major drawbacks were in the definitions of the classes that were used themselves. Specifically, the "Forest" class used the 'FAO definition' of >10% crown cover. Considering that intact forest in this region would have a crown cover of around 70%, this would have over-estimated the amount of forest within the region. However, it seems that the training areas used in the supervised classification procedure were actually skewed towards higher coverage areas, so this may not have been a major source of error. Of greater concern was the definition of degraded forest as "*forest land with less than 10% cover*" This meant that intact forest could be transferred to scrub, while still being classified as forest.

The key problem was in the reporting of these data, there was an emphasis on the very low rate of 'deforestation' of only 0.08% per annum. In fact,

when degradation was included (as most of it should have been recorded as deforestation), the rate of change was closer to 1.3% per annum. It probably needs to be accepted that these degraded forests are likely to be on a one-way trajectory to being deforested. Degradation is commonly the first step in deforestation. This issue is even more important under the new emphasis on the carbon content of these forests.

6. ***Economic Valuation of Ecological Goods and Services (ESE), 2005.*** The study was commissioned by the Ministry of Forests and Soil Conservation, Government of Nepal. The study estimated the value of goods and services of forest ecosystems representing different ecological zones and management regimes. However, the study did not cover all the ecological regions.

7. ***Contribution of Forestry Sector to Gross Domestic Product in Nepal (GDP), 2008.***The DFRS conducted this study to estimate the actual contribution of the forestry sector to national GDP. Both the use and non-use values were taken into consideration in estimating the contribution. The use values include consumptive goods like timber, fuelwood, grass/fodder/bedding materials, NTFPs, sand and boulders. Similarly, the non-use values included recreation, eco-tourism, soil conservation and green carbon sequestration.

A summary of major resource assessment studies and their linkages with thematic elements of sustainable forest management (SFM) is presented in the Table 6.1. The information reveals that not all elements of SFM were covered in these measurements. The table shows that resource assessments were focused on the investigation of the extent of forest area and the estimation of timber volume. Recently, two economic studies on the valuation of forest services have added carbon, biodiversity and protective function of the forests in their assessments. The health of forests and their vitality has yet to be considered in any assessment.

Table 6.1 Strategic forest assessment in Nepal and linkages with SFM

No.	Study	Year	Responsible Organisation	SFM thematic element
1	Forest Resources Survey	1974	FRSO(DFRS)	1, 5
2	Land Resource Mapping Project	1978/79	LRMP/WECS	1, 5
3	Mater Plan for the Forestry Sector	1986	MoFSC/DFRS	1, 5, 7
4	National Forest Inventory	1994	DFRS	1, 5
5	Forest Cover Change Analysis of the Terai Districts	2005	DoF	1
6	Economic Valuation of Ecological Goods and Services	2005	MoFSC	2, 4,5, 6, 7
7	Contribution of Forestry Sector to Gross Domestic Product in Nepal	2008	DFRS	2, 4, 5, 6, 7

Note: *Thematic elements of sustainable forest management are: 1. Extent of forest resources; 2. Contribution to the Carbon cycle, forests and climate change; 3. Forest health and vitality; 4. Biological diversity; 5. Productive functions of forests; 6. Protective functions of forests; and 7. Socio-economic functions of forests. (Source FAO 2009)*

6.3 Methodology

Assessment and tools

It is commonly agreed that measuring forest degradation is substantially more complex and difficult than measuring deforestation (Panta et al 2008; Lambin 1999; Souza et al 2003). Table 6.2 summarises the criteria used in defining forest degradation and the methods used for the Nepalese assessments. This shows that all previous resource assessments have incorporated measurements in the parameters of forest quality – however the tree canopy stocking level was found to be the main criterion used in most assessments. Hence, common acceptance on forest degradation in these assessments is the reduction in production capacity of timber volume. The stocking level was linked with forest productivity. Proxy measurements used include canopy closure, number of mature trees, number of preferred trees density, cut stump, growing stock, regeneration capacity, stand maturity, lopping, species composition, grazing, and soil surface erosion.

Table 6.2 Review of methods used in forest assessment studies

Study	Degradation criteria	Indicators	Methods	Procedure
1. FRSO	Stocking class (Crown cover <10 % as a non forest area) and density class) Scrub and shrub Encroached forest	• Crown closure and number of reproduction size trees/ha (well stocked- >70 % and above 799 reproduction size tree/acre, Medium 40-69% or 400-699 reproduction size tree/acre; 10-39 % or 100-399 reproduction size tree/acre) • Lands with unmerchantable tree and shrub species growing in bush-like clumps. • Heavy and repeated fuel wood cuttings • Lands 10 % or more covered by tree crown and containing commercial timbers but currently being cultivated, unlikely to remain as forests • No legitimate ownership	• Means estimator • Visual interpretation of aerial photographs • 1:12,000 to 1:60,000 aerial photographs • Dot counting • Area rectification and adjustment • Field inventory in commercial forest	• 1”= 1 mile land use map prepared using aerial photographs, • Physiographic regions divided • Forest, Cropland, Grass, Urban, Water, Badly eroded and Barren • Forest subdivided into commercial/non commercial forest • Area rectification • Forest mapping 3”=1 mile Forest inventory for volume and growth information • Systematic grid of 3.2 km x 16.1 km • Cluster of 5, 800 m^2 rectangular plot • Stumps recorded with species & size • Location of measured trees mapped • 5 circular sub-plots of 5.27 ft radius used to record reproduction and dominant crown cover. • Conifer growth estimated by borings
2. LRMP	Stand stocking Soil surface erosion	• Crown density is % of ground area covered by tree crowns as viewed on the photograph or from air (Crown density < 10 % as non-forest, crown cover <40 %	• Visual interpretation of aerial photographs (black and white	• Land utilisation classification in 4 physiographic regions • Aerial and ground reconnaissance • Forest reconnaissance, ground check • Forest, cultivated, grass lands, shrub

		with an average of 25%) • Few scattered trees • Grazing -number of livestock • Forest fire	1: 20,000 to 1:50,000) • Ground truth checks by helicopter • Land surveys • Topographic maps	lands and other lands, • Wall-to-wall forest classification • Interpretation and typing • Topographic maps at 1:50,000, • Field work and data collection • Drafting, planimetry & compilation
3. MPFS	Canopy closure Regeneration	• 10 to 40 % under stocking or degraded • 10 to 40 % crown closure or, if immature containing 250 to 999 regeneration sized trees • If immature containing 999 or less regeneration sized trees • Stands with mature or over-mature trees	• Desk review • Visual interpretation of aerial photographs and field verification	• Creation of data base from LRMP and FSRO research plots, five physiographic regions • Field verification using aerial photographs • Modelling to update information
4. NFI	Crown cover-stand density	• <10% crown cover or well defined stems not found	• Satellite images, GIS, topographic maps, vector data- boundary • Ground based inventory • Visual interpretation of aerial photographs of scale 1:50,000	• Land use categories, forest & shrub • Forest area into reachable, non -reachable and encroached, field verification, data transfer manually onto planimetric sheets, digitisation • Development regions separation • Satellite image analysis- Landsat TM, NDVI. National Imagery not coupled with inventory data District Forest, Churiya forest and remaining hills districts inventory • Photo point sampling, two stage

				cluster designing, 4x4 km, manual transfer, stereoscope for land use
5. DoF	Crown cover tree stocking	• Degraded forest means sparsely distributed trees or forest land with < 10 % crown cover including shrub. • Only conducted in Terai	• GIS, Satellite images analysis and ground verification	• Satellite image analysis and field verification • Landsat TM 1990/91 and 2000/01 • Districts level outputs
6. ESE	Stand density Use value of ecosystem services	• <10 % crown cover as degraded forest or shrub land	• Forest inventory • Questionnaires • Market price • Market price of substitutes • Benefits transfer • Total net stock	• Terai, siwaliks and middle hills regions in 12 districts covering Sal, Terai hardwood, Pine, Sub-temperate forest and shrub land. • Community forests, protected area system and government managed regimes surveyed
7. GDP	Stand density	• <10 % crown cover and shrub as degraded forest	• Ground based forest inventory • Questionnaire • Economic valuation • Market price • Market price of substitutes • Benefits transfer • Total net stock	• High-Hills, Mid-Hills & Terai regions • Sal, Terai Mixed Hardwood, Khair/ Sissoo, Lower Slope Mixed Hardwood, Chir pine, Upper Slope Mixed Hardwood, Oak / Castanopsis and Others forest types, • Management regimes – Leasehold, Government managed, Religious, Community & protected areas.

6.4 Results

The FRSO survey recognised forest quality differentiation primarily based on stand size, density classes, crown closure, and merchantable volume. However, there was no clear definition and assessment of forest degradation. Degradation was characterised by fewer number of trees, lopped trees, unwanted/non-commercial tree species, heavy grazing pressure, unpalatable species, and bushy species. However, it did identify encroached forests as a kind of degraded forest. The LRMP forest assessment is the only one of the 5 resource assessments examined—excluding the MPFS analysis, which was derived from the LRMP assessment—to be based on wall-to-wall high resolution mapping of the national forest. All five assessments used a definition of >10% canopy cover to define forest and <10% canopy cover to define either 'shrubland' or 'degraded forest'. The NFI assessment is the only one not to distinguish between different forest classes according to canopy density. The FRSO, LRMP, and MPFS assessments delineated multiple forest classes between 10% and 100% canopy closure.

Of the five forest assessments conducted in Nepal, only two cover all of the forest area, the LRMP from 1978/9 and the NFI from 1994, although the MPFS can be compared to the LRMP from which it was derived. However, the LRMP assessment was a wall-to-wall and high resolution assessment, whilst the NFI used mapping based on a sample of imagery and a much coarser survey technique to determine forest and shrub cover in the majority of the country. Table 3 highlights the extent of forest and shrub categories reported from the different studies. Further details are presented in Annex 1.

Tables 6.3 and 6.4 suggest that the total shrub and forest area have not changed much in the last few decades, although the forest cover has been degrading. Table 3 shows that, initially, shrub was not included as a separate land use category, but since LRMP it is an important land use category.

Table 6.3 Extent of forest and shrub land cover in Nepal

Study	Year	Forest		Shrub		Forest and Shrub total	
		Area (1.000 ha)	%	Area (1,000 ha)	%	Area (1,000 ha)	%
FSRO	1964	6402	46	-	-	6402	46
LRMP	1978-9	5616.8	38	689	5	6285	43
MPFS	1985-6	5424	37	706	5	6210	42
NFI	1994	4268.8	29	1560	11	5828	40

Table 6.4 Estimation of forest degradation rate in terms of increase in shrub land

Study	Year	Shrub land		Forest degradation % per year (1978/79 to 1994)
		Area 000 ha	%	
LRMP	1978/79	689	4.7	5.57
NFI	1994	1560	10.6	

A comparison of the LRMP with the MPFS analysis shows a small increase in shrub cover (~0.1%) at the expense of forest cover over 6-8 years. However, a comparison of NFI with LRMP appears to suggest that the area under shrub land increased by 126 percent from 1978/79 to 1994, or on average 5.57% per year. At face value, a comparison between the NFI and LRMP assessments suggests that there was no significant change in the area of total forest and shrub land, but that the extent of shrub land more than doubled at the expense of forest cover. However, it is unclear whether this was genuine forest change or a product of the varying quality of the forest surveys used. To explore this hypothesis, a comparison was conducted between the area of the NFI 1994 assessment where high quality (wall to wall) surveys were conducted (largely the Terai) with the areas where the NFI 1994 data detected big increases in forest to shrub conversion (see Figure 6.1 below).

This comparison suggests that in those development regions which had greater 'wall-to-wall' coverage and less sampling the recorded forest-to-shrub cover was less, and vice versa. Overall, 84% of the variation in forest to shrub conversion detected by comparing the NFI 1994 forest assessment with the LRMP assessment could be explained by variation in the survey quality of the NFI 1994 survey. Indeed it is possible that the 126% increase in shrub cover at the expense of forest cover is largely a by-product of the lower resolution and sample-based mapping used in the hilly areas in the NFI assessment rather than a comprehensive measurement of actual degradation through forest to shrub conversion.

Degradation assessment methods

The methodologies used in past assessment can be grouped into Aerial Photography, Field Survey, Satellite Image and Ecosystem Service Valuation. The following table compares the strengths and weakness among these various methodologies and their accuracy level. The analysis reflected in the table indicates that forest degradation assessment accuracy increases if it is supported by ground-based data.

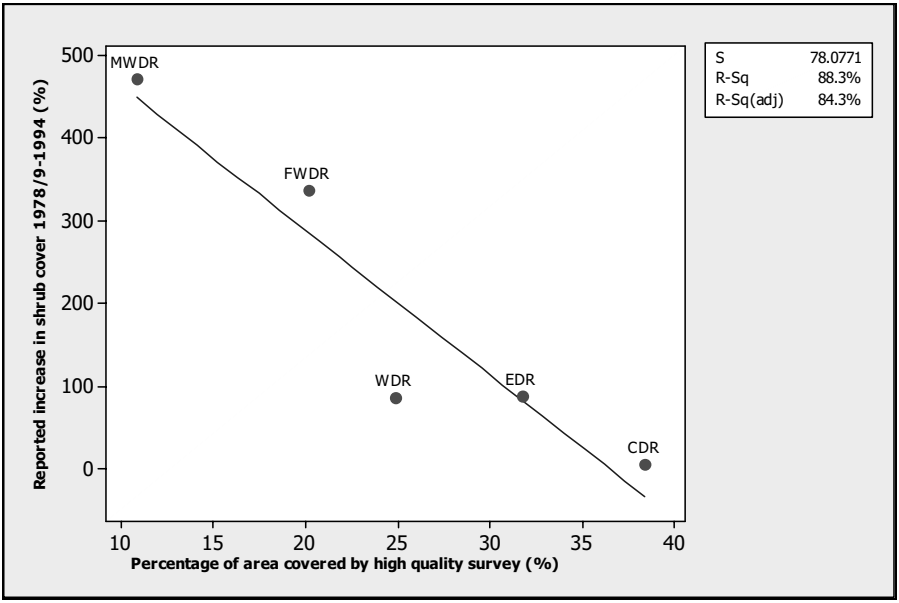

Figure 6.1 Comparison of increase in shrub cover detected by the NFI assessment compared to the area covered by high quality survey.

Note: *There was a significant ($p<0.05$) negative correlation between the area covered by high quality surveys and detection of shrub increase 1978/9-1994. Those areas of forest that were poorly surveyed corresponded to areas where the NFI 1994 assessment detected large increases in shrub cover.*

Table 6.5 Relevancy of different forest degradation assessment methodologies in Nepal
(Based on Photographs 1:12,00 to 1: 60,000 and Landsat TM images experiences)

Methodology	Advantageous	Disadvantageous	Accuracy Level	Costs	Implications for Nepal
Aerial photography	• Easy to understand to local community • Visible to demonstrate forest degradation such as crown cover change, shifting cultivation, forest fragmentation • Long experience • Infrastructure exits • Require low input on technology	• Difficulty in mountain area • High costs, • High time requirement, • Nearly abandoned and replaced by new technologies. • No latest aerial photographs available • Degradation elements such as grazing, fire damage, forest NTFPs and understory damage, encroachment is not completely detectable	High	High	No recent aerial photographs available- less useful
Field survey	• Data available for comparison • More accurate, • Widely understood, • Cheap labor, but quality control difficult • Considerable experience • Simple technology • Capture all kinds of ecosystem services	• More resources, • Long time requirement • Difficult in mountain terrain • No recent data available	High (Std. error for the top 4 volume ranged from 2.61% to 6.66 %).	Medium	Considerable experience exists, labor is cheap- still a good option, community involvement is available, proposed FINNIDA assistance survey will generate new data, but this is

	• National to local scale possible • Scattered case study and academic, research data available				also unlikely to be comparable with anything.
Satellite image analysis and GIS	• Globally uniformity, • Rapidly advancing technology • Easy interpretation in high resolution images, • High resolution images usable as a map for demonstration • Requires low forest inventory	• Technical capacity and infrastructure demanding, • Cloud, shadow and slope in hilly areas, but can be got around now that NGIIP has a 30m DEM • Few control plots for ground verification, • Seasonal images availability, • Limited data to replace ground inventory • Difficult to assess understory including NTFPs.	Medium to high (67-98% to distinguish in different stocking class)	Free to moderately expensive (Landsat to IKONOS) Low or medium	Difficult terrains support it. Needs capacity development, if combined with field survey, is one of the best option
Ecosystem service valuation	• Recognizes broader value of forest ecosystem	• Technically demanding • Outside forestry discipline	Medium to High	Low to Moderate (how?)	Community participation, true valuation of forest services.

6.5 Discussion

Nepal has substantial experience in ground-based forest inventory techniques. These have generated considerable data, although of varying levels of accessibility. However, inventories seem to have been focused on the quantification of commercial timber volumes and were not designed for the assessment forest degradation per se. Recent economic studies are much wider in scopethan previous forest inventories, incorporating the concept of ecosystem services.

A limitation of assessing both deforestation and degradation in Nepal is the use of different methodologies amongst national scale forest inventories such as the LRMP and NFI. A comparison between these two assessments suggests that both deforestation and degradation rates are very high. However, as Figure 1 shows, this is likely to be at least partially a by-product of low-resolution sample-based mapping, rather than actual conversion of forest to shrub cover. Thus, it seems likely that the NFI and the LRMP forest assessments are incompatible. Comparing a wall-to wall assessment (LRMP) with a sampling-based assessment, where coarser techniques were used in higher altitude forest has substantial potential for error (Townshend and Tucker 2000, Grainger 2008). Due to the coarse scale of mapping, a lot of what the NFI 1994 assessment called 'shrub' would probably have been called 'forest' in the LRMP. This was likely a consequence of their attempt to use coarser-scale aerial photography from which it is difficult to distinguish between 'forest' and 'shrub'. This also means that the often cited deforestation rate for Nepal likely to be an overestimation.

The most commonly used methods of forest assessment are ground-based forest inventory, aerial photography, satellite image analysis, or some combination of these. Crown cover has been taken as a proxy for degradation, but this is unable to address broader elements of forest degradation or the complexity of ecosystem change. Canopy reduction will reduce biomass but may enhance watershed conservation, carbon sequestration or biodiversity. Table 6 shows that understory degradation is also a fundamental contributor to degradation. Crown cover assessment alone is unable to account for many of the drivers of degradation. It is possible that more finely tuned field surveys, when combined with image analysis may be able to capture the consequences of other drivers of degradation.

Table 6.6 Drivers of degradation and detectability of different methods

Level and drivers of degradation	Level of significance	Key degradation element	Detectability (low to high, 1-3)		
			Field survey	*Aerial Photos*	*Images*
Fuel wood removal	High	Biomass, understory	3	2	1-3
Timber removal (local)	High	Crown cover, biomass	3	2	1-3
Timber removal (industrial)	High	Crown cover, biomass	3	3	3
Fodder, leaf litter removal	High	Biomass, understory	3	2	1
Over-extraction of medicinal & other species	High	Understory, biomass, biodiversity	3	1	1
Encroachment	High	Crown cover, habitat, biomass, understory	3	3	3
Overgrazing	High	Understory, soil, habitat	3	1	1-3
Development activities- Road	High	Crown cover, habitat, biomass, fragmentation	3	3	3
Forest fire	Medium	Understory, biomass, soil, biodiversity	2	1	3
Settlements to landless	Medium	Crown cover, habitat, biomass	3	2	2-3
Invasive species	Low	Biomass, understory, habitat, biodiversity	3	1	1-3
Rot disease	Low	Biomass	3	1	1-3

Note: *The variable assessments of satellite imagery in regard to the detectability of these drivers relates to the resolution of available imagery.*

There is more confusion about the other studies and their definitions of degradation. The NFI defined shrub land as an area essentially the same as forests but where well-defined stems cannot be found. This implies the need to use the same technique of visual inspection of 1:50,000 aerial photos. The DoF study definition of degraded forest included sparsely distributed trees or forest land with less than 10 % crown cover, including shrubs. These definitions suggest that the authors of these studies regarded shrub land as a

type of degraded forest. However, in some cases, these studies have used different definitions of degraded forests and shrub lands, creating confusion and an inability to robustly compare datasets. The inherently fuzzy boundary between land cover categories needs to be removed by providing clear, simple and consistent definition for all assessments—or alternatively accepting gradations within land-cover categories.

There have been several other spatial and temporal assessments of forest conditions of Nepal that suggest that forest degradation is causing changes in the forest structure, composition, stocking and forest types; change of the vertical structure; or alteration of other attributes. Sharma and Suoheimo (1995) found that about 45% of trees are affected by the rot diseases in Makawanpur and Rautahat districts. Similarly, Acharya (1998) stated that there is degradation within existing forest stock due to repeated logging practices resulting in lower quality forest types. This was illustrated though the conversion of Sal forest (>60 % of basal area) to Sal Terai Hardwood and finally to Terai Hardwood.

It is generally perceived that Nepal is suffering acutely from different drivers of forest degradation. Forest encroachment is a particularly serious problem in the Terai plains. There, a recent estimate showed that about 100,000 ha of forest is under encroachment with the distinct potential for further degradation through encroachment by illegal squatters.High altitude forests continue to be degraded due to the presence of significantly higher livestock density than the estimated local carrying capacities (MoEST 2008; NBS 2002). Table 6 illustrates that degradation can be the results of a single factor or, more commonly, of a combination of multiple factors. It's monitoring and control is critical if we are to maintain subsistence economies, which are based on the exploitation of natural resources as a major source of livelihoods. The detection of such drivers is limited with remote sensing, unless high-resolution imagery is used, or unless it is supported by ground-based data. In summary, forest degradation may occur in following ways:

1. Reduction in biophysical attributes of forests, such as crown cover, in such a way that forest remains as forest, with over 10 % closure.
2. Reduction of crown cover from shrub land or degraded forest until it is converted to other land use. As is the case with 1 above this has an implication for many ecosystem services, including carbon sequestration.

3. Degradation may occur in the understory due to the removal of NTFPs and other resources, or because of fire.

There is a need for the development of a comprehensive methodology to understand and value forest degradation from the perspective of ecosystem services. This need is further enhanced by the necessity for Nepal to prepare for the monitoring requirements of emerging REDD (Reducing Emissions from Deforestation and Forest Degradation) opportunities. The generation of transferable and robust data will require the use and interpretation of high-resolution satellite images in combination with field surveys. It is hoped that the proposed field-based inventory, soon to be commenced with the assistance from the Government of Finland, will generate substantial spatial and temporal information for the country. Additionally, another wall-to-wall high resolution forest cover map for Nepal is urgently required to overcome the limitations of the NFI 1994 assessment. Nepal's overall deforestation and degradation rate will be clear by new high resolution, wall-to-wall assessment.

It is also recommended that a participatory ecosystem services valuation approach (PESVA) be considered to better understand the value of ecosystem services. The adoption of simple techniques that can be carried out by community institutions for community forest management will clearly help our understanding of forest degradation. The PESVA requires expert inputs on the development of methodologies, indices, default values, keys and simple procedures.

There is also a need for a clearer conceptual definition of forest degradation that is more practical and useful for Nepal. In addition to biophysical indicators, this definition needs to consider impacts on ecosystem services, fragmentation, local drivers of degradation, and opportunity costs. Definitions are only practical if they can actually be measured. Likewise, research to assess understory vegetation in different conditions using images needs special consideration.

6.6 Conclusions

Forest degradation is a unique process affecting the provision of valuable ecosystem services (MEA 2005). It is also commonly the first stage in a continuous process leading inexorably to outright deforestation. It is the result of many drivers operating independently or synergistically at different scales,

times and locations. These drivers vary across and within different countries. Due to the heterogeneity of the drivers, and the often incremental or small scale over which they operate, wall-to-wall high resolution mapping is a necessary prerequisite for their detection. In Nepal, a detailed and more specific understanding of these drivers is necessary to address forest degradation. There is also a need for a comprehensive methodology to understand and value forest degradation from the perspective of ecosystem services. This is especially true in a country like Nepal, where the economy is predominantly subsistence-based and where poor people and forest dwellers depend on ecosystem services for their daily needs.

Nepal has substantial experience in the implementation of ground-based forest inventories, which have established considerable data on forest stocks. The methods that have been used within this work have been focused on aerial photograph interpretation, fieldwork and, to a lesser extent, satellite image analysis. The further development of methodologies to assess degradation will largely be constrained by the lack of development of a compatible, measurable definition or definitions. Different organizations have used different definitions and a consensus definition is needed. Similarly, a clear distinction between shrub land and degraded forest, and methods to assess shrub lands, are urgently required. Similarly, several policy documents have used the term 'forest degradation' to mean different things. This needs to be resolved. It is the view of this author that such a definition should consider the full range of biophysical and socio-economic conditions. Nevertheless, in Nepal, a robust methodology which can capture the range of drivers causing forest degradation is necessary.

The present methodologies can be improved in two ways. Firstly, the use of high-resolution satellite images supported by ground-based inventories is a necessary activity. Such work should cover major forest types, physiographic regions and management regimes. The use of satellite images and field-based inventories is suitable to assess biomass, growing stock, basal area, species composition, and forest structure and type. This approach will combine the strengths of both methods. A second approach would be PESVA which will be based on the concept of forest ecosystem services value (ESV). The ESV approach should consider the use value (UV) concept instead of total economic value (TEV). It should also consider the direct use value (DUV) and the indirect use value (IUV) concepts, which rely more critically on forest conditions. ESV is sum of different components of ecosystem service values. Periodic monitoring and comparison of indices with a baseline could provide

information about the extent of forest degradation or enhancement. PESVA needs additional research to create default values using available information and expert consultation. An assessment methodology that can be applied at the community level where communities are managing forests is essential. It also requires developing simple formats, guidelines and procedures.

Improvement in our understanding of forest degradation is required for capacity development, commitments at the political and bureaucratic level, and development of legal measures to underpin forest monitoring. This will require the coordination of agencies using remote-sensing data, as well as an improved understanding of the diverse nature of local drivers of degradation and the measurement of opportunity costs. There is also a strong need to establish an effective national degradation monitoring system.

Annex: Findings of past assessments in Nepal

Study	Key findings related to forest degradation	Inferences
FRSO	**Area:** 45.5% of land covered by forest, out of which 47% is commercial. Whereas in hills 58.1% forest lands, commercial forest area in the hill 34.4% **Composition:** Sal covers 20.7%, sawn timber stands 77% and 23% pole/sapling/regeneration stand **Stocking:** Average volume 63 m3/ha. In Hills, 35.1 % of commercial forest is well stocked, 28.5 % medium and 8.7% is poorly stocked, over story poor with understory medium 7.6, overstory poor understory well stocked well stocked 3.3% and overstory medium with understory well stocked 16.8% **Tree distribution:** In hills, 47% of tree below 22-inch diameter class are from undesirable species (not used for industrial wood, desirable species are sal, Asna, Khair, Chirpine, Blue Pine, Spruce, Fir and Hemlock) **Non commercial forest:** In hills, encroachment: 0.06 percent of non commercial forest area (5236 acre); Scrub and shrub: 5.28% (797203 acre)	Focus was on total merchantable volume of selected species in commercial forest area Forest encroachment was recognised due to fuelwood extraction and lopping.
LRMP	**Area:**Forest area 56,16,800 ha (38.01%), shrub 6,89,900 ha (4.68%), >40% crown cover is 28.1% **Stocking:** 34% (excluding High Himal) of forest is under stocked degraded forests; 55% of forest is in very poor condition in middle mountains;	Forest areas are converting into degraded forest-shrub
MPFS	**Area**: Forest 37.4%, Shrublands and degraded forests: 5% (706,000 ha) P 24, MPFS **Composition:** 59% hardwoods, 17% conifers and 24% mixed forests. Pole reproduction size constitutes only 1% of volume/ha, whereas small timber 65.2% and remaining 1/3rd by	Almost 60% shrub lands are in middle hills. Shrublands increased due to over cut for fuel wood and

	large timber. **Stocking and Degraded forest:** Only 15% of forest area has >70% crown cover, <40% crown cover is in 26.3% of the total forest, 59% have 40-70%. Per ha growing stock is 96 m3 whereas total forest biomass is 628 million ton.	lopping for fodder. Other causes of degradation are fire, cross-border timber smuggling Rate of conversion of forest area into degraded forest/shrub not reduced. Some of deforested area remains as degraded forests.
NFI	**Area:**Forest 29% (4268,800), shrub 10.6% (1559,200 ha), In terai, forest has decreased at annual rate of 1.3% from 1978/79 to 1990/91. In the hilly area, forest area has decreased at an annual rate of 2.3% from 1978/79 to 1994, whereas forest and shrub together have decreased t an annual rate of 0.2%. In the whole country, from 1978/79 to 1994, forest area has decreased at an annual rate of1.7 %, whereas forest and shrub together have decrease at an annual rate of 0.5%. **Composition:** 28.2% of total stem volume is occupied by sal followed by Quercus – 9.3%. All together 229 species identified in inventory. **Stocking:** Mean stem volume is 178m3/ha in 408 stem/ha bigger than 10 cm dbh. Total stem volume of reachable forest is 387.5 million m3 and biomass is 428.5 million ton **Non reachable forest:**About 51.5% of the forests of Nepal are reachable. **Forest degradation:** The shrub land area is result of forest degradation, which has increased form 6,89,900 ha in 1978/79 LRMP estimates to 15,59,200 ha in NFI. It is an increase of 8,69,300 ha in 16 years at a rate of 56% or at an annual rate of3.5%**.** The degradation within the forest category is not accounted in the estimate.	Rate of conversion of forest area into degraded forest-shrub is significantly increased. Higher degradation rate in hilly region,but deforestation is prominent in the Terai. Forest degradation rate is double deforestation rate for 1978/79 to 1994. (Degradation is 3.5% per year compared to 1.7% per year of deforestation) NFI assumed no shrubland in Terai; would have been higher degradation (e.g., DoF study).

DoF	Total forest area in 20 terai districts is 1149494 ha (excluding protected area). Out of the total, 88% (1011362 ha) is forest and 12% (138132) is degraded forest.	Decreasing trend in land cover change in Terai plains from 1990/91 to 2000/01. Encroachment affects forest decline profoundly.
ESE	The highest absolute value per ha was found in the Sal forest(Nrs 3 million). Within the Terai forest ecosystems, the absolute value of shrub land (Nrs 0.76million is half that of Terai Mixed Hardwood Forest (Nrs 1.5 million). The shrub lands have lower per ha values compared to forests ecosystems in the respected region. Pine forest has the lowest values within the forest ecosystems. There is variation in TUV per ha in six research sites. It is mainly due to variation in existing stock of the forest.	Forest ecosystem services vary according to land use, forest type, physiographic region. Values of all three Terai ecosystems are higher than hills ecosystems. Services can be valued by use value of the ecosystem services.
GDP	Forestry sector contribution to GDP in the past was generally estimated 4.4% compared to 9.45%, whereas it is 27.55% including intangible benefits.	Forest contribute significantly to GNP. Forest ecosystems must be valued.

Chapter 7

Preparing Institutions for REDD

- Prakash Lamsal[14] and Rishikesh R. Bhandary[15]

Abstract

Reducing emissions from deforestation and forest degradation (REDD) in developing countries received formal recognition and policy priority after it was identified under the Bali Action Plan. Starting out as a proposal presented by Papua New Guinea, Costa Rica and eight other countries, REDD has now been globally recognized as a crucial component of mitigation efforts and is rapidly taking shape as the UNFCCC negotiations proceed. Such a mechanism has the potential to improve livelihoods and provide other co-benefits, like biodiversity, while aiding in the global effort to mitigate greenhouse gases.As emissions from deforestation and forest degradation presently make up around one fifth of total annual carbon dioxide emissions, any effective global mitigation effort needs to include REDD. (Angelsen and Atmadja 2008). REDD also offers a cost effective way to mitigate greenhouse gases, while simultaneously delivering strong co-benefits, like aiding poverty alleviation and conserving biodiversity. This chapter attempts to assess Nepal's policy and institutional arrangements in the context of climate change in general, and REDD in particular. Existing policy and institutional gaps are briefly analyzed, along with the implications for the implementation of a REDD mechanism.

7.1 REDD: Global and National Context

Nepal has joined hands with its international allies to combat global desertification, mitigate greenhouse gases and conserve biodiversity by being a party to the Rio Conventions and the Kyoto Protocol. Nepal ratified the UN Framework Convention on Climate Change in May 1994 paving way for a greater international role and voice in the climate change debate along with meeting the accompanying obligations.

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Nepal's deforestation and forest degradation rates show that emission reductions can be achieved in Nepal by a mechanism that addresses the drivers of these processes. As Ojha *et al.* (2008) write, during the period 1979-1994, forest cover decreased in Nepal by 24% while the shrub area increased by around 126%. They argue that this is indicative of high degradation rates. Furthermore, Kotru (2009) argues that the deforestation and degradation rates have increased during the past ten years mainly because of "encroachments, conversion of farm lands and felling of trees" in the Terai. As recent data is not available for forest related emissions, Kotru argues that the emissions have significantly increased, resulting in an enhanced potential for REDD-related projects in the Terai.

Pokharel and Byrne (2009) have claimed that deforestation and forest degradation are driven mainly by the "lack of property rights, lack of institutional capacity and lack of appropriate institutional arrangements for sustainable forest management". Hence, if a mechanism is able to address these issues it will significantly reduce deforestation, and thus can play a major role in not only sustainable forest management, but in sustainable development as well.

The CDM process does not include avoided deforestation or carbon stock enhancements, but is limited to afforestation and reforestation (A/R) projects. However, for REDD, the international debate has shifted from only addressing deforestation and degradation to including carbon stock enhancement as well. CFUGs therefore are able to meet the criteria of sustainable forest management that includes carbon stock enhancement and avoided deforestation with strong livelihood benefits. Hence, the question is not whether Nepal's forests have potential for carbon financing, but to what extend and under what conditions (Ojha et al. 2008, Pokharel and Byrne 2009).

7.2 REDD to REDD+: Are CFUGs Nepal's advantage?

The necessity to address not just deforestation and forest degradation, but carbon stock enhancements and sustainable forest management practices has been recognized. Community forests can potentially be included in the resulting "REDD+" regime. As stands, many community forest user groups are not in a position to benefit from REDD, because their forests are not experiencing deforestation or forest degradation. Therefore, REDD would have to be expanded to REDD plus in order for them to benefit. However, REDD could benefit areas not currently under community forestry that are

presently facing deforestation and forest degradation such as in the Terai and inner Terai.

As per the Forest Act (1993), all forests in Nepal fall under either National Forest land or private forests. Community forests (CFs) are government-owned forests where the rights have been transferred as per the Operational Plan agreed on between the community forest user group (CFUG) and the Department of Forests, through the District Forest Office. Provisions like the right to use forest products such as wood and non-wood products are more or less clear in groups' Operational Plans. However provisions related to carbon rights and carbon revenue are not included in the plan and this will have to be sorted out at the regulatory level.

Nepal's community forests (CFs) are considered to be exemplary of best practices in sustainable forest management. Most of these CFs are located in the mid-hills region. The higher altitudes possess few community forests in spite of having high forest cover, as these forests are not very accessible. Similarly, in the Terai region community forests are also limited, making up only seven percent of the total community forest user groups (CFUGs) nationwide, due to a reluctance on the part of the forest department to handover valuable forest lands. The Terai is also where most of Nepal's deforestation has taken place during the last 20 years.

Studies indicate that community forest density has increased by up to 21% per year. Nepal has a total of 1.219 million ha of community forests managed by 14,337 CFUGs with 1, 647, 700 households directly engaged in this process. The average size of a community forest is 85ha. As a result, any mechanism that is able to incorporate all of the CFs and to expand to new areas, mainly in the Terai, is bound impact a substantial portion of the population.

7.3 Addressing sustainable livelihoods

Forests play a major role in the livelihoods of Nepal's rural communities. Pokharel and Byrne (2009) write that nationwide 69% of the households use firewood and 75% of the households collect fodder. However, the level of dependence is not the same for everyone, since those having access to private forests and other means depend less on community forests. The poorest people are particularly dependent on forests for a variety of resources like timber, firewood and fodder.

Though community forest user groups have prospects to receive financial benefits for maintaining and enhancing carbon stocks, any mechanism that regulates access to ensure permanence will "disproportionately and negatively affect" poor people (Pokharel and Byrne 2009). This problem is compounded by the historical and social nature of inequality and access. Therefore, any mechanism that regulates forest use must simultaneously address livelihood concerns and the drivers of deforestation.

Furthermore, the extent of revenue flow, under a market system, depends on the price of REDD credits. If the price of these credits is low and the opportunity cost of other land use options or management systems is high, forest carbon revenues will not be able to avert pressures to deforest. Leitmann (in Vickers 2008) estimates that the price will be sufficiently high to be effective in many areas where timber production is the main opportunity cost, but it is unlikely to match the economic benefits of ranching or soya cultivation in the Amazon.

7.4 Lack of policy and legal coherence

Coordination

Ministry of Environment (MOE) is the state focal agency for climate change issues and is also the Designated National Authority (DNA) for UNFCCC. This ministry has been making decisions regarding the issuance of carbon credits as well, under the Kyoto Protocol's Clean Development Mechanism (CDM). As REDD comes under the aegis of the forestry sector, the Ministry of Forests and Soil Conservation (MFSC) has recently established a *REDD, Forestry and Climate Change Cell* under its foreign aid coordination division.

The REDD Cell staff consists of experts from forestry research and extension services. This team works as a technical expert group to implement the process of REDD in Nepal. The MFSC has envisioned a separate division under the ministry to deal with environmental issues including payment of environmental services and REDD. The *Multi-stakeholder National REDD Working Group (RWG)* is entrusted with the task of making principal decisions on REDD implementation, support and control of the REDD Cell. This working group is made up of a wide variety of stakeholders, including agencies, non-governmental organizations, community forestry networks, donor agencies, members of indigenous groups, and the private sector. As

afforestation and reforestation (A/R) activities have already been included under the CDM (whose DNA is the MOE), there is a strong possibility that any REDD mechanism that rewards carbon stock enhancements will need to be integrated with A/R activities under the CDM, thereby making it necessary for inter-ministerial coordination. Although the MOE and MFSC have similar objectives, no formal institutional linkage exists between these two ministries.

The Climate Change Council, chaired by the Prime Minister, provides institutional space for high-level coordination as it is charged with overseeing climate change activities in the country. As this council carries considerable political weight, it could serve to fill the institutional voids to ensure coordination amongst the line ministries and divisions.

Cross-sectoral coordination and cooperation is weak and has been very limited. Though high-level multi-stakeholder forums have been formed and strategic plans have been formulated, action at the operational level has been lacking. For example, the National Biodiversity Coordination Committee was formed under the chairmanship of the minister of the MFSC in 2003, but it has not met for the last two years.

National policy instruments created to address climate change are yet to be synchronized with national development priorities. In addition, there has been weak coordination amongst the different donor agencies and international and national non-governmental organizations working on REDD and climate change. Though these entities have been engaged in pilot studies, research, and awareness programs, such programs have been confined to the capital and a few districts without much coordination with the government.

Local-level bodies, like district forestry coordination committees, have been established to mobilize local action and in the spirit of decentralized governance of natural resources. With renewed emphasis on local governance being placed as the Constituent Assembly debates over the exact nature of the federal structure, carbon rights and distribution of carbon benefits need to be clearly defined. Pokharel and Byrne (2009) argue that, because local bodies have been inactive due to the political conflict, tensions have not yet emerged between the center and the local bodies. As the peace process takes hold and the local bodies start to exercise their roles in forest governance, clashes with the central government seem inevitable, unless the aforementioned issues are properly addressed. The new constitution has the

opportunity to clearly delineate the devolution of powers. This could help to overcome existing conflicting roles of different bodies.

An example is the legal incoherence reflected in the Local Self-Governance Act 1999 (LSGA) and the Forest Act regarding the management of forests and related revenues. The LSGA gives autonomy to local governments or "bodies"—especially District Development Committees and Village Development Committees—to manage natural resources including air, water, land and forests. However, these provisions are not aligned with many of the sectoral acts, including the Forest Act 1993, and thus create legal ambiguities between local governments and CFUGs. The question of ownership of forest resources or the stipulation to tax the sale of forest products (possibly including carbon) will need to be clarified and a benefit sharing mechanism crafted that can function in a federal state structure.

Tenure Rights

As Staddon (2009) writes, the access rights to community forests are detailed in the operational plan of all CFUGs. One of the main advantages of this system is that the access rights are clearly defined. However, the Department of Forests grants such rights for only up to ten years. After this period, the operational plans must be renewed. As the life cycle of a carbon finance project will likely be longer than 10 years, this introduces a major element of uncertainty regarding the CFUG's ownership over the carbon resources in the community forest once the tenure period is over.

As mentioned above, access rights are well defined, however, carbon rights are not. The issue of carbon rights brings to the forefront the state of devolution of rights from the center to the local bodies. Most of the forests are owned by the government, but rights over "standing biomass" have been granted to the communities according to their operational plans. As these plans don't clearly mention carbon rights, this issue must be clarified at the regulatory level. Furthermore, even within the communities, the issue of equity remains critical. Without a system that guarantees special provisions to the poor and indigenous groups, a carbon tenure system will be incomplete.

As CFUGs already exist as formal and recognized units, using the existing framework for any emission reduction project will have many benefits. For example, these groups already have accounts that can be used to channel

funds that could be generated through a REDD mechanism (Pokharel and Byrne 2009). Nonetheless, a revenue-sharing mechanism needs to be worked out to ensure that the financial benefits received address the needs of poor and indigenous groups and others who may be impacted by a REDD mechanism.

The current revenue distribution system could serve as a precedent for sharing carbon revenue. Currently, CFUGs retain the entire revenue from the sale of forest products except for high value products. These high value products are taxed at 15% if they are sold outside of the CF. Similarly, the government could tax the proceeds that the CF gets from a carbon finance project. The exact modalities will have to be worked out, depending on how the negotiations play out. This is described in more detail below.

If only a REDD mechanism comes into effect, without including forest enhancement, this will not be to the direct benefit of existing community forest user groups. As community forests have already been working on carbon stock enhancement and they have been effective in halting degradation, only new community forests will benefit from such a mechanism. This could create perverse incentives for existing CFUGs to degrade their forests. Without a regulatory intervention that compensates existing community forest groups for their role in sustainable forest management, the ultimate goal of emissions reductions may not be achieved.

If a REDD plus mechanism is adopted, however, CFs are positioned to benefit, but still face many technical challenges, like proving additionality, which are described in the next section. This demonstrates the need for an active role to be played by the government to set a regulatory process that will ensure that they benefit from any global forestry related emissions reduction mechanism. What is beyond doubt is that the formal recognition of rights and tenure of CFUGs will be a comparative advantage for Nepal. However, challenges still remain in terms of establishing clear rules for carbon tenure.

7.5 Challenges in the global REDD architecture

In order for REDD to be an effective mechanism, it will have to satisfy a number of technical criteria, including additionality, leakage and permanence. An exploration of these three critical areas will help to elucidate how ready Nepal is, through institutional and policy processes, for a REDD mechanism.

Additionality

The fundamental concept of additionality is this basic question: Would the emission reductions have occurred if the activity were not implemented as an offset project? Though this definition has been extremely contentious particularly in CDM projects, additionality is nonetheless essential to ensure environmental integrity. If binding emission targets are being met with credits generated from emission reductions that would have happened regardless, this undermines the mitigation goal. As a result, scholars like Karky and Banskota (2007, 2009) have expressed concern regarding the eligibility of CFs, even under a REDD plus system.

The Department of Forests requires that the communities include sustainable forest management in their operational plans. Therefore, as sustainable forest management occurs in the CFs, even in the absence of a REDD plus mechanism, CFs would not fulfill the additionality requirement. However, forest areas that have not yet been handed over to CFUGs would be more likely to meet this criteria. Therefore, even by progressing to a REDD plus mechanism from a REDD only one, the question of additionality is not addressed and could result in the disqualifications of many CFs.

A possible remedy is in the choice of the baseline year. Most of the CFUGs were established in the late 1980s and early 1990s. These areas did experience significant degradation and deforestation before this period. A baseline year that is set before the establishment of the CFUGs would demonstrate the carbon stock enhancement activities of these groups. However, the setting of the baseline depends partially on the outcome of international negotiations, and still does not fully address the additionality issue.

Leakage

The criterion of no leakage requires that a reduction in carbon emissions in one area does not result in increased emissions in another area. Leakages already occur under the existing community forest system, in which some CFUGs protect their own forests and use the adjoining government forests for their livelihood needs, including fuelwood collection, timber and livestock grazing. This is primarily the result of weak enforcement mechanisms of government bodies.

Furthermore, the extent of leakage will be, in part, influenced by the scale of the baseline and crediting. For example, if we have a unified national-level

baseline and crediting system, reductions that take place in the community forests may be canceled out and voided by the increase in emissions from encroachments in government forests. Hence, if a national baseline and crediting approach are used, Nepal may not receive any net credits at all.

The voluntary carbon market has provided methods for monitoring leakage. As livelihood options are a major concern for Nepal, leakage must be seen in this light as well. Restricting land use options for local people and enforcing contracts that limit access to resources could very well aggravate poverty. This needs to be given further attention in considerations for the design of leakage monitoring mechanisms.

Permanence

There are two fundamental issues that determine whether the permanence criterion can be met:

1. The period of time and extent to which communities' forest use and tenure rights are formalized; and
2. Whether it is in the economic interest of the rural communities (i.e. whether carbon is worth more than other alternative uses of the forest land)

Regarding forest rights, CFUGs are not registered under a particular time frame. The access right that the Department of Forests grants the user group is however limited by the operational plan. These operational plans are renewable every 5-10 years depending on the user group. As the user groups have rights to operate as long as they are legally allowed to do so, permanence can be assured with the current legal and legislative framework as long as the operational plans are renewed on a regular basis. However, any legislation or action that denies the rights of the community forest user group will affect the permanence of the carbon sequestered in the forest. Furthermore, unclear access rights will also dampen investor confidence in such projects, especially in the case of the voluntary market. Conversely, any operational plan that is able to address the aforementioned drivers will significantly reduce deforestation. Such a plan will also aid in ensuring permanence.

Next, any long-term carbon finance projects that CFUGs enter into will limit other land use options. Since under a market-based carbon offset scheme, the

financial rewards that the CFUGs get will be contingent upon the price of carbon, a reduced price of carbon will increase the opportunity cost of other options. Unforeseen climatic changes may also necessitate greater use of forest services for adaptive purposes than agreed to in the contract, thereby placing forest users under undue pressure. These factors will determine whether the drivers of deforestation and forest degradation can be checked in the long term.

Along with the issues mentioned above, we must duly recognize that Nepal is a country recovering from a decade-long conflict. Staddon (2009) writes that ensuring permanence will be difficult when there are "areas with unclear land ownership, political instability and conflicts." Political stability will play a major role in determining enforceability of contracts, without which permanence cannot be guaranteed.

7.6 Conclusion

Forestry is a dynamic sector, which could be further affected by a rapidly evolving mechanism that will address emissions from deforestation and forest degradation and promote carbon stock enhancement. Policy, legal and organizational instruments must be flexible enough to address new developments that emerge from international climate negotiations. While the development and institutionalization of participatory forestry programs over the years has been encouraging, a regulatory framework must be devised to ensure the effective involvement of all relevant stakeholders (Kotru 2009).

The challenge is to develop a national framework and policies that are flexible and compatible with those international regulations that will be worked out in subsequent negotiations. Such a framework must be firmly placed within the broader context of Nepal's priorities on poverty reduction and inclusive local social development.

The government's low capacity to implement its own policy, coupled with a seriously lacking inter-ministerial coordination, have left many uncertainties and grey areas. The exact role of different state agencies and their coordination must also be made clear, along with the synergies that can be realized with the support of civil society networks. This requires an urgent need for inter-agency cooperation and institutional capacity building within the MFSC and its departments. Moreover, as negotiations are still underway, Nepal must put forward issues and options that take into account and strive to address its institutional strengths and weaknesses.

Chapter 8

Review of Studies on REDD in Nepal: Status, Gaps and Ways Forward

- Eak Rana[16] and Keshab R. Goutam[17]

Abstract

Nepal is in the process of preparing a national REDD strategy. Individuals, groups and organizations have embarked on various initiatives in this regard. This paper reviews studies on REDD in the context of Nepal. This review reveals that most of the studies have had difficulties estimating forest carbon stocks, while others have tried to establish links between these carbon stocks and revenue generation for livelihood benefits. While some scholars have shown that a REDD scheme could significantly contribute to poverty reduction, others do not agree and suggest developing a scheme that incorporates payments for carbon enhancements through sustainable forest management instead. Though the use of internationally accepted methodologies to estimate carbon in different pools is promising, the applied default values seem inconsistent among the studies. The studies were also confined to community forests, excluding three quarters of the country's forest areas. Similarly, very few studies focus on the Terai and high mountain regions. This chapter suggests a need for further assessment of complementary activities and finding ways to consolidate various REDD-related initiatives being undertaken in Nepal. It also highlights the need for wider consultation and dialogue among government and civil society to define an equitable payment mechanism, clarify forest and carbon tenure regimes, and address issues concerning the rights of indigenous peoples and forest dwellers.

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8.1 Background and intent of the paper

The 13th Conference of Parties (COP) of the United Nations Framework Convention on Climate Change (UNFCCC) held in December 2007 in Bali, Indonesia brought the forestry sector into the climate change framework through a new approach called Reducing Emissions from Deforestation and Forest Degradation (REDD). Reducing emissions from deforestation and forest degradation has long been considered a potential area for abatement, and it is possible that a mechanism will finally be agreed upon during the COP-15 meetings in December 2009 in Copenhagen.

Some REDD-related activities have been initiated in several countries with the support of multilateral institutions. Under the Forest Carbon Partnership Facility (FCPF) of the World Bank, Nepal has also embarked upon programs to strengthen its readiness for REDD. As the potential REDD mechanism will probably go into effect once the first commitment period of the Kyoto Protocol expires in 2012, Nepal needs to be ready on all fronts ranging from institutions to technical capacity (Kotru 2008).

Numerous studies have already been initiated by non-governmental organizations. For example, to assess the feasibility of REDD in Nepal, WWF-Nepal undertook a study in the Western Terai region. Similarly, through its *Kyoto: Think Global Act Local* project, ICIMOD carried out carbon accounting studies in three different ecological regions of Nepal. Individual researchers and university students have also contributed to this initiative by carrying out REDD-related research and case studies on different scales. These initiatives haven't been carried out with proper coordination amongst different groups. This poses a problem to feed the results into a process to make a coherent REDD strategy. We strongly feel the need to consolidate research findings and experiences so that national actors of the REDD initiative can make informed decisions.

As the architecture of the proposed REDD program is still being negotiated and worked out, we can presume that any REDD program will need to have a credible carbon monitoring system, information collection and management infrastructure, institutional setup, and mechanisms for participatory decision-making and equitable benefit sharing. This chapter attempts to review, analyze and consolidate REDD related studies conducted in Nepal. More specifically, the paper encompasses the following objectives:

- Assemble a set of REDD-related studies conducted in Nepal
- Review and analyze the focus of the studies
- Identify the gaps of REDD initiatives and explore future actions

8.2 Methodology

This chapter is entirely based on an extensive literature review. In particular, 10 REDD-related studies, carried out by domestic and international university students and organizations, were reviewed. During the review, the studies were categorized and analyzed to synthesize the information on the following key aspects:

- Study focus
- Study methodologies used
- Major findings

8.3 Findings

Study profile and geographic focus

Out of the total 10 studies reviewed, nine were individual studies conducted by university students. Half of the studies were undertaken by undegraduate students (BSc) of the Institute of Forestry, Tribhuwan University, Nepal as their theses. The next half included three masters degree theses, a doctoral dissertation and a study conducted by an organization (see Table 8.1 below). Majority of the studies were carried out in 2008 while three were carried out in 2005 when the idea of REDD had not fully emerged in the global context. Except for one of the studies, which covered community forests of the high mountain region, almost all of the others focused on the middle hills only.

Focus and key dimensions of the studies

Table 8.2 illustrates the key dimensions covered by the reviewed studies as categorized under the focus areas mentioned above. A majority of the studies have concentrated on the estimation of carbon stock. Some studies have given due focus to valuing environmental services including carbon sequestration, and thus exploring the prospects for REDD in Nepal.

Table 8.1 Profile of studies reviewed

Study Number	Study by Author(s) and Year	Study Level and Associated University/Organization	Study Area
Study1	Singh, P.B. 2005	BSc, Tribhuvan University, IoF Nepal	Kusunde CF, Kaski district
Study2	Bhandari, S.K. 2008	BSc, Tribhuvan University, IoF Nepal	Kafley CF, Lalitpur district
Study3	Ranabhat et al 2008	BSc, Tribhuvan University, IoF Nepal	CFs of Kaski district
Study4	Shrestha, B.P. 2008	BSc, Tribhuvan University	Two CFs of Palpa District
Study5	GC, D.B. 2008	BSc, Tribhuvan University	Singana VDC, Baglung district
Study6	Adhikari, K. 2005	MA, Environmental Science, Tribhuvan University	Sunaulo Ghaympe Danda CF, Kathmandu district
Study7	Dahal, Y. 2008	MSc, Tribhuvan University, IoF Nepal	CFs of Palpa district
Study8	Rana, E. 2008	MSc, Technical University of Menchen, Germany	Torikhet CF, Dhading district
Study9	Karky, B.S. 2008	PhD, University of Twente, the Netherlands	Manang, Lalitpur and Ilam districts
Study10	Nepal Foresters' Association, 2008	WWF Nepal	Kailali, Dang, Nawalparasi, Chitwan and Morang districts

Table 8.2 Key focus and dimensions of the studies

Study Focus	Key Dimensions of the Study	Supported by
Unilinear Quantitative Analysis of carbon storage	Methodologies Spatial coverage of carbon estimation Carbon pool	Study 1, 2, 3, 4, 5 & 6
Valuation of Carbon Sequestration and Water Supply Services Feasibility study of REDD	Define Environmental Services Valuation Methodologies Precondition and technical issues of REDD	Study 7, 8, 9 & 10
Analysis of Deforestation	Analysis of deforestation trend in Nepal	Study 10
Policy Review and Livelihood Impact Policy issues	Scope of REDD in Nepal Impact of REDD on local Livelihoods of forest users	Study 8, 9 & 10
Poverty Reduction through carbon trade	Benefits of carbon trade	Study 4

One of the studies (Study 10) has attempted to analyze deforestation trends in Nepal. Some studies have also reviewed existing forest management and environment related policies.Three studies (Studies 8, 9, 10) have examined the potential impact of REDD on the livelihoods of forest users.One study (Study 4) has paid special attention to the role of carbon trading in reducing poverty incidence among local forest users in Nepal. Study 9, a doctoral dissertation, has estimated the carbon stocks in various eco-regions of Nepal with an emphasis on identifying carbon trade opportunities in the community-managed forests of Nepal.

Carbon estimation: species focus and coverage

All of the studies that estimated carbon sequestration focused on community forests. Some of the studies have focused on calculations of a single species while others have computed carbon sequestration estimates for a particular community forest to assess its carbon trading potential. Some of these studies have also gone further to assess the potential of the carbon market to reduce poverty. Thus, there is considerable variation in the objectives, methodologies, scope and findings of the studies (see Table 8.3).

Table 8.3 Carbon estimation and spatial coverage of reviewed studies

Spatial Coverage	Focus of Carbon Estimation
Carbon calculation of single Community forest	CFUG
Comparative Calculation of Carbon in seven Community Forests of different tree species	*Pinus roxburghii* and *Schima-Castanopsis*forest
Per ha Carbon sequestrating calculation based on secondary information	Carbon estimation based on ICIMOD information
Carbon calculation of two forest species of Single Community Forest	*Schima Castanopsis* and *Shorea Robusta*
Carbon calculation of single species	Bamboo

Carbon estimation: carbon pools considered

As indicated by IPCC (2003) and McDicken (1997), most of the studies estimating carbon content focus on five different carbon pools: above ground biomass, leaf litter, dead materials, below ground biomass and soil carbon, as depicted in Table 8.4. The studies that were reviewed have followed the same approach. Some of the studies, because of associated limitations, have avoided soil carbon content estimation. All of the studies have used ground-based inventory methods for carbon estimation.

An allometric equation developed by MPFS has been used to calculate standing tree biomass. A few studies were found using a biomass table prepared by DFRS to calculate tree biomass of more than 5 cm dbh (diameter at breast height). All of the studies followed the destructive harvesting method to calculate undergrowth—seedlings and saplings of less than 5 cm dbh. Oven-dried biomass for dead materials and litter was estimated by laboratory analysis. Below ground root biomass was calculated using a default value referred to by various authors (Studies 1,2,3,4,5 and 6). Soil carbon was estimated using the Walkey-Black wet oxidation method in all of the studies.A minor variation in computation techniques for aboveground biomass was found. However, most of the authors applied the equation developed by MPFS.

Table 8.4 Carbon pools and their estimation methodologies

Carbon Pools	Methodologies of carbon estimation at different pools	
Above ground biomass	Forest Inventory, Allometric Equation	1. Carbon% = 100-{ash wt. + molecular wt. of O2 (53.3) in C6H12O6)} (Negi et al 2003) 2. ln (W) = a+b*ln (d) where, W= aboveground oven dry biomass of the tree (kg) d= dbh (cm) a,b= parameters 3. Stem Volume, ln (V)= a+b*ln (d)+c*ln (h) (Sharma and Pukkala, 1990) Biomass= V*dry density of wood (Chaturvedi and Khanna, 1982) wt of branches and leaves were taken as 45 and 11% of the stem
Undergrowth live and dead biomass	Destructive harvesting	1. Oven dry biomass, laboratory analysis 2. Y (kg)= aDb where D=d at 15 cm above ground in cm (Hasse and Hasse 1995) 3. ODW=[TFW-{SFW-SODW}]/SFW (Lasco et al, 2005) ODW=Oven Dry weight, TFW=Total fresh weight (g), SFW=Sample fresh weight (g) and SODW=Sample oven dry weight (g)
Below ground (root) biomass	Use of Default value	1. For coniferous, 0.25*aboveground biomass for broadleaved, 0.3*aboveground biomass (FAO, 2000) 2. 30% of aboveground biomass (Nepal, 2006) 3. 46% of aboveground biomass (Cairns, 1997) 4.12.5% of shoot biomass (Houghton et al, 2001, Achard et al, 2002, Ramankutty et al 2007)
Soil Carbon	Walkley-Black's Wet Oxidation method	1. SOC density (t ha^{-1})=Organic C (%)*Soil Bulk Density (kg/m^{-3})*thickness of horizon (m) (Page et al, 1982, Chabbra et al, 2002) 2. Total SOC=SOC density (t ha^{-1})*Forest Area (ha)

Socio-economic valuation of carbon sequestration

One of the reviewed studies attempted to carry out a socio-economic valuation of carbon sequestration and domestic water supply for two mid-hills community forests. The replacement cost, market price and marginal damage cost methods were used for the valuation of carbon sequestration, whereas contingent valuation and avoided cost methods were applied for calculating the economic contribution of CF in domestic water supply. The study found different monetary values for these environmental services of the forests (Table 8.5). The study suggests a need for developing biomass models that can capture

the carbon dynamics of different forest management regimes and of individual forest species. The study also serves to find the quantity of avoided carbon emissions and carbon enhancement of various forest regimes. This also paves the way for defining performance based payment mechanisms of varied forest management regimes in Nepal.

Table 8.5 Socio-economic valuation of carbon sequestration and water supply

Themes of Economic Valuation	Methodologies Used	Average monetary value of per unit ton of carbon in US$
Carbon Sequestration	Replacement Cost Method	24.25
	Market Price Method	27.57
	Marginal Damage Method	28.35
Domestic Water Supply	Contingent Valuation (stated preferences method)	Mean willingness to pay hh^{-1} 31.3
	Avoided Cost Method	Value of Water Supply Service per ha 5,438

Analysis of deforestation trends

The study conducted by WWF in collaboration with NFA included an analysis of deforestation trends in Nepal. A range of techniques, including GIS and Remote Sensing, were used to identify the status of forest cover change in five districts, one from each of the five development regions of the country.

Table 8.6 Methodologies used for analyzing deforestation in Nepal

Methodologies Used
Satellite data acquisition of five district using GIS and Remote Sensing
Geo Tiff file format of Landsat data acquired from Global Land Cover Facility/ Earth Science Data Interface
Carried out Layer Stackinig Operation
Calculated Normalized Difference Vegetation Index (NDVI) of all sets of images using Red and IR bands of image
Area calculation of both forest and non-forest using mosaic preparation

Review and assessment of policy

Studies 8, 9 and 10 have reviewed international policy negotiations related to REDD, climate change and the carbon market. Study 8 has analyzed policy and legislations in the forestry sector and other relevant policies that adhere to climate change and the carbon market. Study 9 reviews a wide range of perspectives on international policy accords and national policies . Existing forest management regimes and potential implications of a REDD scheme have also been analyzed in this study. A summary of the studies is presented in Table 8.7 below.

Assessment of potential impact of REDD on local livelihoods

Study 9 has attempted to assess the potential impact of the REDD initiative on the livelihoods of forest users based on the assumption that the existing forest resource collection practices in community forest would change to meet REDD requirements. The study revealed that forest users would benefit less from carbon trading in a REDD mechanism unless co-benefits are generated from forest conservation. The study suggests that sustainable forest management could be one of the best options to enhance carbon stocks without compromising forest product collection by forest users. On the economic impact, the study revealed that additional household earnings from REDD contribute only insignificantly to the economic enhancement of the poor and the marginalized unless there is a fair distribution of carbon revenues firmly put in place.The study highlighted the possibility of elite capture when monetary flows begin through REDD in the absence of a formal and obligatory benefit-distribution mechanism.

Carbon trade and poverty reduction

Study 3 was concerned with assessing the contribution of carbon revenues to reducing persistent poverty among forest users. The study, conducted in a CF located in the mid-hills, has estimated an earning of NRs.189,487 per ha of CF annually if the sequestrated carbondioxide is traded at the rate of US$ 6 per ton. The study has concluded that additional earnings from carbon can lower the existing poverty incidence of 59% to 1.6% within a period of 25 years (Table 8.8).

Table 8.7 Policy analysis, methodologies, contents and findings

Policy Coverage	Methodologies Used	Analyzed Contents	Findings
International Policy arrangements	Literature review, Internet surfing and review of National Policy related to forestry sector as well as other relevant legislations including Interim Plan, Local Self Governance Act, National Conservation Strategy, Interim constitutions	International policy initiatives, protocol and treaty	Price missing of ecosystem services-economic perspectives and human right perspectives-polluter pays principles are responsible for emergence of climate change and carbon market including REDD issue for creating mechanism of positive incentives to individuals, communities and countries.
		Backdrop ahead to evolve REDD principle	
National forest management policies and institutional arrangement		Harmonization of Forestry Sector Policy to REDD requirements	Nepal has ratified and accessed to international framework, treaties and protocal including UNFCCC, Kyoto Protocol, Convention on Biological Diversity and already abided by ILO 169 and UNDRIP.
		Forestry sector institutional arrangements and existing of monitoring and communication systems	Majority of forest management policies and legislation were formulated before the inception of climate change and carbon market idea. Existing policies don't clerly feature the provision of Payment for Ecosystem Services. Forest policies also lacks to define explicitely concerns of indigenous peoples and forest dwellers in distributing forest resources based on their level of livelihood and cultural connectivity with forest and their contribution in conserving forest.
		Forest management regimes and contribution in REDD principle	Nepal is managing its forest through variety of management practices. Forest transitions and their contribution to abate deforestation and forest degradation vary among the foreand the forest of different regimes.
		Pre-condition of REDD and Nepal's Status	Nepal has little capacity and institutional setup for defining historical deforestation trends, consistent methodologies of monitoring. Strategies are insufficient to avoiding leakage, non-permanence, additionality.

Table 8.8 Assessment of carbon benefits in reducing poverty

Methodology	Content of Analysis	Findings
PRA tools (HH survey, group discussion and key informant survey for socioeconomic data collection	Annual income of CF through carbon trade Contribution of Carbon trade to reduce poverty of forest users	A total amount of NRs. 189,487 per hectare of CF could be earned every year if per tCO_2 is traded at the rate of US$ 6
Secondary data (ICIMOD 2006) for biomass and carbon stock estimation		This revenue can lower the existing poverty incidence of 59% to 1.6% within a period of 25 years

8.4 Discussion

Amidst evolving interest ina forest carbon market through an innovative REDD mechanism, a range of related studies have been undertaken by various individuals and organizations in Nepal. Most of the studies have confined their focus to carbon stock estimations in community forests. This indicates the widely acknowledged role of community forests in playing a strong role in conservation. Studies undertaken after 2005, when the concept of carbon marketsrapidly evolved through the Kyoto Protocol, have linked forest carbon stocks with their economic value.

One study, bearing strong policy relevance, has attempted to analyze historical deforestation trends in Nepal. Angelsen *et al.*(2008) highlights that some of the submissions on REDD to the UNFCCC suggest defining a historical deforestation rate and distinguishing it from the business as usual (BAU) and crediting baselines.

Like deforestation, forest degradation is another important source of emissions. As both deforestation and degradation have been recognized in the Bali Action Plan as areas for mitigation activities, it is essential to measure forest degradation to appropriately address it. However, none of the studies reviewed have taken degradation into account. According to the IPCC (2003), monitoring, reporting and verifying (MRV) deforestation and forest degradation has two components: monitoring changes in forest area by forest type; and monitoring the average carbon stock per unit area and forest type. According to Karky*et al.* (2008), a reference scenario for forest degradation

is much more difficult to establish that that for deforestation because most of the degradation cannot be detected from remotely sensed imagery. As a result, none of the reviewed studies have addressed degradation.

Studies fully examining potential payment mechanisms are also lacking. Angelsen *et al*. (2008) suggest that REDD should go beyond its climate objectives to include the provision oflivelihood benefits and poverty reduction, and the protection of rights and biodiversity. They also highlight the importance of equity considerations, including the fair distribution of benefits between and within countries and groups.

Some of the studies have explored potential livelihood impacts of REDD projects on local forest users.These studies do not differentiate the level of dependency that different users within a forest user group have based on their economic background, ethnic group and cultural groups. ICIMOD, in collaboration with ANSAB and FECOFUN is piloting a project in three watersheds of Nepal to establish a national governance and payment system for emissions reductions through the sustainable management of forests, including the distribution of benefits to indigenous peoples and forest-dependent communities (K. Oli personal communication 2009).

Most of the studies that have provided insights into international policies have focused on policy review and analysis. A PhD dissertation (Study 9) has illustrated the backdrop of the emergence carbon markets and climate change issues. Economic and humanitarian perspectives described in this dissertation have given a clear indication of the reasons why the global community came up with a binding agreement—the Kyoto Protocol.

Governance and the distribution of benefits from carbon sequestration, both at the national level and within groups of forest dwellers, indigenous peoples and forest dependents, are two growing concerns about REDD. Dhakal (2008) highlights that REDD activities can weaken a community's control over its local resources. Nonetheless, only a few studies have made investigations in this regard. Similarly, Pokharel*et al.*(2008)have pointed out that a democratic, open and inclusive, multi-stakeholder action group could be a good vehicle for implementing REDD.

The REDD-Forestry and Climate Change Cell has been established as a separate unit under the Ministry of Forests and Soil Conservation (MFSC) and has been working as the focal point of the World Bank's FCPF. With

support from FCPF, the Cell has been leading the process of preparing Nepal's Readiness Project Proposal Plan (RPPP), following approval of the Readiness Plan Idea Note (R-PIN) in 2008. This is the first phase of the World Bank's Forest Carbon Partnership Facility (FCPF) that aims to build the capacity needed to operate a REDD mechanism nationally. We must also assess how effectively the REDD-Forestry and Climate Change Cell has been functioning to set up a national REDD strategy.

Increasing the institutional and human capacity at the national, regional, district, sub-district and community levels is one of the key strategies needed for development of a REDD Program in Nepal (Pokharel *et al*. 2008). Studies are also needed to evaluate the extent our existing institutional and human capacity meets the demands of an effective REDD implementation in Nepal.

8.5. Conclusions and ways forward

Except for a single study that was carried out in the high mountains, all of the other studies that did forest inventory related calculations were confined to the mid-hills. Community forests have been reasonably successful in rejuvenating degraded forests in the mid-hills. Since REDD is proposed for both the national and sub-national levels, we need estimates of forest biomass for community forests in the Terai, as well as state-managed forests in different ecological regions and socioeconomic settings.

Past studies have adopted internationally approved methodologies to measure carbon stock. Maintaining consistency among the studies is important, while measuring forest carbon within a country. Though some encouraging initiatives are already taking place, further efforts are needed to pave the way for future REDD actions.

Consultation, coordination and cooperation

Though REDD has only recently emerged as a widely recognized essential component of any global GHG mitigation agreement, Nepal has already been able to receive several funding opportunities to pilot REDD activities. The REDD Cell has been functioning as the focal point for the World Bank's FCPF REDD program which has mainly targeted capacity building. NEFIN's REDD awareness project and governance and payment system project by

ICIMOD and its partners are being operated with the support of NORAD. WWF in partnership with Winrock International Nepal is undertaking a REDD methodology project. CARE Denmark has funded a COP 15 project and is being implemented by CARE Nepal in partnership with FECOFUN. Bilateral projects including SNV and LFP are also undertaking awareness raising and capacity building activities. These examples serve to show that major synergies can be realized if these and future activities move forward in a coordinated manner, complementing each other and contributing to the overall goal of an effective national REDD strategy.This requires constant dialogue and consultation among the implementing organizations, civil society groups, indigenous peoples and forest-dependent communities. The Ministry of Environment, the focal point of UNFCCC, should be brought to the forefront of the REDD debate and discussion.

Land tenure and ownership

Forest and land tenure, ownership and concerns of indigenous peoples, forest dwellers and forest dependents are key issues of the emerging REDD architecture. Community Forest User Groups in Nepal are endowed with collective use rights, while the tenure of land still rests with the government. Moreover, forest policies and regulations do not explicitly reflect the rights of IPs and forest dwellers within forest user groups. The collective rights of forest users are shaped by an operational plan, which is normally approved for a period of five to ten years. The plan becomes effective once the District Forest Officer or the Regional directorate approves it. As the time horizon for REDD projects will likely exceed the time duration for which tenure is granted, it is crucial to define a forest tenure system and carbon ownership arrangement that is fully compatible with the REDD process currently under negotiation.

REDD or REDD+?

The original idea of REDD mainly concerns creating positive incentives for reducing deforestation and forest degradation. REDD+ takes a wider approach by incorporating carbon stock enhancements through sustainable forest management and conservation, with explicit recognition of co-benefits like biodiversity conservation, socioeconomic development, ecosystem services and livelihood improvements. Nepal’s forests are under different management regimes and this has implications for the extent of benefits that can be realized.

As one fourth of the total forest area is under community-based management, this area benefits from REDD+ as CBFM is an instrument that abates deforestation and degradation and enhances carbon stocks through sustainable forest management. On the other hand, state-managed forests where deforestation and forest degradation is rampant will potentially benefit from REDD. An alternative could be to deal with REDD and REDD+ separately for state-managed and community-managed forests, respectively. A logical assessment is required for determining the best choice among the options in order to pursue anational level REDD strategy.

Issues of indigenous peoples, forest dwellers and forest dependents

Issues related to land tenure, property rights and customary rights of indigenous peoples, forest dwellers and forest-dependent communities needs to be settled prior to initiating REDD activities. Nepal is a signatory to the ILO Convention 169, obligating it to recognize the rights of indigenous peoples (UNDRIP 2007).Broad stakeholder consultations must be held with IP groups so that their concerns and interests are duly reflected in Nepal's REDD strategy.

Review of institutional restructuring and strengthening

The government's initiative to establish the REDD-Forestry and Climate Change Cell under MFSC is recognized as an encouraging step. The Cell is expected to facilitate the preparation of the Readiness Proposal Plans under the World Bank's FCPF. A review of larger bodies like MFSC and relevant civil society organizations like FECOFUN should be conducted, particularly in light of their vertical organizational structures to ready these institutions for REDD+.

Policy review and reforms

REDD is a recently developed approach for recognizingand supporting the role of standing forestsin combating climate change. Nepal's policies related to forest management should be reviewed and customized to meet the requirements that will most likely shape the REDD mechanism. Studies are required to assess to what extent forest management policies are supportive of a REDD mechanism.

Information management and communication strategy

An assessment of the existing information management infrastructure is urgently needed to find out whether current technologies and human resources will able to meet the international standards for REDD. Similarly, increasing the level of awareness amongst government personnel, private sector actors, civil society groups and forest users, including indigenous peoples and forest dwellers, is an urgent task without which REDD implementation will be extremely difficult.Formulating a REDD communications strategy through a consultation process will help to enhance information management for REDD.

Payment distribution structuring

A much more thorough assessment of the level of forest dependency of users of different economic, ethnic and cultural backgrounds in needed to understand the potential impact of REDD on their livelihoods. This understanding will be instrumental to designing an appropriate payment distribution mechanism. Reviewing the existing practices of benefit distribution between the state and forest user groups would be the first step towards understanding these dynamics and their implications for a pro-poor REDD program in Nepal.

Chapter 9

Carbon Finance and REDD: Lessons and Ways Forward

- Rishikesh R. Bhandary[18]

Abstract

Reducing emissions for deforestation and degradation has achieved renewed attention after it was placed under the Bali Action Plan during COP-13 in December 2007. There had been many attempts to include avoided deforestation under mechanisms like the Clean Development Mechanism (CDM), but because of many unsettled technicalities and the fear of generating excessive hot air this had not been accomplished. The compromise position in COP6 was to allow afforestation and reforestation (A/R) under the CDM and to move avoided deforestation and land use changes and degradation to the purview of the Adaptation Fund.

Viana (2009) argues that deforestation is mainly driven by the "perception of economic gains and not by ignorance, irrationality or stupidity." In order to prevent deforestation, therefore, actors need to be convinced that it is more economically beneficial to keep the forests intact than to cut or degrade them. Efforts to reduce deforestation have taken the form of either national regulations and law enforcement or domestic and international incentives for sustainable forest management. Traditionally, governments have formulated legal instruments to address deforestation. However, these efforts have not been supported by funds through national sources. International bodies have not paid enough attention to forests either. Until recently, the World Bank considered investments in forests to be too risky (World Bank).

This chapter reviews carbon financing mechanisms available for emission reduction projects under the proposed REDD system. The majority of the chapter will focus on lessons learned from the Clean Development Mechanism and the voluntary markets. It is hoped that this review will help to shed light on how Nepal needs to ready itself to compete internationally for REDD finance, and what it can realistically expect from a market-based system.

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9.1 Trends in deforestation; global characteristics

Country level emission data are still being developed and this gap makes it difficult to do cross-country comparisons to assess the relative attractiveness in terms of REDD projects. Table 9.1, excerpted from WRI's (2008) report, shows two studies that it has carried out. Two countries alone account for almost half of the world's deforestation related emissions: Brazil's share is 25%, while Indonesia's is 23%. Forested lands are under severe pressure from cattle and soya industries in Brazil and pulp and palm oil industries in Indonesia. These products are mostly traded and bilateral trade flows can be analyzed to pinpoint the flow of these commodities. In addition, there are only a handful of prominent enterprises that dominate these industries. The high transaction costs of REDD encourages companies to seek large projects to exploit economies of scale. This will divert the financial flows to these two countries. As a result, these countries offer immense opportunities to achieve major emission reductions.

Nigeria, Democratic Republic of Congo and Burma are the next three top emitters from deforestation collectively accounting for 13% of the total (WRI 2008). Because of weak governance in all three of these countries, it is likely that investors will stay away from them.

The statistics in Table 9.1 below refer to net emissions, assuming that 3 tons of carbon are equivalent to 11 tons of carbon dioxide. Global Timber's "Informal Note" (2009) argues that the net emissions actually underestimate the emissions as the list includes countries like Brazil, Malaysia and Indonesia that have expanded plantations at the cost of biodiversity and local communities.

This uneven distribution of forest-related emissions shows that REDD has a strong potential to act in a similar manner to the CDM in terms of project distribution. China, India and Brazil are the hosts of most of the CDM projects and based on a cursory assessment, Brazil and Indonesia will be the favorite destinations of project developers. Project developers will instinctually prefer least-cost abatement options where they can obtain the maximum number of credits. These countries are the most likely sources of the cheapest credits.

It is important for Nepali policy makers to understand how it can create national preparedness so that it can be a major player in the market. To do so, the expectations of the credit buyers need to be understood in the context of

Table 9.1 Top 25 Countries in Terms of Emissions from Deforestation

	A	B
Reference period	*2000-2005*	*2000*
Total	**7,700**	**c.8,300**
Brazil	1,903	2,563
Indonesia	1,781	1,372
Nigeria	452	195
DR Congo	318	317
Burma	241	425
Zambia	233	236
Cameroon	221	77
Philippines	182	95
Venezuela	169	144
Bolivia	151	84
Ghana	151	28
Tanzania	138	15
Ecuador	127	59
Papua New Guinea	120	146
Honduras	118	18
Malaysia	115	699
Paraguay	103	21
Uganda	96	39
Angola	90	18
Cambodia	85	56
Peru	-	187
Nepal	-	124
Colombia	-	106
Mexico	-	97
Ivory Coast	-	91

Source: WRI 2008

a global market-based mechanism. If carefully crafted, REDD has the potential to unleash financial flows to a sector that has been traditionally neglected and underfunded, so that tangible livelihood benefits are achieved while contributing to the global goal of climate change mitigation.

9.2 State of the market

Forestry-generated offsets are popular in the voluntary market (Hamilton *et al*. 2008). Though avoided deforestation are also project options in the voluntary market, these projects account for less than 5% of the total value. This denotes substantial space to generate credits outside of the compliance

market. However, the voluntary markets that exist are only a fraction of the compliance markets like the CDM. Capoor and Ambrosi (2009) estimate the market value of CDM projects was over USD 13 billion accounting for 95% of the entire global market value. The voluntary market on the other hand is worth only about USD 265 million, of which only 15% are forestry-related offsets.

A key question that needs to be asked is: how much money is necessary to implement a mechanism that can play a major role in reducing forest-related emissions? This will help us to assess whether the proposed framework will actually deliver the necessary volume of financial resources to serve as an adequate incentive for the conservation and sustainable management of forests worldwide. The 2008 Eliasch Review has estimated the required amount to be between USD 17-33 billion dollars annually to halve greenhouse gas emissions from deforestation by 2030 (IIED 2009). Ebeling and Yasue (2008) have estimated this amount to be in the range of USD 2-30 billion. As the exact architecture of REDD is not known yet and is still being negotiated, and the existing forest carbon market is limited, these modeling results are based on a number of assumptions and vary considerably due to the large uncertainty element. Some key factors that can play a role in arriving at a figure are the extent of fungibility with other markets, and the depth of emission cuts taken and associated mitigation costs in other sectors.

What is clear from the literature is that the flows generated by a market-based system alone will not be sufficient to reduce emissions significantly based on the estimates calculated to curb forest related emissions significantly. At the same time, Viana (2009) argues that the funds generated through this market process will also be substantially higher than what we can expect from the voluntary side. Direct grants and/or contributions have not been expected to total much, based on the reality of low ODA flows, especially in the forestry sector. Funds can be generated outside of the market system through a few sources. For example, the emission allowances can be auctioned off as is done in the EU Emissions Cap-and-Trade System. Bilateral assistance funds could be another source.

There have not been many studies that have explored the financial side of REDD and other carbon offset projects, especially taking into account the opportunity costs of alternative land use options. A comparative study taking three community forests into account found that, on average, these forests sequestered 6.89 tons of carbon dioxide equivalent per ha per year. Staddon

(2009) argues that this is only USD 82.68 per ha assuming carbon prices in the range of USD 12-15. Though this would make a total of USD 90 million per year for the community forests, which is substantially higher than what they currently make, this revenue estimate needs to be assessed in light of the high transaction costs and the revenue forgone (i.e., opportunity costs) from other land-use options (Banskota et al 2007).

9.3 Challenges in using a market system

This section describes a few selected issues that pose threats that could undermine the effectiveness of market-based system in simultaneously achieving the goals of emissions reductions and co-benefits.

Non-permanence: Failure of CDM afforestation/reforestation

Forest-related emissions reductions are different from other emissions reductions in that there remains a chance that the carbon sequestered or emission avoided will not be permanent. Addressing this very concern, temporary credits were issued for CDM A/R projects called tCERs. These hold an expiry date ranging from five to nine years. The more long-term credits are called ICERs and are valid for the entire duration of the crediting period (Dutschke et al 2004). Temporary credits, however, have low prices compared to permanent credits. In addition, temporary credits need to be replaced when they expire at the end of the commitment period for tCERS, or at the end of the crediting period of ICERs. Private investors have been hesitant to buy temporary credits. Permanent credits are available at fairly cheap prices and purchasing these credits doesn't require investors to buy more after the temporary ones expire.

Market flooding

Papua New Guinea and Costa Rica have proposed using a historical reference level as the baseline. Critics have pointed out that this approach will create "hot air" as it doesn't take into account the nature of deforestation and how it evolves over time. Hot air can be generated when carbon credits don't really represent actual emissions reductions and in this context overestimating deforestation would allow more credits to be claimed than the reductions

made. The forest transition theory posits that a country may start with a high deforestation rate but will not continue to do so forever. This is because the marginal cost of deforestation increases and, after a certain point, actors realize that deforesting does not yield any gain. As a result, any baseline that takes historical reference levels could be capturing only a certain temporal phase of the forest transition trajectory and the resulting baseline would either underestimate or overestimate the credits that can be generated.

Countries that have large tracts of forests and low deforestation rates are against using the historical reference line. They argue that their incomes are still rising and that their historical deforestation rates are not reflective of what can be anticipated. However, to get these countries on board, targets could be given above their current deforestation rates. This would create massive hot air and deflate the price of credits.

If REDD credits cannot be traded in the compliance markets under the Kyoto Protocol or in regional markets like EU ETS, investor interest becomes limited. Some countries like Brazil have opposed using REDD credits to help developed countries meet their compliance targets as a matter of principle—based on the notion that developed countries have an historical responsibility due to their past and present emissions. Others point out that allowing the full fungibility of REDD credits with credits from compliance markets will flood the market. Karsenty (2008) argues that a possible solution can be to have very stringent targets so that new credits can be absorbed.

If REDD credits were tradeable with CDM and the market of inter Annex 1 countries, the same permanence issue as those faced by A/R projects under the CDM would re-emerge. Will a country that is rewarded for reduced deforestation in a first commitment period be forced to make a refund if it oversteps its target for a subsequent period? One obvious solution would be to use the same temporary credits already in force for the A/R CDM credit. Such temporary credits are suggested not only for addressing the risk of non-permanence, but also to mitigate the risk of market flooding. However, it is acknowledged that for the CDM, temporary credits are one of the causes of the failure of forestry projects, since the market is unwilling to buy them.

In the context of REDD, the important takeaway from the CDM experience is that the essential fungibility between European Union Allowances (EUAs) and Certified Emission Reductions (CERs) of the CDM was critical to ensuring strong linkages between their respective markets, and therefore the liquidity of the CER market.

Risks and Management of Delivery Risks

Project developers perform due diligence mainly to asses whether the seller has a legal claim over the carbon and if the seller has the capacity to deliver expected credits according to the agreed plan. Nepal needs to clarify the status of carbon rights and tenure, particularly for existing community forests. Without clear legal mandates, buyers will be hesitant to deal with countries and entities whose carbon rights have not yet been defined. Similarly, it is more attractive for investors to be able to credit projects directly instead of going through a national level crediting process (e.g., as in the voluntary market). This would allow a quick and relatively less arduous process.

Not only are REDD projects at risk from the possibility of non-permanence of emission reductions, they are also highly vulnerable to leakage: deforestation or forest degradation occurring (displaced) outside of a REDD project area as the result of conservation efforts within the project area. In the CDM process, the project developer is expected to be responsible for monitoringleakage. Although, this might be difficult to implement for a REDD mechanism, the project developer will still have to play a major role in monitoring leakage.

Programs like the Biogas Support Program in Nepal have suffered due to the CDM Executive Board's frequent methodological revisions. These revisions do not bode well for investor confidence and increase the uncertainty of achieving a certain amount of reductions. Similarly, the capacity constraints of the CDM EB to review projects and reach decisions have also dampened investor confidence. Any REDD oversight board needs to work towards reducing these uncertainties.

Risk is also generated from potential natural disasters like wild fires that will release the stored carbon. Governance is also another dimension that can add to delivery risks.

An option to keep the delivery risks at a minimum could be to make payments only after performance has been verified. While this could attract investors, we must realize that countries themselves do not have control over many of these delivery risks. Furthermore, as REDD projects, by their very design, are to take place in developing countries, governments cannot be expected to absorb these risks or costs. Furthermore, the general perception exists amongst developing countries that REDD can be another source of much needed

revenue to support the forestry sector. If these countries are to be asked to front the initial costs and bear delivery risks, interest will surely dwindle as most countries simply do not have the necessary funds to initiate these programs.

As already mentioned, governance indicators will also influence decisions on where to locate REDD projects. One of the many causes of deforestation and degradation is weak governance and corruption, and unless this is addressed countries will not likely be the recipients of REDD financing, which could help them achieve reductions in the deforestation rate (Ebeling and Yasue 2008).

To overcome these issues, alternative financing sources to cover upfront costs will need to be explored at different levels. The Prototype Carbon Fund, a program of the World Bank that has helped to fund upfront costs for CDM projects, and has also bought pre-sold credits (rights to unissued credits), has contributed to reducing the risks associated with receipt of payments by developing countries. However, the World Bank has come under much attack for the low price (USD 7 per ton of carbon dioxide equivalent) at which it bought the credits generated in some CDM projects in Nepal. While it is extremely necessary and vital for a body to assist as a risk buffer and as a source of upfront capital, the host country and associated actors must feel that they are gaining from the process as well.

9.4 Readiness and upfront financing

As the ICF International report writes (Meridian Institute 2009), significant preparation is necessary to make sure that countries have the necessary infrastructure in place to implement a REDD plus mechanism. There are major costs that need to be borne before a market approach, or a combined market-based and –fund-based approach, can be initiated. Transaction costs for REDD are very high. For example, existing carbon stocks need to be quantified and this does not come cheap. Similarly, Costa (2007) argues that monitoring and verification costs are also significant, particularly for degradation.

Without a proper mechanism to raise the necessary funds for these upfront costs, countries will not be in a position to implement REDD. Karsenty (2008) argues that global initiatives like the World Bank's Forest Carbon Partnership

Table 9.2 Implications of different risk management approaches

Approach	Description	Local	National
Risk buffers	Percentage (often around 30% of credits are withheld from sale as insurance in the event that the project or program fails	Equity issue if other projects in national REDD systems fail and national accounting is corrected	Lower overall income because credits withheld in buffer account
Replacement of issued credits by sellers	By bringing new areas under REDD schemes if areas from which credits have been pre-sold fail to deliver credits	High risk if cannot replace credits; Prevents access if cannot guarantee replacement	
Temporary credits	Expire after a certain period and need to be replaced. Used in CDM A/R projects	Lower overall investment but potentially less risky for sellers	Low income because low interest by investors (based on CDM)
Payment after verification	Ex-post payments can significantly reduce risks for buyers	Poor market access if no upfront capital; Could result in transfer of liabilities from governments taking on upfront costs	LDCs may lose out if flow levels of upfront capital available
Portfolio approaches	A range of project areas and types are developed. Sourcing credits from such a portfolio reduces risks arising from forest fires and disease that may only affect certain geographic regions.	Lower income and poorer equity of benefits for high-risk activities; Conversely could increase risk-taking by governments.	Increased overall investment; Promotes wider range of geographic areas to be included within a country.

Source: Peskett et al. 2008

Fund (FCPF) and the UN-REDD Programme can help to generate the level of 'readiness' that REDD requires.

Though there are many pilot programs and support projects that are in place, the FCPF is the most extensive program that is helping to build capacity and also pilot projects at the same time. FCPF was "officially launched in COP13 as a new prototype fund for 'avoided deforestation and degradation'" (Karsenty 2009). The box below summarizes the activities covered by FCPF. Based on the areas mentioned, two issues come to the forefront: tackling deforestation and degradation requires a broad range of strategies and not just the 'quick fixes' that some reports seem to imply; and an active role of the government is necessary to ensure that REDD can be implemented effectively.

Box 9.1. FCPF-supported actions to address deforestation and degradation

- Removing subsidies leading to deforestation and degradation
- Improving forest-related law enforcement
- Securing rights for indigenous and forest dwellers
- Devolving forest management to local communities
- Forest certification initiatives
- Conservation concessions
- Strengthening the protected area network
- Direct payments for environmental services
- Improving fire prevention and suppression
- Forest management plans for rational use of forest resources
- Reduced-impact logging
- Reforestation of degraded lands to meet timber and energy needs
- Alternative livelihood programs
- Intensifying agriculture and promoting agroforestry

9.5 Conclusion

Carbon markets have the potential to deliver vast amounts of money based on a few fundamental principles. The cost efficiency of achieving the emission reductions is probably the most important determinant of the direction of financial flow under a market-based system. As this chapter has described, there are a number of risks associated with REDD credits. Without addressing

these risks at the policy level, Nepal cannot be made competitive on this front.

The current type and distribution of CDM projects gives us a strong hint at what to expect from a market-based REDD system. It will not be a surprise if most of the projects under a REDD mechanism go to Brazil and Indonesia, the two countries that make up the largest share of global forest-related emissions. Furthermore, REDD may not deliver the co-benefits that proponents say it will. If we look at the majority of the CDM projects, they involve making minor changes in industrial processes and one can question how such changes are leading to sustainable development and technology transfer.

Working in Nepal's favor, however, is the experience of community forests in sustainable management of forests. As the community forest user groups exist as federated bodies, they also offer the opportunity to bundle projects together. Without this possibility, taking a project wise approach, transaction costs would be much too high. The government must facilitate local involvement in REDD by extending tenure and land rights to the CFUGs so that they can enter into contracts with project developers.

Furthermore, REDD has substantial costs that need to be borne before a proper mechanism can come into effect. Though FCPF has been helping to prepare some countries, whether the scale of financial and technical assistance that it promises to offer will be enough is yet to be known. Karsenty (2008) argues that the implications of requiring upfront funds extends to the poverty and equity dimensions. The poorest countries are less likely to participate if the payment of REDD credits is only on delivery or evidence of carbon stock gains.

Developing a full appreciation of what risks are considered by investors in the carbon market will help to think about how domestic institutions can respond accordingly. It has been shown that carbon markets together with fund-based mechanisms can supply the necessary financial resources to both address emission reduction objectives and achieve livelihood benefits.

Chapter 10

Forest carbon accounting: Lessons learnt from a pilot project in Western Nepal

- Mohan B Gurung[19]

Abstract

In spite of accounting for 17-25% of anthropogenic emissions, deforestation was not included in the Kyoto Protocol. The UN Convention on Climate Change has recently decided to include it in future agreements and has asked its scientific board to study methodological and scientific issues related to positive incentives for reducing emissions from deforestation and forest degradation (REDD) in a post-2012 climate change regime. Assessing forest carbon budgets has received much attention in recent years (IPCC 2000, 2001, 2007). The estimation of carbon stocks provides objective information to support consultations, negotiations and policy processes.

A wide range of organizations and experts are involved in developing methodologies for the quantification of carbon sequestrated by forests and are working to include forests in carbon offsetting schemes. Various tools and techniques have been developed so far to assess forest carbon for both voluntary and regulated markets. The technical standards, guidelines and methodologies for carbon and other green house gas accounting are critical tools that shape the rules of the game in the international climate change politics. This paper reveals that much more research needs to be done to obtain estimates specific to Nepal that can be used for carbon accounting. Cost effective methods that incorporate broad based local participation can be used. However, different methods have to be carefully weighed before embarking on forest carbon accounting projects.

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10.1 The pilot project

As a part ofstrengthening capacity to understand the science of REDD,especially the interface between forests and climate, anearly action pilot study has been undertaken in the western Terai region of Nepal by the Terai Arc landscape (TAL) program, with technical support from Winrock International-Nepal and financial support from WWF Nepal. This study aims to assess the carbon sequestration potential, permanency, leakage and risks of carbon emission from forests. The initiative also aims to establish a baseline for the early action pilot project through enhancing knowledge and the scientific basis for REDD.The ultimate goal of the project is to ensure the ecological, economic and socio-cultural integrity of the critical bottlenecks through forest carbon financing which will also serve as a basis for the formulation of REDD policy and programs in Nepal.

Figure 10.1 The project area consists of a pristine*Bombax* spp forest

The study was carried out in two forest blocks of three district–Dang, Banke and Bardia—during 2009. The study sites are located in the Khata corridor and the Lamahi-Mahadevpuri complex, which are part of the Terai Arc Landscape. The study area covers a total of 133,000 ha out of which 71,000 ha are classified as a dry tropical forest ecological region based on the guidelines set forth by the IPCC (2006). The areas are lowlands with the altitude going down to below 300 m. They have a pronounced dry season that extends over five months with rainfall of less than 1500 mm per year.

10.2 Selection of carbon accounting methodology

Selection of an appropriate carbon accounting methodology depends on the nature of the proposed project. As the IPCC Guidelines for National Greenhouse Gas Inventory (2006, Volume 4) for Agriculture, Forestry and Other Land Use (AFOLU) sectorsare mainly designed for national-level inventories, there is less detail given on project-specific methods. MacDicken (1997), Pearson *et al.* (2007) and others have designed tools and techniques suitable for use at the project level or at a single site. Similarly, the Voluntary Carbon Standard (VCS) focus more on estimating leakage, permanency and additionality while the REDD Sourcebook offers guidance on methodological issues covering remote sensing and ground-based techniques. All of these guidelines help to build a hybrid methodology that is able to accommodate the local context, the nature and the size of the proposed project.

Gibbs *et al.* (2007) have enumerated a number of methods to estimate forest carbon stocks at different tiers with various levels of accuracy. It is more feasible to rely on ground-based forest inventory rather that remotely sensed data to estimate forest carbon stock, because of the cost involved in installing and managing high-tech remote sensing equipments. (Gibbs *et al.* 2007). They also argue that forest inventory methods whereby ground-based measurements of tree diameters or volume are related to forest carbon stocks using allometric relationships have a very low level of uncertainty. Therefore a ground-based inventory method was used to estimate carbon stocks for the study, while remote sensing was used to analyze historic land cover and to make projections in lieu of the lack of historic forest carbon data.

To encourage broad-based participation for the robustness on methodological issues of forest carbon accounting, expert consultations and peerreviewsof the proposed methodology were carried out. The proposed methodology included input from experts and the results of other pilot projects. The Peer Review Committee included experts from the fields of soil science, biometrics, forest inventory, forest carbon inventory, remote sensing and geographic information system, community forestry, biodiversity conservation and climate change. Inputs from both national and international experts were incorporated into the methodology. The pilot study was carried out in March 2009 while fieldwork was carried out during April-May 2009.

10.3 Methods

Human resources and field equipment

By training local people in carbon inventory techniques, a community-based carbon monitoring program can be created to ensure sustainability. Community forest user groups already practice forest monitoring in Nepal while preparing the forest inventory documents for the periodic renewal of their community forest management plans. Therefore, Local Resource Persons (LRPs) for forest carbon inventory were trained as a starting point for community-based carbon monitoring. The inventory team members were equipped with a set of equipment, including a location map of sample plots with coordinates uploaded in GPS, to determine the exact location of the sample plots. All equipment was calibrated, and the weight and size of the sampling bags were noted down prior to conducting field measurements.

Land cover change analysis

Landsat ETM+ imagesfrom the years 1999, 2001 and 2006 were geo-referenced with sub-pixel accuracy. The thermal band was re-sampled to a 30-meter pixel size to normalize the spatial scale differences between the optical and the thermal bands. The spectral radiances of each of the seven bands (band 1 to 7 of the ETM+ imagery) were calculated and converted to reflectance. Thiscalculation was used as the basis for further analysis.

A semi-expert system in image classification, Rikimaru (1996) introduced an alternative deductive approach, i.e. forest canopy density mapper (FCD), to map forest canopy density using four indices from Landsat TM: vegetation, bare soil, shadow and surface temperature. This model involves bio-spectral phenomenon modeling and analysis utilizing data derived from four indices: Advance Vegetation Index (AVI), Bare Soil Index (BI), Shadow Index (SI), and Thermal Index (TI). Using these four indices, the canopy density for each pixel was calculated in percentages. AVI reacts more sensitively to the vegetation quantity, compared toNormalized Differrence Vegetation Index (NDVI). Shadow index increases as the forest density increases. The Thermal Index increases as the vegetation quantity decreases and the Bare Soil Index increases as the degree of bare soil exposure of an area increases.The four indices were expressed in percentages for each pixel.

Based on these four variables, ten canopy density classes, namely 1-10, 11-20… 91-100, were obtained. As the focus is on forests,patches with vegetation canopy density of less than 10% and patches of vegetation smaller than 0.5 ha were discarded from the analysis. The remaining canopy density classes between 10-100% were grouped into three classes according to the classes mentioned in the Master Plan for Forest Sector of Nepal (1988):

- 10-40%: Degraded Forest
- 41-70%: Moderate-Density Forest
- > 71%: DenseForest

Carbon stock estimation and projection

Field sample size

A pilot inventory was carried out to estimate the variance of the carbon stock in the forest strata. This is required to calculate the number of plots required for the inventory. The following statistical formula adopted from Pearson *et al.* (2005) was used to determine the required number of sample plots:

$$n = \frac{(N \times s)^2}{\frac{N^2 \times E^2}{t^2} + N \times s^2} \qquad \text{(Equation 1)}$$

Where,

E = Allowable error or the desired half-width of the confidence interval, calculated by multiplying the mean carbon stock by the desired precision (that is, mean carbon stock x 0.1, for 10 per cent precision),

t = the sample statistic from the t-distribution for the 95 per cent confidence level. *t* is usually set at 2 as the sample size is unknown at this stage,

N = Number of sampling units for stratum (= area of stratum in hectares or area of the plot in hectares),

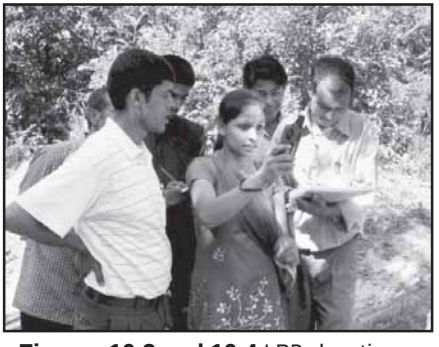
n = Number of sampling units in the population

s = Standard deviation of stratum

Field measurement

With the help of a GPS, 500 square meter size circular plots for tree were established as permanent plots. Tree height was measured using a Sunto Clinometer and a Haglof DME. Each tree within the plot was marked with a

numbered tag about 10 cm above the ground facing the plot center.Likewise, the tree diameter was measured at 1.3 meter above ground level (DBH) using a diameter tape. Shrub biomass was measured in a 25-metersq. plot (2.82 m radius) at the northern edge of each tree plot. The destructive method prescribed by Pearson *et al.* (2005) was applied to measure the biomass inside the plot. The weight of the total biomass inside the sub-plot was recorded. Then the shrubs were cut into pieces and a 500-gram sample from well-mixed pieces of shrub mass was taken into the laboratory to determine its oven-dry weight. Deadwood and litter consist of dead leaves, twigs, branches, grasses, downed dead wood, and standing dead wood. The litter samples were collected from four sub-plots of one sq. meter located along the inner edges of the four directions (east, west, north and south) of each tree plot.



Figures 10.3 and 10.4 LRPs locating sample plots using GPS (left) and measuring tree diameter (right) (Photos by Mohan B. Gurung)

Soil organic carbon was determined from the samples collected from the default depthprescribed by the IPCC guidelines (2006). The default depth of 30 cm from ground level was used for convenience and cost efficiency. Pits were dug at five different points in a W-shape. Such W-shaped pits were dug in four sites inside the litter sub-plots. Collected soil samples were well-mixed in different phases and a 500-gram sample was taken for laboratory analysis. Likewise, a core sampler was used to collect soil cores for bulk density calculations. The collected soil samples and core samples were marked with sample plot numbers and brought to Kathmandu for laboratory analysis.

Biomass model for carbon stock calculation

According to Chave *et al.* (2005) one of the major sources of uncertainty in all estimates of carbon stocks in tropical forests is the lack of standard models for converting tree measurements into aboveground biomass estimates.

Published regression models here in Nepal are usually based on a small number of directly harvested trees and include very few large diameter trees. Hence, these estimates do not represent forests in general. This explains why two models constructed for the same forest may yield different AGB estimates, a difference exacerbated for large trees, which poses a greater uncertainty for stand-level biomass estimates (Brown 1997; Nelson *et al*. 1999; Clark and Clark 2000; Houghton *et al*. 2001; Chave *et al.* 2004). The biomass model developed for the Nepalese tree species neither coversall diameter classes, nor are they available for all species. Moreover, they have not considered the wood specific gravity of each species which Chave *et al.* (2005) concludes to be an important variable in biomass function.

Furthermore,as the natural forests of the project area contain many tree species per ha, one cannot use species-specific regression models. Instead, mixed species tree biomass regression models must be used. To overcome the limitations of locally available models, we used the following regression model,which was critically assessed by Chave *et al.* (2005) and compared with five other different models for quality and robustness in the forests of Uttar Pradesh, India. Uttar Pradesh shares similar climatic conditions and vegetation types with Nepal. Chave *et al.* (2005) claimed that the regression model has just –0.39% departure between estimated and measured biomass and has performed the best fordry tropical forest types of Uttar Pradesh, India.Still, this model only covers a DBH range of up to 34.7 cm.

Table 10.1 Model used to estimate aboveground biomass of trees

Ecological domain description	Model	dbh range	Source
Altitude: 350 m asl Rainfall: =1200 mm Dry months: 7 Forest type: Dry tropical	ln (AGB)= -2.235+0.916 ln ($D^2H\rho$)	5-34.7 cm	Chave *et al* (2005)

This biomass regression model seeks information on the trunk diameter D (in cm), total tree height H (in m) and wood specific gravity ñ (in g/cm^3). Tree diameter and height were measured in the field, while wood specific gravity was derived from the “Master Plan for the Forestry Sector Nepal: Forest resources information status and development plan”. A weighted specific gravity of 0.878 and 0.87 for Sal (*Shorea robusta*) and its associated species and Khair-Sissoo (*Acacia catechu - Dalbergia sissoo*) trees were used, respectively. The biomass of individual trees was multiplied by the carbon fraction prescribed by IPCC (2006) (Table 10.2).

The carbon content of individual trees was summed up and divided by the sample plot area to determine the expansion factor of carbon per unit area. The total carbon stock of the forest area was calculated by multiplying the total forest area by this expansion factor.

Table 10.2 Carbon Fraction of Aboveground Biomass

Domain	Tree Parts	Carbon Fraction (CF) Mg C (Mg d.m.)$^{-1}$	Reference
Tropical	All	0.47 (0.44-0.49)	Andreae and Merlet, 2001; Chambers et al., 2001; McGroddy et al., 2004; Lasco and Pulhin, 2003

Source: IPCC, 2006

Aboveground shrub and litter biomass

Shrub samples collected through the destructive method were oven dried in the laboratory. The green weights of the samples were also taken at the inventory spot. The ration of oven-dry weight to green weight was used to extrapolate the total oven-dry weight of the shrub mass of the sample plot. Similarly, an expansion factor of oven-dry shrub biomass derived from the shrub sample plot area (25 sq. m) and the total oven-dry shrub biomass of the sample plot were used to calculate total shrub biomass per ha for the entire project area. A similar technique was applied to calculate the litter biomass of the sample plots of the entire project area.

Below-ground biomass

IPCC (2006) has recommended the default value in Table 10.3 for the ratio of belowground to aboveground biomass.However, most of the sample plots of the project area have more than 20 mg aboveground biomass per ha. Thus the ratio of 0.28 was used for the calculation of belowground biomass, to provide a conservative estimate of total biomass. The product of the ratio (R) and the aboveground biomass of the sample plot gives the belowground biomass in kg.

Soil organic carbon

Analysis of soil samples was done in the Soil Science laboratory of the National Agriculture Research Council (NARC) in Kathmandu. Two tests—

Table 10.3 Ratio of Belowground Biomass to Aboveground Biomass

Domain	Ecological Zone	Aboveground Biomass	Ratio(R) $(mgshoot)^{-1}$	Reference
Tropical	Tropical dry forest	Aboveground biomass <20 Mg ha^{-1}	0.56 (0.28-0.68)	Mokany*et al.* 2006
		Aboveground biomass >20 Mg ha^{-1}	0.28 (0.27-0.28)	

Source: IPCC, 2006

for soil bulk density and soil organic carbon—were carried out to determine the total soil organic carbon content in the project area. The Soil Bulk Density is the ratio of oven-dry mass to the core volume of the sample. It was determined by the core method. The sample was dried at $110^0 \pm 1^0$ C and weighed for the oven-dry mass, which was divided by the volume of the cylindrical metal sampler. The soil organic carbon (SOC) analysis was done using the Colorimetric method with the external heating method and standard laboratory procedures described by Anderson *et al.* (1993) and Baker (1976). From the values obtained, SOC (Mg ha^{-1}) was calculated using the equation adopted from Pearson *et al.* (2005), given below:

$$\text{SOC (Mg/ha)} = (\text{Soil Bulk Density (gm/cm}^3) \times \text{Soil Depth (cm)} \times \text{C}) \times 100$$

(Equation 2)

Where C is the carbon fraction of the sample expressed as a decimal.

The total soil carbon stock in the forest was calculated from the average carbon stock of all plots, extrapolated to per ha and multiplied by the total forest area.

Total carbon stock

All biomass measurements, including aboveground biomass, belowground biomass, and litter were converted into carbon content and summed up for their respective plots in tons of carbon per hectare using an appropriate expansion factor based on the area of each plot. The expansion factor for the total forest area was derived by summing up the carbon per hectare results for all plots, including soil organic carbon, divided by the total number of

sample plots. This expansion factor was used to calculate the total carbon stock of the project area.

Projecting baseline and with-project scenario

The baseline scenario provides potential forest cover change and corresponding carbon stock changes under a business-as-usual (i.e. no-project) scenario. To define the current status of carbon stock and project the future sequestration potential of the forests, two types of data were analyzed: i) spatial data to estimate the current area under different land uses as well as future projections; and ii) forest carbon inventory data to estimate the carbon stock (Mg C ha^{-1}) in the major carbon pools. The deforestation rate without the project scenario is the product of the area that would have been deforested in the absence of the project and the carbon stock lost through deforestation. The carbon stock lost through deforestation is the average carbon stock per ha minus the average residual carbon stock that remains post-deforestation.

To estimate the effect of protecting such an area on the net reduction of carbon dioxide emissions, it is important to determine the likelihood or risk that a given area will be deforested. Projected rates of deforestation can subsequently be combined with this risk assessment and estimates of carbon stocks in the forests to produce estimates of the net GHG emissions that would occur if the area was not protected. To develop a framework for reporting carbon benefits from forest protection activities, a spatial modeling approach of deforestation and quantitative analysis of future modeled deforestation (projected baseline) combined with a field inventory was used. Carbon stock changes due to degradation will bedetermined by the stock difference of the permanent sample plots in the subsequent inventories.

The baseline scenario was compared to the with-project scenario, in which fewer hectares are deforested and there is a lower rate of degradation due to project activities. Emissions reductions from avoided deforestation attributable to the project were then calculated as the difference between the with-project and without-project hectares deforested multiplied by the average carbon stock lost through deforestation.

Drivers of deforestation and forest degradation

Baseline drivers of deforestation and forest degradation are defined as the activities predominantly taking place in the absence of the project, which the

project will reduce. Like elsewhere in the country, the project-specificdrivers of deforestation and forest degradation lie outside the direct influence of the forestry sector. The major drivers of deforestation and degradation are agriculture, energy, urbanization, infrastructure development and demographic changes.The drivers act at different levels and the people engaged in activities that cause deforestation and degradation are called 'baseline agents'. Baseline agents of deforestation and forest degradation in the project area include forest dependent communities, migrants, landless and forest dwellers, cattle ranchers, fuelwood collectors, and timber contractors, including industries like Katha-cutch, pulp and paper, plywood and furniture.

With-project deforestation projection

After 20 years of project implementation, the deforestation rate is assumed to be constant for the remainder of the 30-year analysis period as we assume that there is some residual deforestation that cannot be eliminated. The following exponential decay function was used:

$$\text{Ratetime}_2 = \text{Ratetime}_1 \times (1\text{-k})^{20}$$

Projection of emissions reductions

By multiplying the difference in the area deforested with and without the project,during the project period,with the average CO_2 emissions from deforestation per ha gives an estimate of the avoided emissions attributable to the project each year.This is a conservative estimate of emission reductions that could be claimed by the project. This estimate is most likely an underestimation of the emission reductions achieved as the technique used was conservative and does not incorporate the carbon stored in wood products for a long period of time. Non-CO_2 GHG emissions represent an additional and potentially significant component of the project's overall GHG emissions benefit. The current analysis does not consider any changes in non-CO_2 GHG emissions due to avoided deforestation. However, methane (CH_4) emissions from forest fire could be a significant part of the baseline scenario.

Leakage, permanency and additionality

Leakage as a negative externality of the project can cause loss of net carbon benefits of the project as a consequence of the implementation of leakage

triggering project activities. Leakage is associated with drivers and agents of deforestation and degradation. The potential magnitude of leakage of any activity is determined by the extent of the unmet demand and the compatibility of the activity with present land use and management practices. During the baseline study, project activities that can trigger possible leakage were identified and alternative livelihood activities were explored in order to reduce leakage. Potential leakage was estimated using a twin track approach: by identifying the key indicators such as demand and supply of fuelwood and timber from the project area and by establishing permanent sample plots in the leakage belts.

Baselinesof the rate of collection of fuelwood, timber and other forest products from the project area were collected through participatory rural appraisal and a household survey. During each verification period, subtracting the with-project rate from the baseline rate of forest products collection provides an estimate of the volume of fuelwood, timber and other forest products displaced outside the project area by the project activity. Furthermore, permanent sample plots at the major leakage belts were established for monitoring and verification purposes.

Forests are not permanent stores of carbon; natural or anthropogenic disturbances, such as fire, pests or land-use change decisions can result in GHG emissions from forests that were once protected. The potential reversibility of sequestered/protected carbon must be addressed to be eligible for REDD/VCS crediting.REDD activities will delay deforestation for a finite period of time (VCS 2007). To mitigate the risk of non-permanence, VCS uses a buffer mechanism to secure long-term carbon benefits of the REDD project activities. However, at this preliminary stage, only the principal risk factors for a REDD project and potential mitigating activitieswereidentified during the survey and consultation workshops using PRA tools.

Drivers and agents that bear risks for permanence were identified. The overall risk rating of the project is recommended to be done in the stages of project design, implementation and monitoring. During project design, non-permanence risk analysis was recommended following the VCS (2007) recommended “risk likelihoods x significance” approach to assess both quantitative and qualitative risks in an integrated manner and to come to a single overall risk classification of “low”, “medium”, “high” or “unacceptably high”.

In order to satisfy additionality, the project must demonstrate that the increase in the carbon stock from the project is additional to what would have happened in the absence of the project. The following three VCS-proposed tests were carried out to demonstrate that the project was additional:

- Project test
- Performance test
- Technology test

Quality assurance and quality control

Forest inventory teams were comprised of a forest technician, local resource persons and community members. The teams were supported by forestry experts from Winrock International and WWF. Prior to conducting field work, each member of the team was trained on all aspects of data collection. Step by step procedures and standard data collection formswere prepared for the field work. Checking of measurement techniques as well as measured data wasalso done by the experts. A Forest Carbon Expert and a Social Survey Expert monitored, supervised and carried out different checks in order to ensure the quality of the field work. Two different types of checks were conducted during the baseline survey:

- Hot Check and
- Blind Check

Hot checks were done during the inventory work in the presence of crew members and feedback and suggestions were provided on the spot. Besides on the spot coaching, guidance through mobile phone was provided in the case of any confusion during the field work. Blind checks were carried out after the completion of inventory work by the crew.

Uncertainty assessment

The calculation of total uncertainty was done by the simple error propagation method.

10.4 The way forward

Frequency of monitoring

Since the measurement involvedground based carbon inventory, same methodis recommended for monitoring purposes in the future as well. However, since the magnitude and rate of change of carbon stocks varies from pool to pool, different time intervals are prescribed for the purpose of monitoring. Considering global as well as national practicesof forest inventory, five-year intervals are recommended for the re-measurement of biomass.This can be shortened upon the availability of resources for inventory and the requirements of verification. To detect carbon emissions from forest degradation, yearly monitoring is recommended. Soil organic carbon is to be measured every 10 years due to the slow response of the soil.

Capacity building of stakeholders and community-based carbon monitoring

The project area is a mosaic of forest management modes, including community forests, government-managed national forests, private forests and agro-forestry plots. The study estimated that a significant part of the project forest area is covered by community forests. Management practices of these community forests, therefore, play a vital role both in the carbon sequestration rate as well as the permanency of the sequestrated carbon. Capacity building of these communities for an optimal combination of management practices to derive multiple benefits and perform carbon monitoring should be a componentof the project. Development of LRPs during the baseline inventory period was the first step towards capacity building of the local communities. These LRPs are expected to support the concerned CFUGs in future carbon and forest inventory work. Such inventory work is mandatory for the renewal of community forest management plans which are usually stipulated for five years.

In order to increase carbon sequestration rates to maximize benefits from carbon financing, it is imperative to integrate carbon stock inventories into community forest management plans. The management activities that increase the sequestration rate and reduce emissions should be incorporated into management plans. This can be done by community-based training and awareness-building activities during the project period. Periodic carbon

inventory data should be incorporated into the community forest management plans as carbon sequestration is one of the forest management objectives.

Scoping for the voluntary market

The baseline information is required for the preparation of a project design document for the carbon forestry project. Even in the best-case scenario, REDD will take more time to materialize under a compliance market. Therefore the project can benefit from the voluntary market. The ex-ante quantification of the baseline and with-project scenario were calculated in order to determine the feasibility of the project and to select significant carbon pools. Some carbon pools were excluded from the calculation to generate a conservative estimate of the number of carbon credits generated. To be eligible for REDD projects under VCS, the boundary of the REDD activity should be clearly delineatedand defined and include only land qualifying as “forest” for a minimum of 10 years prior tothe project start date.

The project comprises the following VCS REDD activities:

- Avoiding unplanned frontier deforestation and degradation (AUFDD): reduces GHG emissionsby stopping deforestation/ degradation of degraded to mature forests at the frontier that hasbeen expanding historically, or will expand in the future, as a result of improved forest access.
- Avoiding unplanned mosaic deforestation and degradation (AUMDD): reduces GHG emissionsby stopping deforestation/ degradation of degraded to mature forests occurring under themosaic configuration.

The baseline report of the proposed project for VCS REDD has two main components:

- A land-use and land-cover change component; and
- An associated carbon stock change component.

Baselineprojections of deforestation and degradation under the AUFDD and AUMDD activities have been developed considering the deforestation rates of the Terai region in which the project area is located. Thistakes into account historical deforestation and degradation rates.Also the proposed regional baseline areais similar to the project area in terms ofthe drivers of

deforestation/degradation, landscapeconfiguration and socio-economic and cultural conditions.

10.5 Lessons for national and sub-national REDD projects

Choice of methods

As discussed earlier, the baseline report of the proposed project for VCS REDD has to have two main components: a land-use and land-cover change component; and an associated carbon stock change component. To detect land-use and land-cover change in the project area, remote sensing is not only a useful tool but it can also be used for stratification of the project area. However, the lack of Landsat images for the desired years was a major challenge for the study. Adequate planning is essential for the use of remote sensing in forest carbon inventories.In Nepal's context, community involvement in carrying out regular forest inventories is high. In addition, the field labor costs are low. Considering the limited access to remote sensing, ground-based forest inventory techniques for measuring changes in carbon stocks should be given priority.

Two methods can be employed to determine carbon stock changes: the Gain-Loss Method based on estimates of annual change in biomass from estimates of biomass gain and loss; and a Stock-Difference Method which estimates the difference in total biomass carbon stock over a particular time period. The biomass gain-loss method is applicable for all tiers. The stock-difference method will provide more reliable estimates for relatively large increases or decreases in biomass or where very accurate forest inventories are carried out. Since the project area covers a small area, the stock difference method was applied. For the national inventory system, the availability of data and information fromecological surveys, forest ownership patterns, activity data, conversion and expansion factors, as well as cost-benefitanalysis should be taken into consideration while choosing a methodology.

Biomass models

The IPCC Guidelines recommend local biomass models to estimate the aboveground and belowground biomass. However, there are some limitations to using biomass models developed for Nepalese tree species. These biomass

modelshave coveredonly a small range of diameter classes and have not considered wood specific gravity of the species that Chave *et al.* (2005) conclude to be an important variable in the biomass function. The biomass models of major tree species and their associated species covering larger diameter classes should be developed and used for carbon accounting. Otherwise, we have to rely on regional models that are published internationally and may not yield the best estimates for Nepal.

Degradation analysis

Monitoring forest degradation requires mapping to be carried out at least annually as the spatial signatures of the degraded forests can substantially within one year. (GOFC-GOLD Project Office 2008). Due to the unavailability of annual images of the project area, it was not possible to predict the trends in forest degradation and, consequently, avoidance of emissions from forest degradation. In addition, monitoring methods based on remote sensing may not be appropriate when gaps in the forest canopy are not detected. Therefore, the annual measurement of permanent sample plots, at least at the initial period, is recommended to detect and prepare a model of forest degradation. Ground measurements are also important to cover collection of dead wood and understory vegetation.

Institutional capacity

A suitable degree of organizational capacity within the country is required to establish andoperate a national forest-carbon monitoring program. Prerequisites include the acquisition of different typesof data, analysis, estimation, and international reporting. Different actors and sectors need to work in coordination to make the monitoring system efficient in the long term.Sustainability considerations are important in setting up a REDD monitoring system.UNFCCC (2009) has recommended the establishment and maintenance the following institutions as a minimum, with a clear definition ofroles and responsibilities:

- A national coordination and steering body or advisory board
- Central carbon monitoring, estimation and reporting authority/ department
- Forest carbon monitoring implementation units

Like elsewhere, carbon inventory is in its infant stages in Nepal. The Department of Forest Survey, which is responsible for monitoring national forest resources and reporting, and the Department of Forests, which regularly carries out forest inventories for the preparation of community forests' Operational Plans, are yet to develop their capacities in this new field. Organizations like Winrock International/WWF, ICIMOD and individual researchers have been working to take this forward. It is essential to consolidate the knowledge of such organizations and individuals to design a national monitoring, reporting and verification (MRV) plan for the success of REDD in Nepal. In addition, research on the development of biomass models, upgrading facilities of central laboratories and devising robust and context-specific degradation analysis tools should be given major attention. Community forest management plans should incorporate carbon as a forest product and incorporate management activities for optimum carbon sequestration.

10.6 Conclusion

The pilot project was envisioned to ensure ecological, economic and socio-cultural integrity of the critical bottlenecks of the Terai Arc Landscape through forest carbon financing. To realize this objective, a study was carried out to assess the carbon sequestration potential of the forests of the study area and to establish a baseline for the early action pilot project through enhancing knowledge and the scientific basis for REDD. The WWF/Winrock joint initiative under the TAL program was the first in Nepal to provide major support to prepare Nepal for REDD.

The carbon accounting methodology adopted for the study is based on the national green house gas inventory guidelines (IPCC 2006). To address the issues of leakage, permanency and additionality, the Voluntary Carbon Standards (2007) were followed whereas the Bio-Carbon Fund/Winrock International "Sourcebook for land use, land use change and forestry projects" was followed for field measurements. Furthermore, the "REDD Source book of Methods and Procedures for Monitoring, Measuring and Reporting" prepared by the GOFC-GOLD Project Office was used for the land use and land use change analysis.The pilot study demonstrated that state-of-the-art carbon accounting technologies can be implemented in Nepal in collaboration with local stakeholders. In addition, this project has also demonstrated that by involving local stakeholders, carbon accounting can be made more

sustainable and cost-effective, especially in terms of monitoring, reporting and verification (MRV) procedures.

The study has faced several limiting factors andidentified gaps in carbon accounting that should be addressed in national level MRV systems. The use of and access to remote sensing technologies and their implications for dependency on developed countries; the development of appropriate biomass models for a wide range of forest types including important parameters; capacity building of local stakeholders; choice of methods; the equipping of central laboratories; selection of degradation analysis methods; and the optimal combination of multiple forest management objectives are some of the issues that need to be addressed in a national level MRV system. Research and the sharing of innovative technologies across the North-South, South-South, and South-North divides, and among the various stakeholders within a country, should be encouraged. The establishment of an effective and efficient institutional setup at the national as well as regional level that encourages broad-based participation is also key to making REDD a reality.

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International climate negotiations are starting to give shape to a new policy mechanism that will provide incentives to reduce carbon dioxide emissions from deforestation and forest degradation (REDD) by compensating developing countries for their forest conservation and regeneration efforts. How ready is Nepal to implement REDD? Does it have the necessary institutions and technical capacity? To what extent can Nepal benefit, and in what areas and ways?

Ready for REDD? Taking Stock of Experience, Opportunities and Challenges in Nepal attempts to bring together some of the research and analyses that have been done in Nepal's context. The book aims to introduce the REDD process to the general reader and to help them understand the implications for Nepal. Anyone wanting to learn more about REDD's diverse sociocultural, technical, economic, ecological, institutional and political challenges and opportunities in a specific geographical context will benefit greatly from this volume.

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