USAID
FROM THE AMERICAN PEOPLE

MANAGING INDIA'S FORESTS IN A CHANGING CLIMATE:

EMERGING CONCEPTS AND THEIR OPERATIONALIZATION

MANAGING FORESTS IN A CHANGING CLIMATE:

EMERGING CONCEPTS AND THEIR OPERATIONALIZATION

OCTOBER 2017

This report was prepared by:
Tetra Tech
159 Bank Street, Suite 300
Burlington, Vermont 05401 USA
Telephone: (802) 658-3890
Fax: (802) 495-0282
Email: international.development@tetratech.com

Tetra Tech Contact(s):
Ben Caldwell, Chief of Party
159 Bank Street, Suite 300
P.O. Box 1397
Burlington, VT 05402
Tel: (802) 495-0282
Email: ben.caldwell@tetratech.com

TABLE OF CONTENTS

ABBREVIATIONS

A&R, A/R	Afforestation and Reforestation
ABS	Access to Benefit Sharing
ACU	Adult Cattle Unit
ADC	Autonomous District Council
AFOLU	Agriculture, Forestry and Other Land Use
ANSAB	Asia Network for Sustainable Agriculture and Bio-resources
AWG-LCA	Ad Hoc Working Group on Long-term Cooperative Action under the Convention
BEE	Bureau of Energy Efficiency
BCF	Bio Carbon Fund
BDA	Biological Diversity Act
BMC	Biodiversity Management Committee
BNDES	Brazilian National Development Bank
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CaT	Cap and Trade
CBD	Convention on Biological Diversity
CCBA	Climate, Community and Biodiversity Alliance
CCBS	Climate, Community and Biodiversity Standard
CDM	Clean Development Mechanism
CEBPOL	Centre for Biodiversity Policy and Law
CER	Certified Emission Reductions
CFR	Community Forest Resource
CFM	Community Forest Management
CIFOR	Center for International Forestry Research
CO	Community Organization

CO_2	Carbon dioxide
COP	Conference of Parties
CPR	Common Pool Resources
DFO	Divisional Forest Officer
DNA	Designated National Authority
DOE	Designated Operational Entities
EA	Ecosystem Approach
EAFM	Ecosystem Approach to Forest Management
EDC	Eco-development Committee
EI	Emission Intensity
EIA	Environment Impact Assessment
ELDF	Enviro-Legal Defence Firm
ERU	Emission Reduction Unit
ESMF	Environmental and Social Management Framework
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FC	Finance Commission
FCA	Forest Conservation Act
FCPF	Forest Carbon Partnership Facility
FD	Forest Department
FDA	Forest Development Agency
FGD	Focus Group Discussion
FGLG	Forest Governance Learning Group
FIP	Forest Investment Program
FPIC	Free, Prior and Informed Consent
FRA	Forest Rights Act
FRC	Forest Rights Committee
FREL	Forest Reference Emission Level
FRL	Forest Reference Level
FSI	Forest Survey of India
GCF	Green Climate Fund

GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GIM	Green India Mission
GIS	Geographic Information System
GOI	Government of India
GP	Gram Panchayat
GPS	Global Positioning System
GSDP	Gross State Domestic Product
HRG	Himalayan Research Group
IAS	Indian Administrative Service
IBIS	Integrated Biosphere Simulator
ICFRE	Indian Council of Forestry Research and Education
ICIMOD	International Centre for Integrated Mountain Development
IFA	Indian Forest Act
IIFM	Indian Institute of Forest Management
IIRS	Indian Institute of Remote Sensing
IISc	Indian Institute of Science
INCCA	Indian Network for Climate Change Assessment
INDC	Intended Nationally Determined Contributions
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal Rate of Return
ITD-HST	Institute of Trans-Disciplinary Health Sciences and Technology
ISFR	India State of Forest Report
IUCN	International Union for Conservation of Nature
JFM	Joint Forest Management
JFMC	Joint Forest Management Committee
KII	Key Informant Interview
LULC	Land Use/Land Cover
LULUCF	Land Use, Land Use Change, and Forestry
MARD	Ministry of Agriculture and Rural Development, Vietnam

MDF	Moderately Dense Forest
MEA	Millennium Ecosystem Assessment
MFP	Minor Forest Produce
MGNREGA	Mahatma Gandhi National Rural Employment Guarantee Act
MNREGS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoA	Ministry of Agriculture
MoEF	Ministry of Environment and Forests
MoEFCC	Ministry of Environment, Forest and Climate Change
MoPR	Ministry of Panchayati Raj
MoRD	Ministry of Rural Development
MoTA	Ministry of Tribal Affairs
MoU	Memorandum of Understanding
MoWD	Ministry of Wasteland Development
MRV	Measuring, Reporting and Verification
NAMA	Nationally Appropriate Mitigation Action
NAP	National Afforestation Programme
NAPCC	National Action Plan on Climate Change
NBA	National Biodiversity Authority
NCB	Non-Carbon Benefits
NDA	National Designated Authority
NDC	Nationally Determined Contributions
NFI	National Forest Inventory
NFMA	National Forest Monitoring and Assessment Programme
NFMS	National Forest Monitoring System
NFP	National Forest Policy
NFRL	National Forest Reference Level
NGO	Non-government Organization
NMPB	National Medicinal Plants Board
NORAD	Norwegian Agency for Development Cooperation
NPP	Net Primary Productivity
NPV	Net Present Value

NRLM	National Rural Livelihood Mission
NRM	Natural Resource Management
NRPS	National REDD Plus Strategy
NSSO	National Sample Survey Organization
NTFP	Non-Timber Forest Product
NWFP	Non-Wood Forest Product
OF	Open Forest
PAT	Perform, Achieve and Trade
PDD	Project Design Document
PES	Payment for Ecosystem Services
PESA	Panchayats (Extension To The Scheduled Areas) Act
PIS	Pre-investment Survey of Forest Resources
PPP	Purchasing Power Parity
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institution
R&D	Research and Development
RBP	Results-based Payment
REDD	Reducing Emissions from Deforestation and Forest Degradation
REDD+	Reducing Emissions from Deforestation and Forest Degradation, and the Role of Conservation, Sustainable Management of Forests, and Enhancement of Forest Carbon Stocks in Developing Countries
RFP	Requests for Proposal
SAPCC	State Action Plan on Climate Change
SBB	State Biodiversity Board
SEPC	Social and Environmental Principles And Criteria
SES	Social and Environmental Safeguards
SESA	Strategic Environmental and Social Assessment
SFD	State Forest Department
SFM	Sustainable Forest Management
SIS	Safeguards Information System
SNA	System of National Accounts

SOC	Soil Organic Carbon
TOF	Trees outside Forests
TOPS-FTC	Trading of Performance by States in Forest and Tree Cover
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UN-REDD	United Nations Programme on Reducing Emissions from Deforestation and Forest Degradation
UT	Union Territory
VCS	Verified Carbon Standard
VCU	Voluntary Carbon Unit
VDF	Very Dense Forest
VP	Van Panchayat
WLPA	Wildlife Protection Act
WP	Working Plan
WPC	Working Plan Code
WPO	Working Plan Officer
WWC	Wildlife Works Carbon
WWF	World Wide Fund for Nature

UNITS

cm	centimeter
dbh	diameter at breast height
€	Euro
Gt	giga ton
ha	hectares
INR	Indian Rupee
km	kilometer
km^3	cubic kilometer
m	meter
m^3	cubic meter
mCER	million CERs
mha	million hectares
Mha	milli hectares
mm	millimeters
Mt	metric ton
mtc	million tons of carbon
sq. km./km^2	square kilometers
t	ton
tc	tons of carbon
tCO_2eq	tons of carbon dioxide equivalent
USD	United States Dollar
yr	year

INTRODUCTION

Chapter 1: REDD+ and other key emerging concepts in forestry: relevance for India

Sushil Saigal

INTRODUCTION

A number of new concepts have emerged in the forestry sector at the international level over the past few decades. Notable among these is REDD+, the institutional and governance framework for reducing emissions from deforestation and forest degradation, and for promoting conservation, sustainable forest management, and forest carbon stock enhancement. This concept has come to the fore due to increasing concern over climate change and the realization that it cannot be addressed without focusing on the forestry sector – both as a major source and sink of greenhouse gases (GHGs). Two additional concepts have gained currency in recent decades: an ecosystem approach, developed by the Convention on Biological Diversity; and a landscape approach, which focuses on management of forests as an integral component of larger dynamic landscapes.

This book deals with the above three concepts, with a primary focus on REDD+. Section 2 of this introductory chapter presents the core ideas behind REDD+ and the ecosystem and landscape approaches. Section 3 discusses the relevance of these approaches to the Indian forestry sector. The final section, Section 4, outlines the book's overall structure.

KEY CONCEPTS

REDD+

The roots of REDD+ extend to the United Nations Framework Convention on Climate Change (UNFCCC),[1] which emerged from the United Nations Conference on Environment and Development (UNCED) held in 1992 (also known as the Rio Earth Summit). The convention detailed the parties' sustainable forest management commitments:

> All Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives, and circumstances, shall … [p]romote sustainable management, and promote and cooperate in the conservation and enhancement, as appropriate, of sinks and reservoirs of all greenhouse gases not controlled by the Montreal Protocol, including biomass, forests, and oceans as

well as other terrestrial, coastal, and marine ecosystems … (Article 4 (1) (d)).

The next major agreement (the Kyoto Protocol), signed in 1997, also included forestry.[2] This agreement "operationalized" the UNFCCC by requiring selected industrialized countries to commit to binding emission reduction targets, around 5 percent below the 1990 levels, during the first commitment period (2008–2012).[3]

From a global forestry perspective, the most important part of the Kyoto Protocol is Article 12 that relates to the Clean Development Mechanism (CDM). This flexibility mechanism allows non-industrialized countries (i.e., those not included in Annex I of the Protocol) to undertake project activities that contribute to certified emission reductions. Industrialized countries (Annex I countries) are allowed to use such certified emission reductions to meet part of their quantified emission limitation and reduction commitments. This flexibility mechanism contributes to efficiency as some projects in non-industrialized countries could achieve emissions reductions at a lower cost as compared to similar emissions reductions in industrialized countries.

Although forestry was included in the list of eligible activities (as part of land use, land use change, and forestry), its scope was limited to afforestation and reforestation (A&R).[4] Further, due to stringent requirements and complexity (e.g., issues related to baseline, permanence, additionality, and leakage), only 0.80 percent of the CDM projects could be registered under the A&R categories by 2014 (UNFCCC, 2014a).

The limit in scope of CDM forestry projects to A&R only excluded deforestation and degradation in non-industrialized (developing) countries from the international climate change mitigation framework. This meant that issues related to a major source of GHG emissions remained unaddressed. According to the Food and Agriculture Organization of the United Nations (FAO), deforestation occurred at an average rate of 16 million hectares per year during the 1990s (net change: -8.3 million hectares per year) and around 13 million hectares per year during the 2000s (net change: -5.2 million hectares per year) (FAO 2010). The Intergovernmental Panel on Climate Change (IPCC) estimated that deforestation contributed 5.8 gigatons of carbon dioxide emissions annually in the 1990s, which was over 17 percent of the total emissions and more than all emissions generated by the transport sector in the same time period (IPCC 2007).

This exclusion of a major source of GHG emissions from the international climate change mitigation framework continued for over a decade. "Reducing emissions from deforestation in developing countries and approaches to stimulate action" was first introduced as an agenda item by the Governments of Papua New Guinea and Costa Rica (supported by eight other parties) during the UNFCCC's eleventh session of the Conference of Parties (COP 11) held in Montreal, Canada, in 2005.

COP 13, held in Bali, Indonesia, formally took up the discussion of REDD+ in 2007. It was included in the "Bali Road Map," a set of decisions that represented the work to be done under various negotiating "tracks" to attain a secure climate future for the world. In addition to deforestation and forest degradation, the road map also included conservation, sustainable management of

forests, and enhancement of forest carbon stocks in the international dialogue.

The REDD+ approach was formally recognized during COP 16 held at Cancun, Mexico, in 2010. The outcome of efforts by the Ad Hoc Working Group on Long-term Cooperative Action under the convention were the "Cancun Agreements," reflected in Decision 1/CP.16, Paragraph 70, of this decision to launch REDD+ formally. Through this decision, the COP encouraged developing country parties to:

> [C]ontribute to mitigation actions in the forest sector by undertaking the following activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances:
>
> (a) Reducing emissions from deforestation;
> (b) Reducing emissions from forest degradation;
> (c) Conservation of forest carbon stocks;
> (d) Sustainable management of forests;
> (e) Enhancement of forest carbon stocks (Paragraph 70)

Points (a) and (b) above relate to REDD, whereas points (c), (d), and (e) constitute the "+" component.

The Cancun Agreements requested that developing countries develop the following elements of REDD+:

(a) A national strategy or action plan
(b) A national forest reference emission level and/or forest reference level
(c) A national forest monitoring system

The Cancun Agreements emphasized the need for environmental and social safeguards to ensure a multiplicity of forest functions, conservation of natural and biologically diverse forests, sustainable forestry management, respect for the knowledge and rights of indigenous peoples and local communities, and effective participation of relevant stakeholders.

The institutional and governance framework for REDD+ was further developed and formalized in subsequent COPs. At COP 19 held in Warsaw, Poland, in 2013, seven decisions (Decision 9/CP.19 through Decision 15/CP.19), collectively referred to as the "Warsaw Framework for REDD+," reaffirmed various decisions related to REDD+. The framework reiterated that (1) mitigation efforts have to be "in accordance with national circumstances," (2) REDD+ finance will be "results-based," and (3) agreed safeguards must be "addressed and respected" before any payments can be made. The framework also recognized the importance of incentivizing non-carbon activities for long-term sustainability and the critical role of the Green Climate Fund.

The REDD+ institutional and governance framework is still evolving. It is widely expected that the framework will be further refined over the next few COPs and implemented beginning in 2020. However, certain features of the final framework have already become apparent:

- The principal objective of the REDD+ mechanism will be to mitigate carbon emissions from forests through a wide range of activities described in the Cancun Agreements. Thus, the mechanism could be used either to reduce negative changes or enhance positive changes, not for business-as-usual activities.

- It is likely that the framework will be results based, meaning that the mechanism will fund eligible activities on the basis of results *achieved* in reducing or avoiding carbon emissions at the national scale.
- The activities eligible for funding under the REDD+ mechanism will have to be measured, reported, verified, and assessed on the basis of a previously developed reference level.
- In line with the principle of "common but differentiated responsibilities," activities undertaken will be subject to the developing countries' capabilities and circumstances and contingent upon delivery of predictable and adequate financial and technical support from developed countries.
- The REDD+ mechanism is unlikely to be limited to carbon only and will engage with a range of environmental and social objectives (UNEP 2014).

Ecosystem Approach

The concept of sustainability has a long history in organized forestry. The initial focus of forest management in several countries (including India) was on sustained yield of a limited set of goods and services, primarily timber. In recent

Box 1.1: Categories of Ecosystem Services

The Millennium Ecosystem Assessment (MEA) classified ecosystem services into the following broad categories along functional lines:

- Provisioning services: Products obtained from ecosystems, including food, fiber, fuel, genetic resources, biochemicals, natural medicines and pharmaceuticals, ornamental resources, and fresh water.
- Regulating services: Benefits obtained from the regulation of ecosystem processes, including air quality maintenance, climate regulation, water regulation, erosion control, water purification and waste treatment, regulation of human diseases, biological control, pollination, and storm protection.
- Cultural services: Non-material benefits obtained from ecosystems through spiritual enrichment, cognitive development, reflection, recreation, and aesthetic experiences. These include cultural diversity, spiritual and religious values, knowledge systems, educational values, inspiration, aesthetic values, social relations, sense of place, cultural heritage values, and recreation and ecotourism.
- Supporting services: Services necessary for the production of all other ecosystem services, including soil formation and retention, production of oxygen, nutrient cycling, water cycling, and provisioning of habitat. These services differ from the other three in that their impacts on people are either indirect or occur over a very long time.

Source: Millennium Ecosystem Assessment 2005

decades, the range of goods and services for which sustainable yield is sought has vastly increased, with a focus on forest ecosystem services (see Box 1.1).

Over time, the idea of sustainability evolved into the concept of Sustainable Forest Management (SFM). SFM reflects an acceptance of the need for sustainable development, defined in *Our Common Future* (also known as the Brundtland Report) as: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (WCED 1987, p. 43).

During the 1992 UNCED held in Rio de Janeiro, attendees arrived at an international understanding and consensus on sustainability, captured in a systematic manner for the first time in the Forest Principles.[5] For example, Principle 2(b) states that "[f]orest resources and forest lands should be sustainably managed to meet the social, economic, ecological, cultural, and spiritual needs of present and future generations." This understanding has been further refined over the past two decades through international forest policy dialogue within the Intergovernmental Panel on Forests, Intergovernmental Forum on Forests, and United Nations Forum on Forests. It has also benefited from the process of a set of criteria and indicators developed for achieving sustainability in forest management. Several international organizations, including the FAO, the International Tropical Timber Organization, the UNEP, and other members of the Collaborative Partnership on Forests, support this process. The deliberations regarding forest certification, although outside formal inter-governmental dialogue, also contributed to enhancing collective understanding of sustainability issues in forestry.

While several definitions of SFM have been attempted, some have gained wider acceptance and recognition than others. The FAO has adopted the following definition developed by the Ministerial Conference on the Protection of Forests in Europe (Sayer and Maginnis 2005):

> The stewardship and use of forests and forest lands in a way, and at a rate, that maintains their biodiversity, productivity, regeneration capacity, vitality, and their potential to fulfil, now and in the future, relevant ecological, economic, and social functions, at local, national, and global levels, and that does not cause damage to other ecosystems.

While the concept of SFM continues to remain widely accepted and relevant, there is a shift toward managing entire ecosystems rather than only some of their components, such as trees. As a result, an ecosystem approach, which originated from biodiversity conservation, is gaining currency and is being promoted for forest management. The ecosystem approach is closely aligned with "ecosystem management," which refers to the concept of managing entire ecological units in an integral and holistic way. Originally, and especially in the United States, the term was used primarily for understanding and managing ecological processes (Sayer and Maginnis 2005). An ecosystem approach has a broader scope than ecosystem management as it also includes relevant social processes. The ecosystem approach concept has been discussed and developed in the meetings related to the Convention on Biological Diversity. The convention defines an ecosystem approach as:

[A] strategy for the integrated management of land, water and living resources that promotes conservation and sustainable use in an equitable way … An ecosystem approach is based on the application of appropriate scientific methodologies focused on levels of biological organization, which encompasses the essential structures, processes, functions, and interactions among organisms and their environment. It recognizes that humans, with their cultural diversity, are an integral component of many ecosystems.

Box 1.2: Malawi Principles of Ecosystem Approach

The Millennium Ecosystem Assessment has classified ecosystem services into the following broad categories along functional lines:

- The objectives of management of land, water, and living resources are a matter of societal choice.
- Management should be decentralized to the lowest appropriate level.
- Ecosystem managers should consider the effects (actual or potential) of their activities on adjacent and other ecosystems.
- Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem management program should:
  - Reduce those market distortions that adversely affect biological diversity;
  - Align incentives to promote biodiversity conservation and sustainable use; and
  - Internalize costs and benefits in the given ecosystem to the extent feasible.
- Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.
- Ecosystems must be managed within the limits of their functioning.
- The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.
- Recognizing the varying temporal scales and lag effects that characterize ecosystem processes, objectives for ecosystem management should be set for the long term.
- Management must recognize that change is inevitable.
- The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.
- The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations, and practices.
- The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

Source: Convention on Biological Diversity n.d.

The Convention on Biological Diversity also developed a set of 12 principles (the "Malawi Principles") of ecosystem approach, which are listed in Box 1.2.

An ecosystem approach emphasizes maintenance of a sustained flow of ecosystem service bundles that contribute to human well-being. As succinctly expressed by the International Union for Conservation of Nature (IUCN): "use them, but don't lose them" (Pirot *et al.* 2000, p. ix).

Landscape Approach

In addition to an increasing emphasis on managing forests as ecosystems, another important change in international thinking is that forests are no longer viewed in isolation, but as integral parts of dynamic landscapes. In this context, a landscape can be defined as "a contiguous area… with a specific set of ecological, cultural, and socio-economic characteristics distinct from its neighbours" (WWF 2002).

A landscape approach focuses on large, connected geographic areas to fully recognize natural resource conditions and trends; natural and human influences; and opportunities for resource conservation, restoration, and development. It seeks "to identify important resource values and patterns of environmental change that may not be evident when managing smaller, local land areas" (BLM n.d.). For example, effective management of resources such as stream flow water and migratory wildlife is not possible unless a broader landscape perspective is adopted.

There is considerable global interest in landscape approach, especially forest landscape restoration. The objective is to regain ecological functionality and enhance human well-being across deforested or degraded forest landscapes. The focus is on landscapes rather than individual sites. This typically results in "a mosaic of interdependent land uses across the landscape, such as protected areas, ecological corridors, regenerating forests, agroforestry systems, agriculture, well-managed plantations, and riparian strips to protect waterways" (IUCN and WRI 2014).

The wide international acceptance of this approach is reflected in "The Bonn Challenge," a global effort to restore 150 million hectares of land by 2020 and 350 million hectares by 2030. By July 2017, the challenge had crossed the 150 million hectares mark, with pledges from 44 governments, private associations, and companies (IUCN 2017).

The landscape approach has also been introduced in India, especially by the National Mission for a Green India. The opportunities and challenges for doing so are discussed in Chapter 15 and the Conclusion.

RELEVANCE FOR INDIA

All three of these concepts – REDD+, the ecosystem approach, and the landscape approach – are very pertinent to the Indian forestry sector. India is among the ten most forested countries in the world, with a total forest area of around 76.46 million hectares, or 23.26 percent of the country's geographical area.[6] Actual forest cover – which is a better indicator than forest area – is also about 70.17 million hectares, or 21.34 percent of the country's geographical area (see Figure 1.1).[7] Additionally, estimates suggest the tree cover is around 9.26 million hectares, or 2.82 percent

of the geographical area.[8] Thus, the combined total of forest and tree cover in the country is 79.42 million hectares, or 24.16 percent of the country's geographical area (FSI 2015).

Forest and tree cover have been used as key indicators for India's forestry sector for several decades[9]. These indicators show that the country's forest and tree cover is not only respectable (given the high population pressure on land) but also stable and even improving over the past 30 years (see Figure 1.2).

While the forest and tree cover indicators are important, they do not reveal the full picture. For example, this indicators do not communicate the types of forests (natural or plantation), forest health (such as regeneration status), or how well these forests are managed. Therefore, we need to look at other indicators as well. For example, while the overall forest and tree cover is a respectable 24.16 percent of the country's geographical area, very dense forests (tree canopy density greater than 70 percent) cover a mere 2.61 percent of the

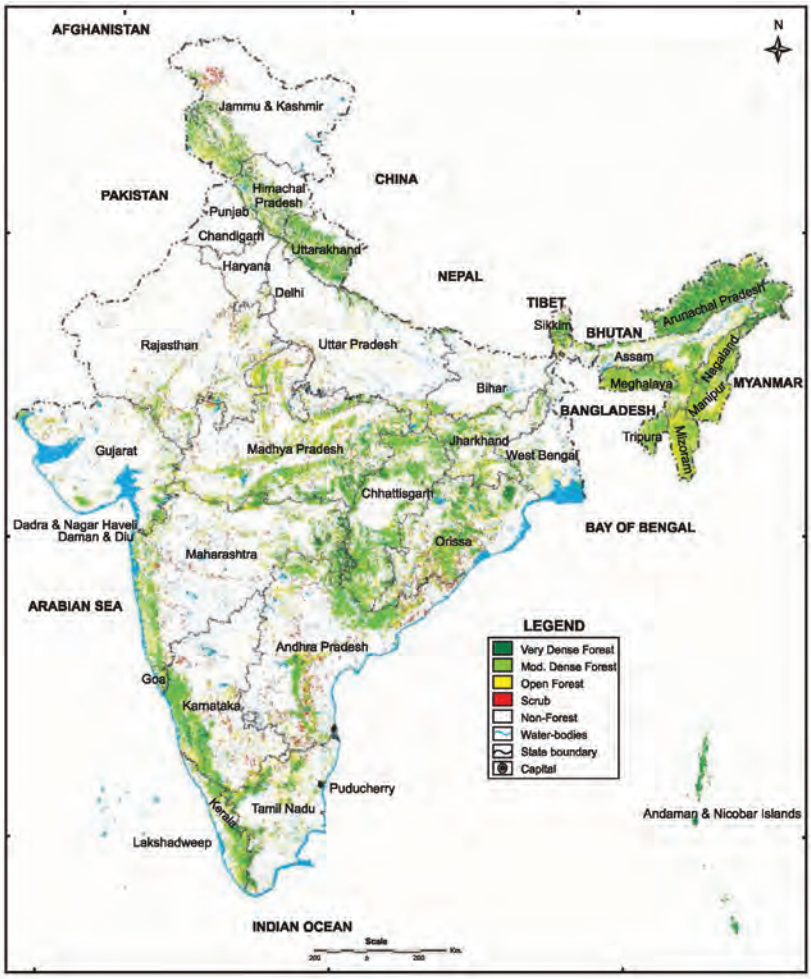


Figure 1.1: Forest cover map of India (FSI 2015)

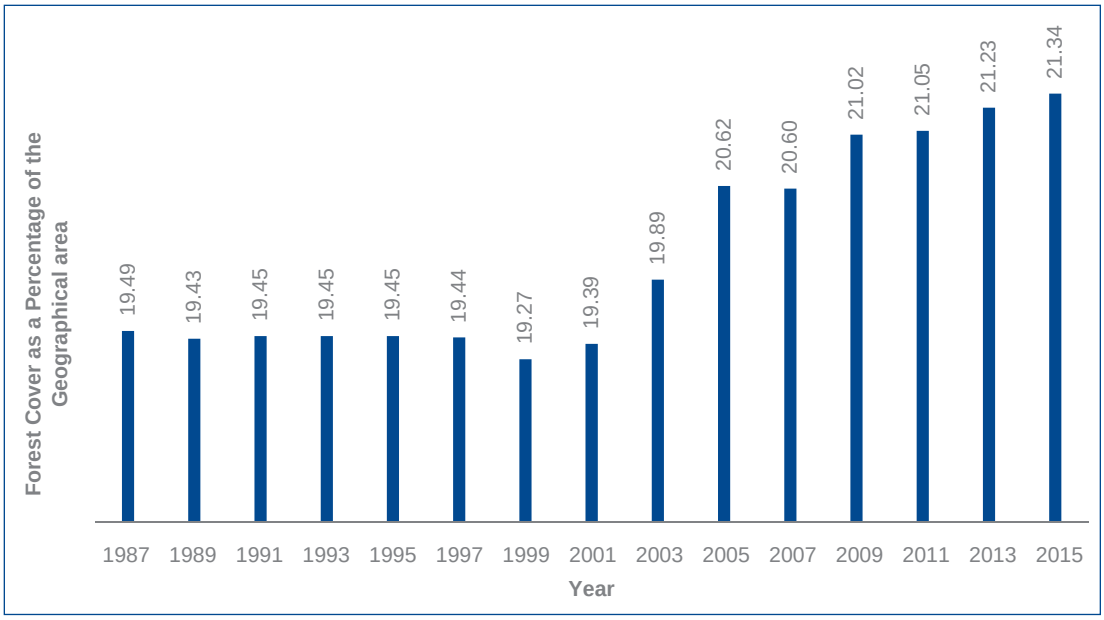


Figure 1.2: Change in forest cover of India, 1987-2015[10]

geographical area. Furthermore, as many as a third of all endemic species (faunal as well as floral) in India are facing the threat of extinction (NFC 2006). Growing stock (an important indicator from a climate change perspective) of India's forests is 58.46 m^3/hectare (FSI 2011), which is less than half the global average of 131 m^3/hectare (FAO 2010). Similarly, the carbon stock in the living forest biomass carbon pool is barely over half the global average (FSI 2013).[11] This indicates that there is great potential to enhance the stocking and carbon storage value of India's forests through sustainable management, which will make a significant contribution towards carbon sequestration for climate change mitigation. This has direct relevance for REDD+.

India's forest ecosystems are also critical for the country's water and food security. India's forests help in maintaining both river flows and groundwater aquifers. Hill forests, such as those in the Himalayas, feed India's major rivers. The national policy-makers have now realized the importance of watershed protection service provided by forest ecosystems. A task force constituted by the Planning Commission to look into issues related to hill areas noted:

> [The Himalayan] States must be persuaded to emphasize on a development path that does not disturb the primary colours of this picture: white, blue, green and brown representing the precious natural resources of the [Indian Himalayan Region], namely the snow and water, forest, and land (Planning Commission 2010a, p. 10).

Forests also play an important role in maintaining groundwater aquifers, which are critical for Indian agriculture. Around 60 percent of irrigated agriculture in India depends on groundwater, which is being exploited at an unprecedented rate (c. 210 billion m^3 per

annum). A study by the National Aeronautics and Space Administration showed that, between 2002 and 2008, India lost about 109 km^3 of water, leading to a decline in water table to the extent of 0.33 meters per annum (Planning Commission, 2010b). The above discussion demonstrates the need for adopting ecosystem and landscape approaches for India's forest ecosystems.

These new concepts can also help address different challenges facing the Indian forestry sector. The National Forest Commission lists eleven major threats and several other miscellaneous threats and constraints (NFC 2006). While some of these, such as macro demographic changes and insurgencies, are beyond the scope of this book, others, such as forest degradation due to unsustainable use, development needs, fires, invasive species, and lack of proper inventory of forest resources, could be addressed through concerted action. Some of these threats and constraints are briefly discussed in this section.[12]

Livelihood Dependence

A major reason for forest degradation is unsustainable use and over-exploitation. Apart from pressures from industrialization and urbanization, a sizeable proportion of the rural population depends on forests for meeting their subsistence requirements. These requirements are one of the reasons for low growing stock of forests in the country. Fuelwood and fodder are two key products that are extracted in substantial quantities from forests.

Fuelwood: It is estimated that 23 percent of the population using fuelwood obtains it from forests.[13] The forest lands supply around 27.15 percent of the total fuelwood consumption of 216.42 million tons per annum (FSI 2011). Apart from contributing to greenhouse gas

Plate 1.1: *Millions of people in India depend on fuelwood extracted from forests.*

emissions, fuelwood burning is a major source of indoor pollution in India. The World Health Organization estimates that a pollutant released indoors is one thousand times more likely to reach people's lungs than a pollutant released outdoors. According to an estimate, about half a million women and children die each year from indoor air pollution in India (ICMR 2001).

Grazing and Fodder: India has nearly 530 million livestock (MoA 2011). It is estimated that as many as 38.49 percent of fodder-consuming livestock are partially or completely dependent on forests. As different types of livestock have different fodder requirements, the standard measure of Adult Cattle Units (ACUs) can provide a better picture. It has been estimated that 22.63 percent of ACUs in the country are completely dependent on forests for fodder (FSI 2011). The recent data from the National Forest Inventory indicates that 7.70 percent of forest area is affected by heavy grazing, 31.53 percent by moderate grazing, and 41.87 percent by light grazing (FSI 2015).[14] India's National Forestry Action Programme (2000-2020) estimated that even 67 percent of its National Parks and 83 percent of its Sanctuaries were affected by grazing (MoEF 1999).

Forest Fires

Fires, especially anthropogenic fires, are a major threat to India's forests. During 2010-11, as many as 13,898 fire incidents were recorded by the Forest Survey of India through remote sensing and reported to different State Forest Departments (FSI 2011). That is over 38 incidents per day. Apart from the air pollution (including release of CO_2) they cause, these fires often affect natural regeneration and are damaging to certain species (such as ground nesting birds). It is estimated that 55 percent of the country's forests are prone to fire and 70

Plate 1.2: *Nearly two-fifths of India's fodder-consuming livestock is dependent on forests.*

percent of forests have no natural regeneration. Repeated and extensive fires can even alter the character of a forest (for example, from wet evergreen to semi evergreen) and affect its biodiversity value (NFC 2006). The recent data from the National Forest Inventory indicates that 2.4 percent of forests in India are affected by heavy fires, 7.49 percent by moderate fires, and 54.40 percent by occasional fires (FSI 2015).[15] With climate change, the frequency as well as severity of forest fires is likely to increase (Bernier and Schoene 2009; Mukhopadhyay 2009).

Invasive Species

Invasive species have emerged as a major threat to India's forests. The major invasive plant species include *Lantana camara*, *Eupatorium odoratum*, *Eupatorium adenophorum*, *Parthenium hysterophorus*, *Ageratum conyzoides*, *Mikania micrantha*, *Prosopis juliflora,* and *Cytisus scoparius*. Invasive climbers such as *Chromolaena* and *Mikania* have overrun and strangulated native species in the Himalayas and Western Ghats. Aquatic invasive species such as Water Hyacinth (*Eichhornia* spp.) and *Salvinia* have choked several freshwater ecosystems, depriving native species of sunlight, oxygen, and nutrients (MoEF 2008). While invasive grasses are not as pressing of a concern in India as they are in some other countries, some invasive grass species (for example, *Chloris barbata*) have been reported in forests. (Reddy 2008).

Development Imperative

There is considerable pressure on India's land resources as the country supports around 17 percent of the world's population on less than 2.5 percent of global land area. In order to support this large population, around 42 percent of the country's geographical area is already used for agriculture (MoA 2013). The remaining area, including forests, is under tremendous pressure from development. In many places, forest lands have been fragmented due to expansion of agriculture or other developmental activities. In the Western Ghats, large tracts have been converted to monoculture plantations such as coffee and rubber (MoEF 2009). It is estimated that more than 45 percent of protected areas have public thoroughfares that divide them into smaller parts (NFC 2006).

As India's economy grows rapidly, these development demands on forests are likely to increase further. The Twelfth Five Year Plan notes:

> …potential conflict arises because most of our mineral resources are in areas, which are forested and the effective exploitation of these resources calls for acquisition, which may disrupt some tribal communities (Planning Commission 2012, p. 21).
>
> Most of our coal resources and hydro potential are in ecologically sensitive areas and a successful resolution of these problems is critical if we are to be able to exploit our potential energy resources. The alternative is to either accept a much lower rate of growth, or rely even more than we already do on imported energy, which has implications for both the balance of payments and energy security (Planning Commission 2012, p. 22).

Climate Change

Finally, India is particularly vulnerable to climate change, which has emerged as a major threat

to forest ecosystems. It is estimated that 40-70 percent of forested grids in different states are vulnerable to climate change, which may lead to dying forests and loss of biodiversity (Planning Commission 2012). The impact is likely to be unique to each state, with forests in some states more vulnerable than others (MoEF 2010). The Indian Network for Climate Change Assessment (INCCA) has carried out a detailed assessment of forests in four key regions: (1) the Western Ghats, (2) the Himalayas, (3) the coastal regions, and (4) the North Eastern Region. After a detailed analysis, INCCA concluded that forest ecosystems in the Himalayan region are the most vulnerable, the coastal and Western Ghats forests are moderately vulnerable, and forests in the North Eastern Region are least vulnerable to climate change. Although the net primary productivity may increase in many forest areas due to enhanced CO_2 concentration, around 70 percent of the vegetation is likely to find itself less than optimally adapted to its existing location, making it more vulnerable to both adverse climatic conditions and increased biotic stresses. This may have serious adverse impacts on biodiversity in most forest biomes of the country (INCCA 2010).

It is clear from the above discussion that emerging concepts such as REDD+, ecosystem approach, and landscape approach are not only relevant for India but urgently need to be operationalized to address various challenges facing India's forestry sector.

This primary focus of this book is on REDD+. It is worth clarifying that although REDD+ emerged from the concern over carbon emissions from forests, its scope is much wider. In fact, the Government of India's official position is also that carbon is only a co-benefit of forest ecosystem services:

> … enhancing the quantum of forest ecosystem services that flow to the local communities. The services include fuelwood, timber, fodder, NTFP and also carbon sequestration. It is underlined that in the Indian context, carbon service from forest and plantations is one of the co-benefits and not the main or sole benefit.[16]

Some critics may argue that REDD+ is an alien concept, far removed from India's ground realities. It is therefore pertinent to mention that India has already deployed a domestic mechanism in the form of forest grants that are closely aligned to the REDD+ principles. While making its recommendations, the Thirteenth Finance Commission considered the "need to manage ecology, environment and climate change consistent with sustainable development." Therefore, the Finance Commission recommended three environment-related grants of INR 5,000 Crores for: (1) protection of forests, (2) renewable energy, and (3) water sector management.

Out of these three grants, the forest grant is of direct relevance to REDD+, as it recognizes the principle of payment for forest ecosystem services.[17] The following extract from the report of the Thirteenth Finance Commission shows a clear link between the forest grant and the philosophy behind REDD+:

> Forests provide a wide variety of services. These encompass, first and foremost, the class of regulatory services such as carbon sequestration; sediment control and soil conservation; ground water recharge;

> protection from extreme weather events and preservation of bio-diversity. These services, by their very nature, accrue beyond the boundaries of the state in which the forest lies. Although there are benefits that do accrue exclusively to the state, from forest produce and recreational services yielded by standing forests, there are national restrictions on timber felling which impose the costs of having land under forests exclusively on the state in whose jurisdiction it lies. The Forest (Conservation) Act, 1980 restricted the diversion of forest lands for non-forestry purposes without prior approval from GoI [Government of India]. The Supreme Court, in its order of December 12, 1996 restricted irregular felling of forests and mandated management of forests according to a scientifically prepared working plan, approved by GoI. Harvesting of forests was allowed only within the prescriptions of the working plan, with additional restrictions on felling in high altitude regions. The combination of benefit externalities and internalized costs clearly calls for federal compensation. Accordingly, a grant calibrated to the share of the national forested area falling in a state, as well as to economic disability on the basis of the percentage of forested area in each state, is the first of the three environmental grants provided for (Finance Commission 2009, pp. 209-210).

The grants for the first two years of the award period were untied, but it was suggested that priority should be given to the preparation of working plans. The release of grants in the last three years of the award period was linked to the progress in the number of approved working plans. Twenty-five percent of the grants in the remaining three years of the award period were for preservation of forest wealth. The remaining 75 percent of the grants could be used by the states for development purposes. The payment under this grant was based on forest density classes, as reported by the Forest Survey of India. As it was based on data at a given point, it essentially rewarded existing stock. The broader intent, however, was to encourage states to preserve and improve the condition of their forests. The Forest Commission's report noted:

> It is hoped that the size of the grant will provide the wherewithal for preservation, going forward, so as to halt and hopefully reverse past declines in the quantum and quality of area under forests (Finance Commission 2009, p. 210).

The Fourteenth Finance Commission has also incentivized the states to maintain and enhance their forest cover by allocating it a weight of 7.5 percent in its formula for allocation of revenue among different states.(Mundle 2016)

THE RESOURCE BOOK

India's forest policy and practice has been continually evolving to respond to emerging national and international needs. In recent decades, climate change has emerged as a major global concern. The forestry sector contributes a significant proportion of GHG emissions that are causing climate change. In order to address this issue, an international REDD+ institutional and governance framework is currently under development. In parallel, other important concepts such as the ecosystem approach and the landscape approach have also emerged.

Some of this new thinking is already reflected in the Government of India's key policies and

programs. The National Mission for a Green India and forest grants have been discussed in the previous section. The National Working Plan Code, National Forest Policy, and India's Intended Nationally Determined Contribution (INDC)[18] also reflect the policy makers concern for environment and sustainable development, and the critical role of the forestry sector.

While the central and state governments have undertaken a number of measures to translate the new vision into reality, further orientation and capacity building of the field-level forest managers is needed to effectively bring about this paradigm shift on the ground. The operationalization of REDD+ and other emerging ideas requires theoretical understanding as well acquisition of practical skills by the field practitioners, from government agencies as well as civil society and private sectors.

This book has been conceptualized and written especially for field practitioners. The chapters in the book have been contributed by different experts and professionals, including Forest-PLUS staff members. This book aims to provide a comprehensive overview on a range of topics that are relevant to REDD+, the ecosystem approach, and the landscape approach, with a focus on the Indian context. A section on further reading and additional resources has been added to some chapters to allow interested readers to pursue selected topics in greater depth.

These chapters were prepared at different times during the course of Forest-PLUS Program (2012-17). As all readers are not likely to read the book from cover to cover, the chapters have been prepared in way that these could be read independently and selectively. This has necessitated some overlap between different chapters.

The rest of the book is organized into the following sections and chapters:

Section I: Resource and Policy Context

Chapter 2: Climate Change and India's Forests
Chapter 3: Trees Outside Forests: Status and Potential
Chapter 4: Forests in India's North East
Chapter 5: India's Position on REDD+

Section II: Sustainable Forest Ecosystem Management

Chapter 6: Ecosystem Approach and Working Plans
Chapter 7: REDD+ and Biodiversity Conservation: Safeguards and a Scope for Synergy
Chapter 8: Managing Forests for Non-Timber Forest Products

Section III: Economic Perspective

Chapter 9: Valuing Forest Ecosystem Services
Chapter 10: Clean Development Mechanism: The Indian Forestry Experience

REFERENCES

Bernier, P. and D. Schoene. 2009. "Adapting forests and their management to climate change: An overview." *Unasylva 231/232* 60: 5-11.

Bureau of Land Management. (BLM). n.d. Retrieved from http://www.blm.gov.

Convention on Biological Diversity. n.d. Principles. Retrieved from http://www.cbd.int/ecosystem/principles.shtml.

Food and Agriculture Organization. (FAO). 2010. *Global Forest Resources Assessment*. FAO Forestry Paper 163. Rome, Italy: Food and Agriculture Organization of the United Nations.

Finance Commission. 2009. *Thirteenth Finance Commission 2010-2015*, Volume 1. New Delhi: Finance Commission, Government of India.

FSI. 2011. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2013. "Carbon Stock in India's Forests." In *State of Forest Report 2013*, 53-55. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2015. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment, Forest and Climate Change, Government of India.

Indian Council of Medical Research. (ICMR). 2001. *ICMR Bulletin* 31 (9). New Delhi: Indian Council of Medical Research, Government of India.

INCCA. 2010. *Climate Change and India: A 4x4 Assessment*. New Delhi: Indian Network for Climate Change Assessment, Ministry of Environment and Forests, Government of India.

IPCC. 2007. *Climate Change 2007: Synthesis Report*. Geneva, Switzerland: Intergovernmental Panel on Climate Change.

IUCN. 2017. The Bonn Challenge. Available from https://www.iucn.org/theme/forests/our-work/forest-landscape-restoration/bonn-challenge.

IUCN and WRI. 2014. *A Guide to Restoration Opportunities Assessment Methodology (ROAM): Assessing Forest Landscape Restoration Opportunities at the National or Sub-National Level*. Working Paper (Road-test edition). Gland, Switzerland: International Union for Conservation of Nature and Washington, DC: World Resources Institute.

Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-being: A Framework for Assessment*. Washington, Covelo, CA and London: Island Press.

MoA. 2011. *Basic Animal Husbandry Statistics 2010*. New Delhi: Department of Animal Husbandry, Dairying & Fisheries, Ministry of Agriculture, Government of India.

MoA. 2013. *Annual Report, 2012-2013*. New Delhi: Department of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture, Government of India.

MoEF. 1999. *National Forestry Action Programme - India*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2008. *National Biodiversity Action Plan*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2009. *India's Fourth National Report to the Convention on Biological Diversity*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2010. *National Mission for a Green India (Under the National Action Plan on Climate Change)*, Draft submitted to Prime Minister's Council on Climate Change. New Delhi: Ministry of Environment and Forests, Government of India.

Mukhopadhyay, D. 2009. "Impact of Climate Change on Forest Ecosystem and Forest Fire in India." *IOP Conference Series: Earth and Environment Science* 6 (38).

Mundle, Sudipto. 2016. "Fiscal Federalism in India 14th Finance Commission Award: 2015-16 to 2019-20." In *International Conference on Co-operative Federalism: National Perspective and International Experience*, 20-21 January, 2016, New Delhi. Accessed August 25, 2017. http://interstatecouncil.nic.in/wp-content/uploads/2016/icf/FiscalFederalismIndia.pdf.

NFC. 2006. *Report of the National Forest Commission*. New Delhi: National Forest Commission, Ministry of Environment and Forests, Government of India.

Pirot, J.Y., P. J. Meynell and D. Elde. 2000. *Ecosystem Management: Lessons From around the World: A Guide for Development and Conservation Practitioners*. Gland, Switzerland and Cambridge, UK: International Union for Conservation of Nature.

Planning Commission. 2010a. *Report of the Task Force "to Look into Problems of Hill States and Hill Areas and to Suggest Ways to Ensure That These States and Areas Do Not Suffer in Any Way Because of Their Peculiarities*," in association with G.B. Pant Institute of Himalayan Environment & Development, Almora, Uttarakhand. New Delhi: Planning Commission, Government of India.

Planning Commission. 2010b. *Mid-Term Appraisal for Eleventh Five Year Plan 2007-2012*. New Delhi: Planning Commission, Government of India.

Planning Commission. 2012. *Twelfth Five Year Plan 2012-2017: Faster, More Inclusive and Sustainable Growth*, Volume I. New Delhi: Planning Commission, Government of India.

Reddy, C.S. 2008. Catalogue of invasive alien flora of India. *Life Science Journal*, 5 (2): 84-89.

Sayer, J. A. and S. Maginnis, eds. 2005. *Forests in Landscapes: Ecosystem Approaches to Sustainability*. Cambridge, UK: International Union for Conservation of Nature and London: Earthscan.

UNEP. 2014. *Forests in a Changing Climate: A Sourcebook for Integrating REDD+ into Academic Programs*. Nairobi, Kenya: United Nations Environment Programme.

UNFCCC. n.d. United Nations Framework Convention on Climate Change. http://unfccc.int/2860.php.

UNFCCC. 2014a. Clean Development Mechanism. Accessed November 21, 2014. http://unfccc.int/kyoto_protocol/mechanisms/clean_development_mechanism/items/2718.php.

UNFCCC. 2014b. *Key Decisions Relevant for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+)*, Decision Booklet REDD+. Bonn, Germany: United Nations Framework Convention on Climate Change Secretariat.

WCED [World Commission on Environment and Development]. 1987. *Our Common Future*. Oxford: Oxford University Press.

WWF. 2002. Position Paper: The Landscape Approach. February 2002. Available from http://assets.panda.org/downloads/po11landscapeapproach.pdf.

SECTION 1
RESOURCE AND POLICY CONTEXT

Any forestry program, including REDD+, has to operate within the broader resource and policy context. Effective resource planning requires good understanding of the resource – current as well as future scenarios. This section has four chapters. The first three chapters deal with forest resources and their dynamics. The first chapter (Chapter 2) presents an overview of India's forest resources and the likely impact of climate change on them. The second chapter (Chapter 3) deals with issues related to Trees Outside Forests (TOF) – an important component of India's forestry sector – highlighting its current status as well as potential. As India's thickly forested north-eastern region has a special place in the country's forestry sector, the third chapter (Chapter 4) discusses the resource, policy, and institutional context in the north-eastern states along with opportunities and challenges for REDD+. The final chapter (Chapter 5) discusses key elements of India's climate change policy and position on REDD+, with a focus on India's role in different Conference of Parties (COPs) of the United Nations Framework Convention on Climate Change.

Chapter 2: CLIMATE CHANGE AND INDIA'S FORESTS

Indu K Murthy, Sushma Sridhar, Poornima Kumar and Vinisha Varghese

INTRODUCTION

Forests have an important role in the climate change debate as they are both a sink and source of source of carbon emissions and a large stock of carbon is stored in them. This chapter explores the impacts of climate change on forests, especially in the Indian context.

The details of forest resources of India (extent, density classes, forest types, and tree cover) are presented in this introductory section. The next section discusses the nature of impacts of climate change on forests, along with details of various pressures and factors. The vulnerability assessment of India's forests, along with key approaches and review of major assessments carried out is presented in the third section. The key opportunities and challenges for REDD+ are discussed in the fourth section. The chapter ends with a set of guidelines for field practioners of REDD+.

Forest constitutes the second-largest land use category in India after agriculture. From the tropical wet evergreen forests in the north-east and south-west India, through tropical deciduous forests over a large part of the country, to the tropical dry thorn forests in the central and western parts, India is home to diverse types of forests. Forest ecosystems provide valuable ecosystem services for human well-being in the form of provisioning, regulating, supporting and cultural services. These services often are not additively separable and often not produced simultaneously from the same location. Despite the importance of the forest ecosystems, a significant proportion have been degraded and lost in most parts of the world, including India, which is the one of the most megadiverse countries of the world. The loss and degradation of forest ecosystems can be attributed to various demographic and socio-economic pressures, along with institutional and policy failures.

Forests have varied definitions. The Food and Agriculture Organization of the United Nations defines forests as "A land with tree crown cover of more than 10 percent and area of more than 0.5 hectares (ha), or trees able to reach these thresholds in situ". According to the Convention on Biodiversity (2001), "Forest is a land area of more than 0.5 ha, with a tree canopy cover of more than 10 percent, which

is not primarily under agricultural or other specific non-forest land use. In the case of young forests or regions where tree growth is climatically suppressed, the trees should be capable of reaching a height of 5 meter (m) in situ, and of meeting the canopy cover requirement."

According to the Government of India, for reporting under the United Nations Framework Convention on Climate Change (UNFCCC), forest is defined as "A land having tree crown cover value of minimum 15 percent, land area value of minimum 0.05 ha and tree height value of minimum 2 m". According to the Forest Survey of India (FSI), forest cover is defined as "All lands more than 1 ha in area, with a tree canopy density of more than 10 percent, irrespective of ownership and legal status". Thus, forest cover, as reported by the State of Forest Reports, has no distinction based on the origin of tree crops (natural or man-made) or tree species (timber species, bamboos, fruit-bearing trees, coconut, palm trees, etc.), and encompasses all types of lands irrespective of their ownership, predominant land use and legal status. Thus, forest cover as reported by FSI includes a number of land-use categories which qualify based on the tree crown cover and area eligibility criteria (Ravindranath *et al.* 2014).

India has a total land area of 329 million hectares (mha), out of which 76.87 mha i.e., 23.84 percent is classified as forest land (FSI 2015). An overview of forest cover and forest types is discussed in the ensuing sections (see Figure 2.1).

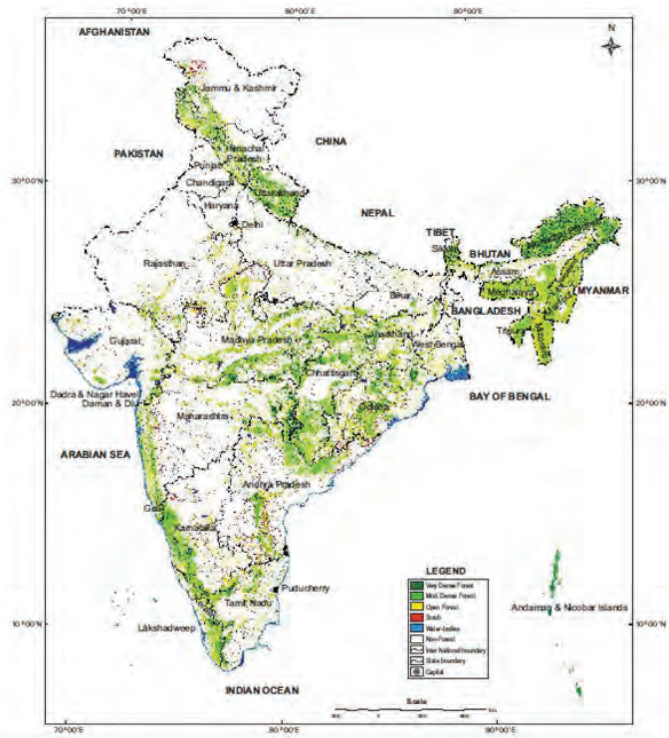


Figure 2.1: Forest cover map of India (FSI 2015)

Table 2.1: Forest cover of India (FSI 2015)

Class	Area (km^2)	% Geographical Area
Forest Cover		
Very Dense Forest	85,904	2.61
Moderately Dense Forest	315,374	9.59
Open Forest	300,395	9.14
Total Forest Cover	**701,673**	**21.34**
Scrub	41,362	1.26
Non-Forest	2,544,288	77.40
Total Geographic Area	**3,287,263**	**100.00**

Includes 4,740 km^2 under mangroves

Forest Density Classes

Based on the tree canopy density, the forest cover of India has been classified by FSI into pre-defined classes namely: i) Very Dense Forests (VDF), ii) Moderately Dense Forests (MDF), and iii) Open Forests (OF) An estimate of scrub lands has also been made. The country level forest cover is shown in Table 2.1 and its proportion is shown in Figure 2.2.

In terms of forest density classes, area covered by VDF is 85,904 square kilometer (km^2), MDF is about 315,374 km^2 and OF is 300,395 km^2.

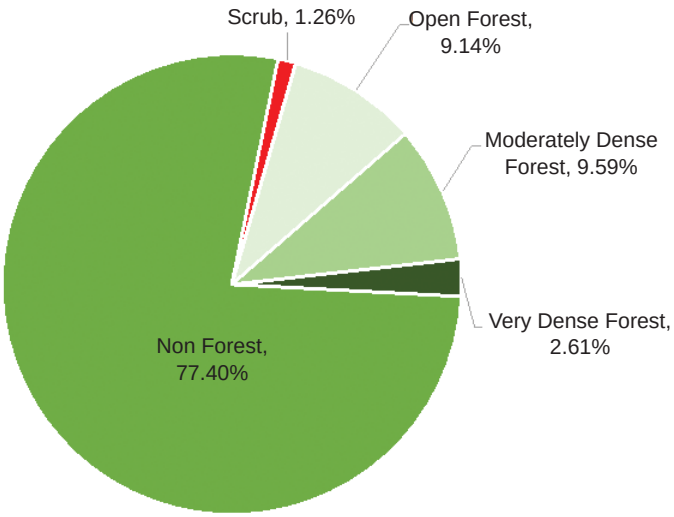


Figure 2.2: Forest cover of India

While the VDF constitutes about 2.61 percent of the total geographical area, MDF and OF cover about 9.59 percent and 9.14 percent of the total geographical area of the country, respectively.

Forest Types

India has a diverse range of edaphic, climatic and physiological conditions which has resulted in vast diversity of flora and fauna. Forests also vary from tropical evergreen forests in Andaman and Nicobar Islands, the Western Ghats and the north-eastern states, to dry alpine scrub high in the Himalayan region. The country also has semi-evergreen forests, moist deciduous forests, thorn forests, sub-tropical pine forests, and temperate montane forests. The different forest types present in India are briefly discussed below:

A. Moist tropical forests

They are divided into four groups and each group is further sub-divided into subgroups, which, in turn, are further split into formations and associations.

Group 1: Tropical wet evergreen forests: Such forests are found in regions with rainfall over 2,500 milimeter (mm) per annum, mostly in Western Ghats and along south-west of Assam and Cachar. *Dipterocarpus* and *Shorea* (sal) are the main trees.

Group 2: Tropical semi-evergreen forests: These forests are found along the Western Ghats, in Assam and lower altitudes of Eastern Himalayas, Odisha, Malabar Coast and the Andamans. Rainfall varies from 2,000-2,500 mm.

Group 3: Tropical moist deciduous forests: These forests are typical found in areas with rainfall in the range of 1,500-2,000 mm. These forests are present in many states such as Uttar Pradesh, Bihar, Odisha, West Bengal, Maharashtra, Madhya Pradesh, Karnataka, Tamil Nadu, and Kerala.

Group 4: Littoral and swamp forests: These are further sub-divided into two sub groups:

- Littoral forests: The littoral forests occur all along the sea coasts and along the sandy bars of deltas of the larger rivers.
- Tidal swamp forests: The tidal swamp forests are further divided into five types:
  - Mangrove scrub
  - Mangrove forests
  - Salt water mixed forests
  - Brackish water mixed forests, and
  - Palm swamp.

The Sundarbans (West Bengal) and the Bhitar Kanika (Odisha) mangrove forests come under this category.

B. Dry tropical forests

They are divided into three groups:

Group 1: Tropical dry deciduous forests: Several forests in northern and central states such as Bihar, Uttar Pradesh, Madhya Pradesh, Punjab, and Haryana come under this category. In some areas, the dominant tree species is the commercially valuable teak.

Group 2: Tropical thorn forests: These are distributed in areas of low rainfall (250-750 mm per annum) in both northern and southern states of India, such as Punjab, Haryana, Rajasthan, Uttar Pradesh, Madhya Pradesh, Maharashtra, and Andhra Pradesh.

Group 3: Tropical dry evergreen forests: These are dense forests of coriaceous-leaved evergreen forests.

C. Montane sub-tropical forests

These are further divided into the following three groups:

Group 1: Sub-tropical broad-leaved hill forests

Group 2: Sub-tropical pine forests: These are found throughout the entire contour of the western and central Himalayas.

Group 3: Sub-tropical dry evergreen forests: These forests contain small-leaved evergreen trees and shrubs including some thorn species.

D. Montane temperate forests

They are divided into three groups:

Group 1: Montane wet temperate forests: These forests occur in the east Himalayas from east Nepal to Arunachal Pradesh.

Group 2: Himalayan moist temperate forests: These forests occur above 1,500 m and extend upto 3,000 m in the western and central Himalayas.

Group 3: Himalayan dry temperate forests: These are open forests composed of evergreen conifers and some broad-leaved trees. They occur above 1,700 m.

E. Sub-alpine forests

These forests occur in Jammu and Kashmir, Himachal Pradesh, Uttarakhand, West Bengal, Assam and Manipur. They occur within an altitudinal range of 2,900 m to 3,500 m.

F. Alpine scrub forest

These forests extend from 3,600 m up to tree line. They are well distributed in Kashmir (3,600 m), West Kumaun (3,800 m) and Garhwal (3,700 m) in Uttarakhand and along the Western Himalayas from 2,900 to 4,250 m.

Trees Outside Forests (TOF)

India has diverse bio-geographical zones and agro-climatic conditions, which provide a conducive environment for growth of various tree species. The term 'Trees Outside Forests (TOF)' refers to trees on land not defined as forests or other wooded land, and generally include trees on farmlands, in cities and human settlements, orchards, roadside pastures, river banks, etc. According to FSI (2015), TOF refers to all the trees growing outside the recorded forest area, irrespective of the size of patch. It includes trees in both rural and urban areas. These trees not only provide timber and fuelwood but are also a source of food and fodder, and contribute towards carbon sequestration and biodiversity conservation.

The total tree cover of the country (FSI 2015) is estimated to be 92,572 km^2, accounting for 2.82 percent of the total geographical area of the country. Among the physiographic zones, maximum tree cover has been recorded in Central Highlands (11,004 km^2), followed by East Deccan (10,120 km^2) and Western Himalayas (9,835 km^2). Eastern Himalayas have the lowest tree cover of 537 km^2 and when the percentage geographic area under tree cover is considered, the West Coast (8.04%) dominates, followed by the Western Ghats (5.08%) and the East Coast (3.20%).

IMPACTS OF CLIMATE CHANGE ON FORESTS IN INDIA

Some of the major effects of climate change on forests will involve changes in forest distribution, Net Primary Productivity (NPP) and Soil Organic Carbon (SOC). Tropical evergreen forests in eastern India and the Western Ghats may expand, as may the forests in the western part of Central India. However, projections show nearly no changes in the north eastern parts of India, which are less vulnerable because they are denser, more biodiverse, and less fragmented. They have among the lowest rates of vegetation change, temperature increase and gain, and among the highest tree density in the country.

The same is the case with the southern portion of the Western Ghats. Their lower vulnerability makes them quite suitable for initial REDD+ projects (Chaturvedi *et al*. 2011). The limitation with many of these projections is their inability to adequately account for forest fragmentation. In reality, forest fragmentation would likely affect seed dispersal, which could cause forest degeneration. In the face of climate change, wetter forest types show greater tendency to proliferate. More than 80 percent of the land in north eastern India is classified under 'forest', but this region also faces high deforestation levels. 65 percent of the deforestation in India between 2005 and 2007 happened here, with much of it attributable to encroachment and shifting cultivation (Chaturvedi *et al*. 2011).

Climate change will likely result in serious biome shifts in the Indian sub-continent. In a study by Chakraborty *et al*. (2013), certain projections were made as to the nature of these likely biome shifts. In northern India, in the Himalayan region, sub-alpine tropical moist forests are projected to decrease, and alpine regions are likely to shift to sub-alpine and montane regions.

In north-eastern India, tropical wet forests may reduce overall. Tropical rainforests, on the other hand, are likely to increase. Here too, alpine will likely give way to sub-alpine and montane forests. In the Western Ghats, it was found that tropical wet forests would possibly reduce. In western India, tropical desert (plain) and tropical desert scrub (lower montane) may reduce and be replaced by tropical dry scrub (plains). In Central India, tropical moist forest (lower montane), which is mostly deciduous forest, is projected to decrease. Overall, tropical moist forest and tropical deciduous forest (lower montane) will probably show the most shift, and be replaced by tropical dry forest and tropical very dry forest (plain) in central and south India (Gopalakrishnan *et al*. 2011).

Tropical rain forests may increase marginally, while tropical dry forest (plain and lower montane) and tropical moist forest (lower montane) will possibly exhibit the most change. Tropical thorn woodland (lower montane) will be replaced by tropical very dry forest (plain) and tropical dry forest (lower montane). Tropical dry forest (lower montane) will increase, and replace tropical moist forest and tropical thorn woodland (plain) will likely shift. Montane tundra is the least likely to be affected (Chaturvedi *et al*. 2011).

SOC is likely to increase along with NPP, with greater litter input to soil. Sub-tropical pine forests and Himalayan moist temperate forests are likely to have lower increases (0-30%) in SOC than tropical moist deciduous forests and

sub-alpine and alpine forests, which may have 40-45 percent increases in SOC.

Nature of Impacts

Climate change stands to affect forests in a multitude of ways, both directly and indirectly. A study done on the forests of China revealed that lighting fires would become an increasingly frequent phenomenon in the decades to come (Xiao-Ying *et al.* 2013). Ecological functions are vulnerable to small changes in climate. Productivity and water use, for instance, significantly impact forests. If the global average temperature become higher, winters may be warmer, and may increase the growing season, which will, in turn, increase evaporation and water consumption. This could increase drought-proneness and make trees more susceptible to pest attacks and diseases (Rustad *et al.* 2012).

Apart from these, forest edges may retreat, and the nature of the forests may be altered by changes in productivity, vegetation composition and distribution. One of the primary causes for this would be changes in plant phenology brought about by changes in temperatures and climatic patterns (Xiao-Ying *et al.* 2013). Forest fires and pests are likely to become more common. It is becoming increasingly clear that the frequency and intensity of wildfires will increase with climate change (Guhathakurta *et al.* 2011).

VULNERABILITY OF FOREST ECOSYSTEMS TO CLIMATE CHANGE

The Intergovernmental Panel on Climate Change (IPCC) defines vulnerability as "the degree to which a system is susceptible to or unable to cope with adverse effects of climate change, including climate variability and extremes". According to IPCC (McCarthy *et al.* 2001), the three main components of vulnerability are exposure, sensitivity and adaptive capacity. Exposure includes socio-economic, climatic as well as ecosystem factors. Sensitivity is a characteristic of the system and represents the degree to which a system is affected or a "dose-response relationship between exposure and impacts" (Ravindranath *et al.* 2011). Adaptive capacity is the ability of the system to adapt or adjust in order to expand its coping range toward changing scenarios. While exposure is external to the system of concern, sensitivity and adaptive capacity are internal or inherent properties. The relationship between these components is outlined in Figure 2.3 below.

Forests in India are already subjected to multiple stressors and this will be further aggravated by climate change, which will cause vegetation shifts, and increased incidence of disease and pests (Gopalakrishnan *et al.* 2011). It is also vital to understand the role of pressures and drivers of change that increase or decrease forest vulnerability. They are briefly summarised in the ensuing sections (Afreen *et al.* 2011).

Pressures on Forests

The pressures on forests include:

Shifting Cultivation: Large tracts of forests are left degraded as soil productivity in forests is declining, especially in the hilly regions. Local ecosystems are affected, as this also results in habitat loss, fragmentation of natural forests, and soil erosion. Hence, resilience is reduced.

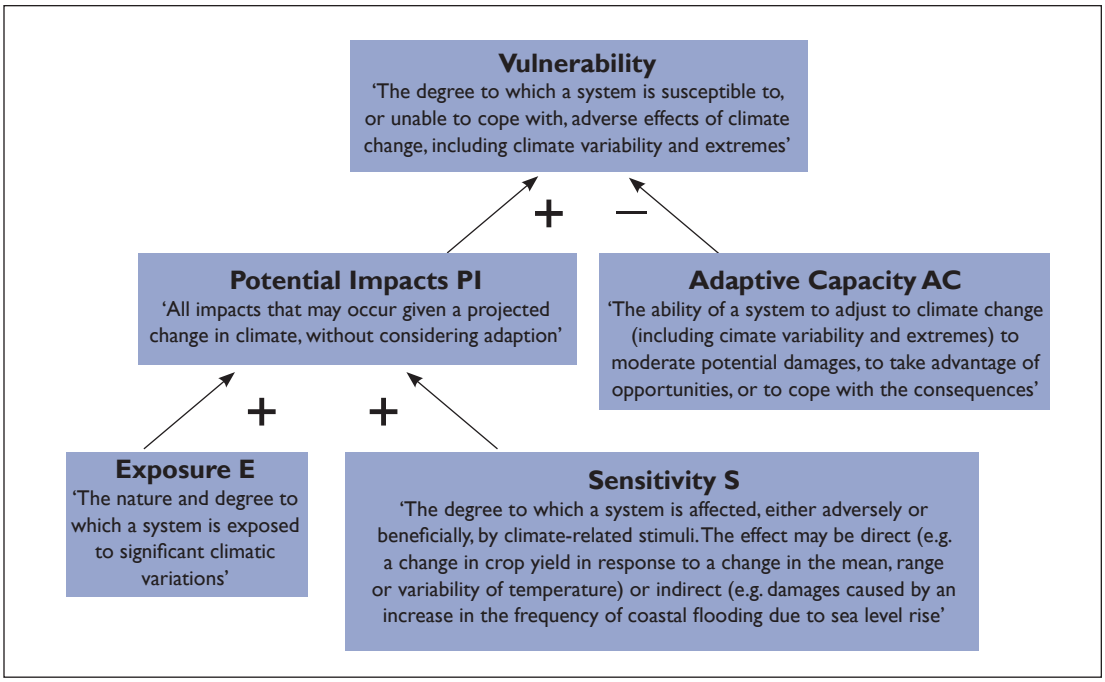


Figure 2.3: The components of vulnerability (definitions taken from McCarthy *et al.* 2001)
Note: The signs under the arrows mean that high exposure, high sensitivity and low adaptive capacity induce high vulnerability (Locatelli *et al.* 2008).

Demand for Fuelwood, Timber and Non-timber Forest Products (NTFPs): Unsustainable (and unregulated) extraction of these resources from forests increases their vulnerability.

Grazing: When uncontrolled, it can lead to adverse effects of overgrazing such as reduced regeneration of new plants, erosion of top soil, loss of species diversity, etc. This could potentially increase the vulnerability of forests.

Forest Fires: Although they can be caused by both natural and anthropogenic factors, the effects are far-reaching and can even cause extinction due to loss of habitat. Fires also destroy the inherent resistive capacity and resilience of forests, thereby increasing their vulnerability.

Invasive Species: By hindering conservation and native biodiversity, adaptive capacities of indigenous species are reduced. Consequently, the sensitivity of the macro-ecosystem is increased.

Factors likely to Impact Forest Vulnerability

The factors likely to impact forest vulnerability to the projected climate change include:

Forest Fragmentation: Land conversion activities like urbanization, agriculture, grazing

and timber extraction divide large contiguous forests into smaller patches. This altering of landscapes affects micro-climates, threatens species diversity and paves the way for further habitat destruction (especially of former dense forests).

Afforestation and Reforestation: There are two important factors to consider here, species selection and site selection. If executed improperly (e.g. single species for plantation or monocultures), it makes the local fauna less resilient to pests, diseases and fires.

Silvicultural Practices, Fire and Pest Management: Appropriate pruning (or thinning) practices, controlled fires or burning of plots can reduce forest vulnerability, if executed scientifically.

Forest Planning and Management: By introducing community-based management and benefit-sharing schemes, local communities in and around forests are made stewards of their livelihood resources. This encourages sustainable utilization of resources. Governance structures can further reduce vulnerability by proper planning and timing of adaptation strategies.

Forest Policies: Policies have a direct bearing on the status of forests. Inappropriate policies can have detrimental effect on forest vulnerability and adaptive capacities, both directly and indirectly.

VULNERABILITY ASSESSMENT OF FORESTS IN INDIA

Forests are diverse and require evidence-based assessments to direct management and conservation efforts. A vulnerability assessment is required to identify the way in which forests will most likely respond to drivers of change and is a critical step for long-term planning. The information provided by such assessments can aid identification of traits that put forests (by regions or ecosystems) at greatest risk, prioritize policy and project interventions and also aid in forest resource management. In this section, a general outline of vulnerability assessment methods is given, followed by a brief discussion on some studies conducted for Indian forests at different scales.

Approaches to Vulnerability Assessments

Different entities use different methodological approaches to assess vulnerabilities. It is recommended to have a healthy combination of data collection, data modelling and analyses, literature reviews, on-field surveys, stakeholder consultations, and expert opinions. The level of detail and involvement of each aspect mentioned above would depend on factors such as resource availability, data availability, reporting requirements, etc.

According to the IPCC (Parry *et al*. 2007), there are two streams of vulnerability assessments: (i) a contextual vulnerability assessment, which is essentially qualitative by nature and is constructed using case studies, surveys, etc., and (ii) an outcome vulnerability assessment using quantitative techniques like modelling. Vulnerability assessments are required at different scales (from local to landscapes and larger biomes) to direct forest resilience enhancing measures (Sharma *et al*. 2013). Another dimension crucial to assessing vulnerability is the climate and time scale – current climate will give the inherent vulnerability and the future climate scenario

will give the vulnerability due to climate change (CICERO and IISc 2015). A vulnerability assessment can be done by taking key factors like biological, socio-economic and livelihood indicators while also assessing the present capacity of forest management systems, involving exposure, sensitivity and adaptive capacity of the forests (Murthy *et al.* 2011).

Brief Review of some Vulnerability Assessments in the context of Indian Forests

Sharma *et al.* (2013) present a generic methodological approach to assess "inherent vulnerability" (resulting from stresses under the current climate scenario) at the local scale. The proposed framework is based on a coupled human-environment system where a selection of criteria and indicators and input from experts help synthesize a "vulnerability index". The proposed framework was applied to the Aduvalli Protected Forest in the Western Ghats region of Karnataka. Both climatic and non-climatic factors were used, reconnaissance survey, field studies (sampling plots) and inputs from experts were solicited. It was found that two indicators (see Figure 2.4 for all indicators), preponderance of invasive species and forest dependence of community, contributed about 90 percent to the vulnerability index and, therefore, accounted for a majority of the assessed inherent vulnerability.

Sharma *et al.* (2015) presented a similar framework based on inherent vulnerability but for forests at the landscape level. The chosen area was the Western Ghats region of

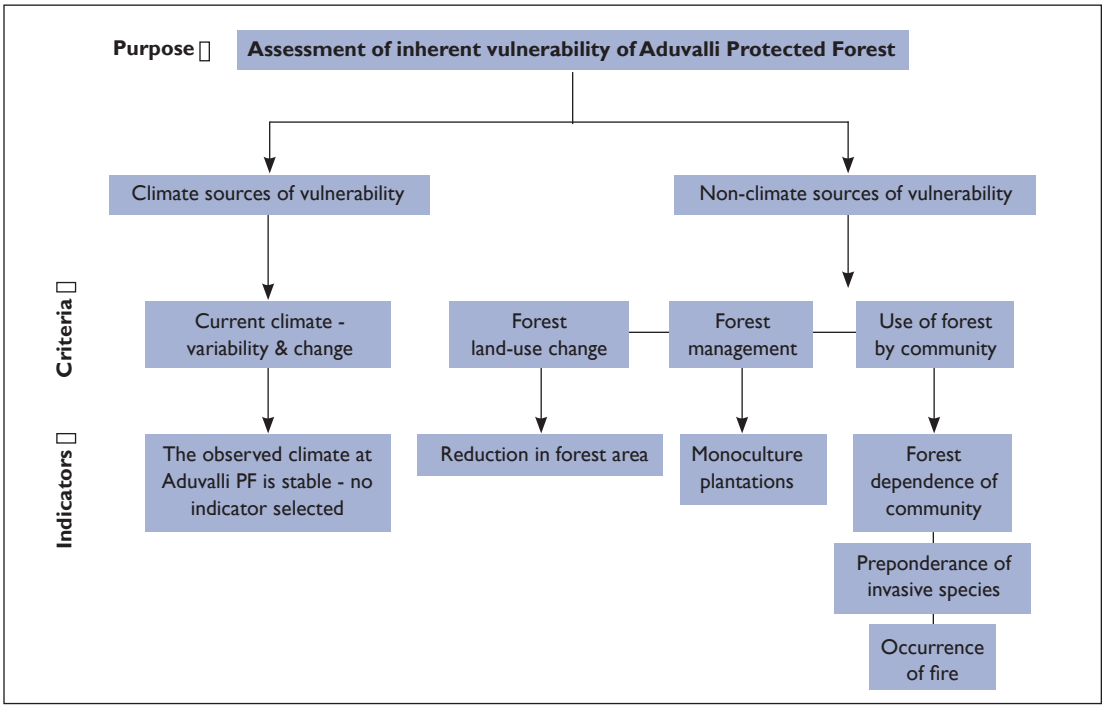


Figure 2.4: Hierarchy of criteria and indicators selected to assess the inherent vulnerability of Aduvalli Protected Forest (Sharma *et al.* 2013)

Karnataka. The study portrays the utility of the approach by selecting appropriate indicators for the landscape area of concern. The outcome (see Figure 2.5) aids the purpose of conserving forests and forest ecosystem services while providing an insight into non-climatic drivers of inherent vulnerability.

Ravindranath *et al.* (2011) used an index-based approach to develop vulnerability profiles of different sectors (water, agriculture, forests) of north-east India. For each of the components of vulnerability, formal indices were constructed and combined. For a specific sector, it is typically based on a number of indicators which determine the vulnerability of that sector to climate change.

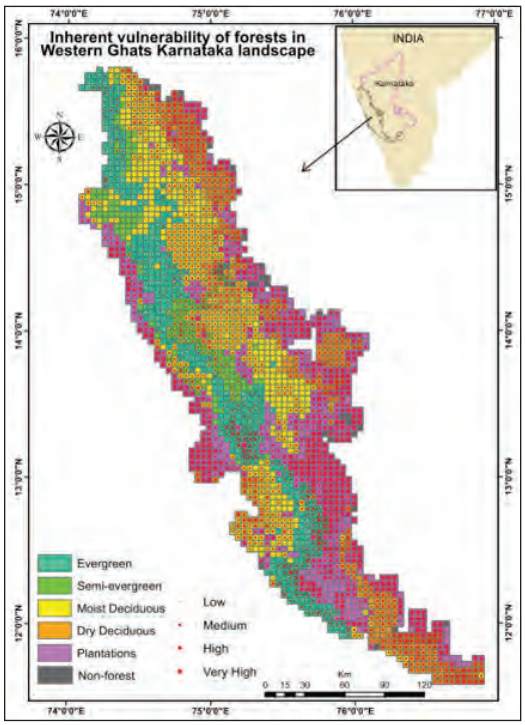


Figure 2.5: Distribution of inherent vulnerability in Western Ghats Karnataka landscape, according to forest types

Note: Inherent vulnerability in the landscape is shown in low, medium, high, and very high vulnerability classes. Generally, forest grid points with high and very high inherent vulnerability are located in plantation forests, and in the dry deciduous forests on the eastern side in the landscape (Sharma *et al.* 2015).

For the forest sector, disturbance, fragmentation, biological richness and projected impact of climate change were taken into account. Equal weights were assigned to each of the indicators as there was no preceding study on the same. Current and future forest vulnerabilities were assessed (see Figure 2.6). Data was aggregated at district level and ranks were assigned to districts based on the vulnerability indices.

A Centre for Science and Environment study (Ghosh 2012) led to formulation of a report on the socio-economic vulnerability of the Indian Sundarbans forests by using qualitative, semi-structured interviews and field studies. The interviewees comprised of academicians, researchers, scholars, policy actors, bureaucrats, representatives of gram panchayats across the regions, and representatives of Non-Governemental Organizations (NGOs). Vulnerability is reported to have steadily increased, especially for agriculture, fisheries and other natural resource-based livelihoods that depend on the Sundarbans forests. The study highlighted the need for a comprehensive vulnerability assessment of the Sundarbans and zoning of the Sundarbans according to the resulting vulnerability profiles.

At the national level, Chaturvedi *et al.* (2011) assessed the impacts of projected climate change on forests in India using Regional Climate Model of the Hadley Centre (HadRM3) and the Dynamic Global Vegetation Model

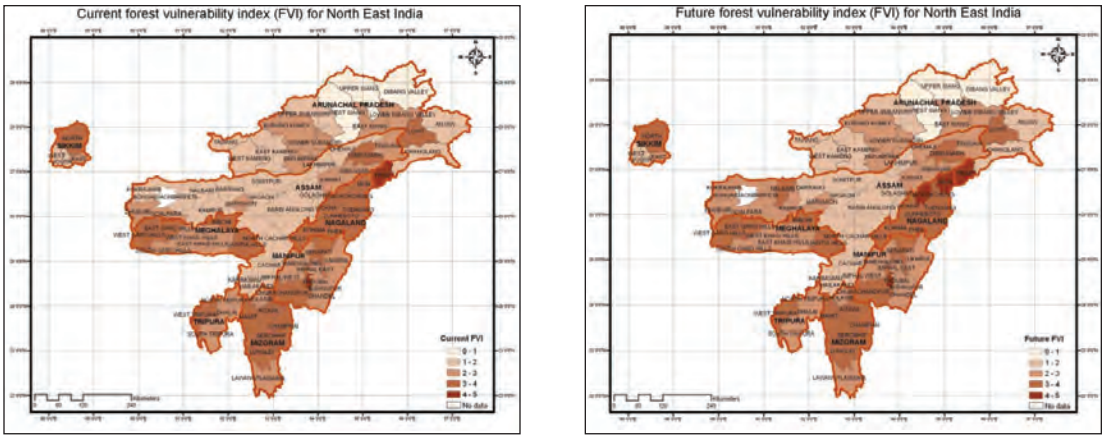


Figure 2.6: Distribution of current and future forest vulnerability over the districts of north-east India (Ravindranath *et al.* 2011)

(DGVM), and Integrated Biosphere Simulator (IBIS). The study presents a forest vulnerability index for India which is based on observed datasets of forest density, forest biodiversity and model-predicted vegetation type shift estimates. Various classes were defined for the vulnerability index by spatially combining forest diversity (monoculture versus natural forest), forest density (indicator of degradation levels), and IBIS vegetation type change estimates. The vulnerability index suggested that the upper Himalayas, northern and central parts of Western Ghats and parts of central India are most vulnerable to projected impacts of climate change, while the north-eastern forests are comparatively more resilient. The results of this vulnerability index can be corroborated with the results of a study on climate change impacts by Gopalakrishnan *et al.* (2011), wherein vulnerability maps were developed for different forest types and regions and their vulnerability to projected climate change was assessed using the IBIS model (see Figure 2.7). The distribution of vulnerable grids was mapped on shifting of vegetation types in the future scenario.

Another regional level vulnerability assessment to directly map the adaptation strategies was carried out for the Himalayan ecosystem in Himachal Pradesh by Upgupta *et al.* (2015). Himalayan ecosystems are vulnerable due to several non-climatic factors too. They employed Coupled Model Inter-comparison Project phase 5 (CMIP5) models-based climate projections under different Representative Concentration Pathways (RCPs) and IBIS to evaluate and rank the districts of Himachal Pradesh for both the current climate scenario and future climate scenario. The methodology followed was based on Gopalakrishnan *et al.* (2011), Sharma *et al.* (2013) and Sharma *et al.* (2015) (discussed earlier). A combined vulnerability index was adopted to include current vulnerability and projected impacts so as to prioritise adaptation interventions. Five major forest districts identified as vulnerable districts were Chamba, Kangra, Kullu, Mandi and Shimla (see Figure 2.8).

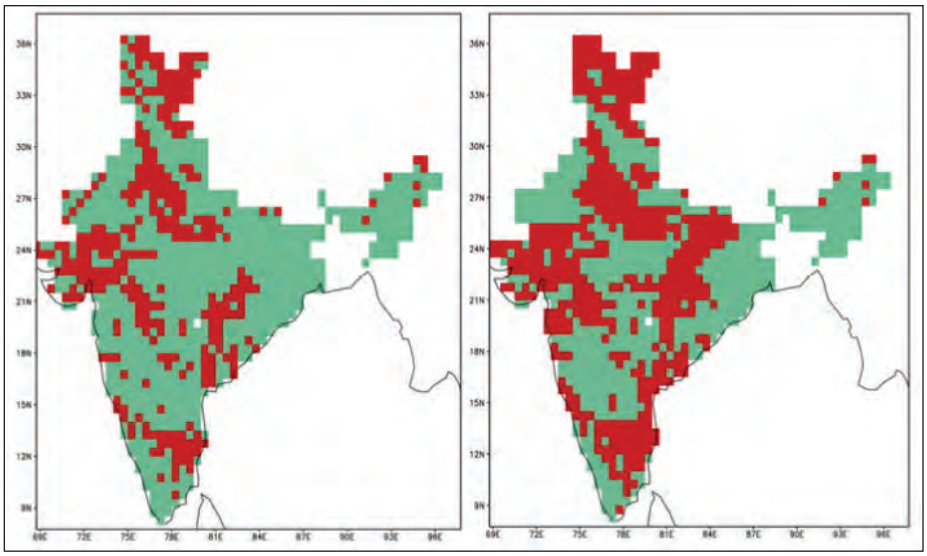


Figure 2.7: Vulnerable grids (marked red) in the A1B scenario.

(Left panel): For the time-frame of 2021-2050. Here 326 (30.6%) out of a total number of 1,064 grids are projected to be vulnerable.

(Right panel): For the time-frame of 2071-2100. In this case, 489 (45.9%) grids are projected to be vulnerable.

Note: In turn, all forest areas in such vulnerable grids are projected to be vulnerable to climate change

(Gopalakrishnan *et al.* 2011)

KEY OPPORTUNITIES AND CHALLENGES FOR REDD+ IN INDIA

Forests have significant economic and ecological value as a provider of ecosystem services, being home to much of the world's biodiversity and supporting the livelihoods of many people. Reducing Emissions from Deforestation and Forest Degradation (REDD) in developing countries is a critical component of the overall Greenhouse Gas (GHG) emission reductions and now the significance of REDD+ (which is not only about reducing emissions but halting and reversing forest loss), in delivering climate change mitigation benefits along with co-benefits, is increasingly being recognized in the global climate negotiations.

Methodological guidelines for Measuring, Reporting and Verification (MRV) for the REDD+ mechanism were agreed by Parties to the UNFCCC in Conference of Parties (COP) 19 at Warsaw. These provide that the data and information used by Parties in the estimation of anthropogenic forest-related emissions and removals, forest carbon stocks and areas, and their changes for REDD+ activities should be transparent, consistent over time and with the established forest reference emission levels and/or forest reference levels, maintaining consistency with the national GHG inventories of the countries. It is, therefore, clear that methodologies for REDD+ projects used by countries will require a definition of forest and presentation of a land-use change matrix, according to the six IPCC land use categories.

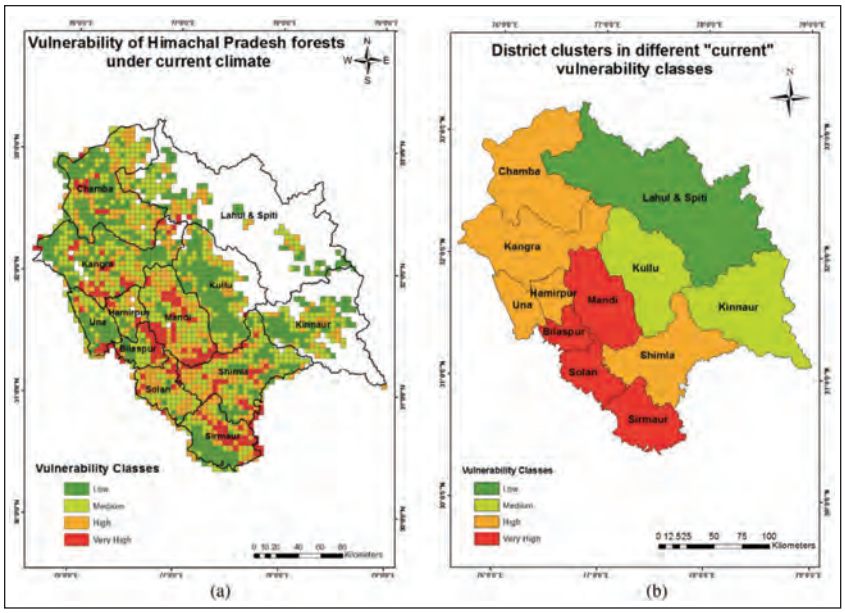


Figure 2.8: Forest vulnerability under 'current climate' scenario (inherent vulnerability): (a) distribution of vulnerability at grid cell level (there are no forest grid cells in the area shown in white colour; (b) distribution of vulnerability at district level (Upgupta *et al.* 2015)

This could potentially involve the concept of predominant land use to determine the land-use category classification of lands with perennial tree cover (Ravindranath *et al.* 2014).

While under the Kyoto Protocol, deforestation has been defined as "the direct human induced conversion of forest land to non-forest land", its definition under REDD+ has not been clearly provided. However, since the REDD+ methodologies, including definitions have to maintain consistency with national GHG inventories, countries can use their national definitions of land-use categories for REDD+, as they normally do for their national GHG inventories, and consequently also define deforestation using a country-specific definition. In this context, India should explore the possibility of having a definition of forest that is consistent across various reporting frameworks and applying it consistently across time for the development of land-use change matrix according to the six IPCC land-use categories for monitoring and reporting of deforestation rates, construction of forest reference level and estimation of carbon stock changes and non-carbon dioxide emissions from forests. The current definition of forest cover adopted by FSI includes all perennial tree cover. This may not be adequate for national policy makers, State Forest Departments (SFDs) and conservationists in assessing the actual state of forests, deforestation rates (in particular, the loss of primary forests), status of biodiversity and conversion of primary forest to commercial plantations or fruit orchards or annual crops (Ravindranath *et al.* 2014).

Currently, there could be complacency in India, assuming that the area under forest is stable and only increasing, leading to an assumption that there is no deforestation or forest degradation. However, this is largely due to the reporting framework currently in place. A change in the reporting framework that reports forest area in a stratified manner should include reporting of area under natural or primary forests, degraded forests, plantation forests, commercial plantations, fruit orchards and TOFs. These include (Ravindranath *et al.* 2014):

Natural or Primary Forests: Would provide an idea of the status and extent of biodiversity-rich primary forests. Currently, any loss of primary forest is not visible in the national reporting in India. Spatial information on the decline and the loss of primary forest is critical to prioritizing interventions to halt deforestation and promote conservation measures under REDD+ and other programs.

Degraded Forests: Identification of degrading forests would assist in developing programs to regenerate the degraded forests under REDD+.

Plantation Forests: India has been implementing one of the largest afforestation programs in the world (Ravindranath, Chaturvedi and Murthy 2008). Currently, the area reported in the State of Forest Reports do not reflect how much of the total area reported is constituted by forest plantations.

Commercial Plantations: It is important to know if, and to what extent, commercial plantations such as coffee or rubber are grown by converting secondary or even primary forests. Such a report would provide information on the drivers of land use change or deforestation and help put in place measures for conservation or afforestation and reforestation under REDD+ and other programs.

Fruit Orchards: These are grown for commercial purposes and are largely characterized by monocultures. Reporting of area under fruit orchards along with their spatial distribution is important for understanding pressures on forests and for developing alternate conservation and afforestation strategies, especially if secondary or even primary forests have been or are being converted to orchards.

Trees Outside Forests: Trees are grown in croplands and homesteads, and along avenues, railway lines and canals (Ravindranath *et al.* 2014). They do not qualify as forest or plantations, but need to be monitored and reported to enable estimation of carbon stocks and agro-biodiversity.

The current procedures in India for forest area monitoring and reporting are inadequate for meeting the needs of a REDD+ mechanism. There is a need for a new approach to monitoring and reporting of forest area to meet these challenges.

REDD+ could provide additional incentives for forest protection. Although designed to limit harmful climate change, it could provide collateral benefits such as conservation of biodiversity (Murthy, Sharma and Ravindranath 2013). This is, however, dependent on the extent to which emission reduction and biodiversity conservation can be achieved in the same place. Yet, without specific provisions for biodiversity, REDD+ is likely to protect forests that are most cost-effective for reducing carbon emissions. Venter *et al.* (2009) have demonstrated that prudent targeting of

REDD+ funds can double biodiversity benefits while incurring only a small reduction (4 to 8%) in carbon benefits. There are, however, challenges in developing equitable benefit sharing mechanisms at different scales and would require adoption of a pro-poor approach that is central to development of community-based approaches to forest management. Some of the essential pre-requisites for successful implementation of a REDD+ mechanism (Murthy, Sharma and Ravindranath 2013), in addition to clarity on methodological issues are:

- Ensure that the natural forests, particularly old growth forests, are safeguarded and biodiversity is not threatened.
- Indigenous forest dwellers and forest dependent local communities are an integral part of the entire process and have sufficient incentives to ensure that the projects are successful.
- Effective mechanisms are developed to quantify reduction of emission and assess the correct monetary value of a forest.
- Sufficient funds, irrespective of whether these come from national or international sources, are made available.
- Each stage of a REDD+ project, from approval to completion, is transparent, and there is accountability.

Thus, building of a national REDD+ system presents a huge and unprecedented undertaking for forest protection, management, restoration and establishment of a national architecture to accurately measure, report, and verify national forest carbon stocks, and emissions and removals (Murthy, Sharma and Ravindranath 2013). Developing countries such as India are starting from a difficult position as national inventory was not designed for the purpose of forest carbon accounting. However, the introduction of REDD+ will open opportunities to reverse deforestation trends and capture forest carbon values in regions, wherein deforestation and forest degradation along with protection of the rights of indigenous people and traditional communities are issues of concern (Laurance 2008).

RECOMMENDED SET OF GUIDELINES FOR FIELD PRACTITIONERS OF REDD+

India has a draft national REDD+ policy and strategy. It aims to provide a roadmap for building comprehensive strategies for implementing REDD+ projects and programs effectively. However, field implementation of REDD+ requires an entirely different set of activities that will facilitate and enable successful implementation of REDD+ in India. These include the following:

Creation of a REDD+ Information System

There is an urgent need to create a centralized information system and a technical cell to provide information on data and share technical capabilities with field practitioners, to promote convergence of efforts and information that could feed into the national monitoring database.

Transparent, Equitable and Accountable Management

A national fund management system, for consolidation of finances available from various sources and for operationalization of REDD+ performance-based payments based on the principle of equitable benefit sharing.

Capacity Building

- *Forest Department Staff:* To collect information related to REDD+ and monitoring for REDD+.
- *Local Youth, Men and Women:* In villages wherein forestry activities are to be implemented, there is a need to build capacity for controlling forest fires, insect and pest damages.
- *Local Communities:* To involve in non-natural resources' based economic activities for diverting unsustainable pressure from forests.

Strengthening Stakeholders' Participation for Addressing Forest Degradation

Drivers for forest degradation vary from state to state and even within a state from one site to another. There is a primary need to identify these drivers of degradation which could be outside the domain of forests, requiring specific action. They could be:

- Assessment of site-specific performance of species for better productivity and supply of forest products including small timber, fuelwood and NTFPs. Increased soil and water conservation measures, etc. that would prompt community motivation to conserve forests.
- Promotion of options for addressing shifting cultivation, where it exists.
- *Provision of alternative options:* Cheap fuel options such as promotion of non-conventional energy sources, low cost permanent housing facilities, improved infrastructural facilities including health, improving agricultural and livestock productivity.
- Promotion of afforestation and agro-forestry on all lands and not just forest lands for meeting demands of fuelwood and fodder of local communities.
- Effective and improved silvicultural operations for improving site-specific productivity with a focus on local livelihoods.

All these require development of technical and institutional capacities of various stakeholders including SFDs, local communities, other related government agencies, and educational institutions for implementation of REDD+ programmes including MRV (MoEFCC 2016).

Such capacities are needed for carrying out periodic assessment of carbon and other non-carbon benefits that need to be monitored and reported under REDD+. In addition to the technical issues that field practitioners must deal with, there is a need for them to be sensitive to issues of equity and the role of forest-dependent communities, ensuring (1) improvement of livelihoods of forest-dependent communities and (2) incentives for carbon sequestration do not give rise to inequity. Overarching all these, a robust information management system needs to be in place to maintain a record of information gathered at different scales and across different regions.

REFERENCES

Afreen, Shamama, Nitasha Sharma, Rajiv K. Chaturvedi and Ranjith Gopalakrishnan. 2011. Forest policies and programs affecting vulnerability and adaptation to climate change. *Mitigation and adaptation strategies for global change* 16 (2): 177-197.

Chakraborty, Anusheema, P. K. Joshi, Aniruddha Ghosh, and G. Areendran. 2013. "Assessing biome boundary shifts under climate change scenarios in India." *Ecological Indicator* 34: 536-547.

Chaturvedi, Rajiv K., Ranjith Gopalakrishnan, Mathangi Jayaraman, Govindasamy Bala, N.V. Joshi, Raman Sukumar, and N. H. Ravindranath. 2011. "Impact of climate change on Indian forests: a dynamic vegetation modeling approach." *Mitigation and Adaptation Strategies for Global Change* (Springer) 16 (2): 119-142.

CICERO and IISc. 2015. *Climate Change Mitigation and Adaptation in the Forest Plantation Sector*. Oslo: CICERO & Bangalore: Indian Institute of Science.

CBD. 2001. *Report of the Ad Hoc Technical Expert Group on Forest Biological Diversity*. Montreal: Secretariat of the Convention on Biological Diversity.

FSI. 2015. *State of Forest Report.* Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

Gopalakrishnan, Ranjith, Mathangi Jayaraman, Govindasamy Bala, and N. H. Ravindranath. 2011. "Climate change and Indian forests." *Current Science* 101 (3): 348-355.

Ghosh, A. 2012. *Living with Changing Climate – Impact, Vulnerability and Adaptation Challenges in Indian* Sundarbans, 91-108. New Delhi: Centre for Science and Environment.

Guhathakurta, P., O. P. Sreejith and P.A. Menon. 2011. "Impact of climate change on extreme rainfall events and flood risk in India." *Journal of Earth System Science* 120 (3): 359-373.

Laurance, William F. 2008. Can Carbon Trading Save Vanishing Forests? *BioScience* 58 (4): 286-287. https://doi.org/10.1641/B580402.

Locatelli, B., M. Kanninen, M. Brockhaus, C. J. P. Colfer, D. Murdiyarso, D. and H. Santoso. 2008. "Facing an uncertain future: How forests and people can adapt to climate change." *Forest Perspectives* no. 5: 97. Bogor, Indonesia: CIFOR.

McCarthy, J. J., O. F. Canziani, N. A. Leary, D. J. Dokken and K. S. White. 2001. *Climate change 2001: impacts, adaptation and vulnerability*. Cambridge, UK: Cambridge University Press.

MoEFCC. 2016. *National REDD+ Policy and Strategy*. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India. www.envfor.nic.in.

Murthy, Indu K., Nitasha Sharma and Nijavalli H. Ravindranath. 2013. "Harnessing REDD+ opportunities for forest conservation and carbon stock enhancement in the Northeastern States of India." *Natural Science* 5 (3). DOI:10.4236/ns.2013.53048.

Murthy, Indu K., Rakesh Tiwari and N. H. Ravindranath. 2011. "Climate change and forests in India: adaptation opportunities and challenges." *Mitigation and Adaptation Strategies for Global Change* 16 (2): 161-175.

Parry, Martin, Osvaldo Canziani, Jean Palutikof, Paul van der Linden, and Clair Hanson. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, UK: Cambridge University Press.

Ravindranath, N. H., Rajiv K. Chaturvedi and Indu K. Murthy. 2008. "Forest conservation, afforestation and reforestation in India: implications for forest carbon stocks." *Current Science* 95 (2): 216-222

Ravindranath, N. H., Sandhya Rao, Nitasha Sharma, Malini Nair, Ranjith Gopalakrishnan, Ananya S. Rao, Sumedha Malaviya, Rakesh Tiwari, Anitha Sagadevan, Madhushree Munsi, Niharika Krishna, and Balatchandirane Govindasamy. 2011. "Climate Change Vulnerability Profiles for North East India." *Current Science* 101 (3).

Ravindranath, N. H., Indu K. Murthy, Priya Joshi, Sujata Upgupta, Swapan Mehra and Nalin Srivastava. 2014. "Forest area estimation and reporting: implications for conservation, management and REDD+." *Current Science* 106: 1201-1206.

Rustad, Lindsey, John Campbell, Jeffrey S. Dukes, Thomas Huntington, Kathy Fallon Lambert, Jacqueline Mohan, and Nicholas Rodenhouse. 2012. *Changing climate, changing forests: The impacts of climate change on forests of the northeastern United States and eastern Canada*. Gen. Tech. Rep. NRS-99, 48. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station.

Sharma, J., R. K. Chaturvedi, G. Bala. 2013. "Challenges in vulnerability assessment of forests under climate change." *Carbon Management* 4 (4): 403-411.

Sharma, J., R. K. Chaturvedi, G. Bala. 2015. "Assessing 'inherent vulnerability' of forests: a methodological approach and a case study from Western Ghats, India." *Mitigation and Adaptation Strategies for Global Change* 20 (4): 73-590.

Upgupta, Sujata, Jagmohan Sharma, Mathangi Jayaraman, Vijay Kumar and N. H. Ravindranath. 2015. "Climate change impact and vulnerability assessment of forests in the Indian Western Himalayan region: A case study of Himachal Pradesh, India." *Climate Risk Management* 10: 63-76.

Venter, Oscar, Erik Meijaard, Hugh Possingham, Rona Dennis, Douglas Sheil, Serge Wich, Lex Hovani, and Kerrie Wilson. 2009. "Carbon payments as a safeguard for threatened tropical mammals." *Conservation Letters* 2 (3). doi:10.1111/j.1755-263X.2009.00059.x.

Xiao-Ying, Wang, Zhao Chun-Yo and Jia Qing-Yu. 2013. "Impacts of Climate Change on Forest Ecosystems in Northeast China." *Advances in Climate Change Research* 4 (4): 230-241.

FURTHER READING

Miles, Lera, and Valerie Kapos. 2008. "Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation: Global Land-Use Implications." *Science* 320 (5882): 1454-1455. doi:10.1126/science.1155358.

Mukhopadhyay, Durgadas. 2009. "Impact of climate change on forest ecosystem and forest fire in India." *IOP Conf. Series: Earth and Environmental Science*. IOP Publishing. doi:10.1088/1755-1307/6/8/382027.

Chapter 3: Trees Outside Forests: Status and Potential

Piare Lal

INTRODUCTION

Trees Outside Forests (TOF) play an important role in the provision of resources and environmental functions. TOF offer products such as timber, fuel wood, food, fruits, and fodder, as well as other non-wood products such as edible and non-edible oils, condiments, dyes and tannins, medicines, gums, and resins. TOF enhance the quality of the environment through soil and water resource conservation, soil enrichment, shade and shelter provision, carbon sequestration, climate change mitigation, and overall environmental amelioration. TOF may be natural, planted, or of coppice origin and can grow in formations such as blocks or linear, or be scattered. They can be found in rural or urban environments, and ownership may be with individuals, communities, or the government, depending upon land settlement and ownership rights. Although humans, both individually and communally, have been planting, maintaining, preserving, and using TOF since time immemorial, the awareness of TOF's economic and environmental values is growing.

If societies can improve, develop, and manage diversified global forest and TOF resources and further improve their productivity on a sustainable basis, people all over the world can continue to benefit from supplies of wood and non-wood products. In addition, societies could also benefit from environmental services like conservation of biodiversity and ecological resources, which would simultaneously contribute to climate change mitigation and environmental amelioration. However, if deforestation and degradation of forests are not reversed, and forest and TOF resources are exploited beyond sustainable limits, the consequences will be extremely serious. Major negative impacts will be observed on soil fertility, water resources, livelihoods, food security, productivity of agricultural crops, horticulture and livestock, biodiversity, and ecological security in a changing climate scenario.

Serious public concern over climate change issues arose after the World Climate Conference held in Geneva in 1979, and subsequently through the Intergovernmental Panel on Climate Change (IPCC) created in 1988. The first report that IPCC released in 1999 confirmed that the threat posed by climate change was real. Major developments

since the signing of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 include the Kyoto Protocol in 1997, which set binding emission reduction targets; and the Conference of the Parties (COP) 11 in 2005, which initiated an incentive framework for climate change mitigation by Reducing Emissions from Deforestation and Forest Degradation (REDD). The Copenhagen Accord signed during COP 15 not only recognized the crucial role of REDD, but also acknowledged the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries, which was referred to as REDD-plus (REDD+). The Warsaw Framework for REDD+ at COP 19 in 2013 delivered a set of seven decisions backed by USD 280 million (provided by the United States, Norway, and United Kingdom) to support developing nations to progress and fully implement activities under REDD+ (Gera 2014).

Like forests, TOF provide a variety of products and environmental services. Scientific development, utilization within sustainable limits, regular assessment, and monitoring of this critically important resource can make significant contribution to climate mitigation efforts. Thus, TOF needs to a key element of the REDD+ strategy, especially in the Indian context.

DEFINITIONS

There are no uniform and globally accepted definitions for the terms "forest" and "trees outside forests." Normally, a large area of land with dense vegetation comprising trees, shrubs, and herbs without agricultural crops is regarded as a forest. However, the extent of a patch of land, canopy cover, and tree height, or legal definitions of forest in various countries can also determine whether a particular patch of land is a forest or not. The concept of "trees outside forests" was coined in 1995. As per the Food and Agriculture Organization of the United Nations (FAO) guidelines (Foresta *et al.* 2013), it pertains to trees growing on other lands excluding forests and other wooded lands. It is difficult to have one direct, specific, and universally accepted definition of the term "trees outside forests" unless the definitions of terms "tree," "forest," and "other wooded land" are understood and accepted uniformly. However, clearly understood and broadly acceptable definitions are certainly required to understand the extent; classification; complexities; and social, economic, ecological, and environmental benefits of these unique tree resources along with many other important related issues at the country and global levels.

The FAO has defined these and related terms as follows, and made suitable recommendations to member countries for adoption, to ensure uniformity in reporting about these resources at a global level (Foresta *et al.* 2013):

Forest: Land that spans more than 0.50 hectares (ha) with trees higher than five meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.

Other Wooded Land: Land not classified as forest that spans more than 0.50 ha; with trees higher than five meters and a canopy cover of 5–10 percent, or trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes, and trees above 10 percent. It does not include land that is predominantly under agricultural or urban land use.

Other Land: All land that is not classified as forest or other wooded land.

Other Land with TOF: Land classified as other land that spans more than 0.05 ha with trees higher than five meters and canopy cover above 5 percent, or with trees able to reach these thresholds *in situ*; or with a combined cover of shrubs, bushes, and trees above 10 percent. It includes land that is predominantly under agricultural or urban use, but also some land that is not predominantly under agricultural or urban use with areas spanning less than 0.50 ha and more than 0.05 ha. Other land with TOF includes windbreaks, shelterbelts, and corridors of trees and shrubs with an area spanning less than 0.50 ha or a width of less than 20 meters but more than 3 meters.

According to FAO's Global Forest Resources Assessment 2010, "trees outside forest" refers to trees found on lands that are not categorized as "forest" or as "other wooded land." They include trees (isolated, linear, and groups or stands of trees and tree systems) found in rural landscapes (e.g., on farms; in fields, pastures, and various forms of horticulture and agroforestry systems; in hedges; and along roads and streams) and in urban settings (e.g., on private or public lands and along streets (FAO, 2010). TOF have been further classified into following three categories (Foresta *et al*. 2013):

- TOF-AGRI: TOF on lands predominantly under agricultural land use,
- TOF-URB: TOF on lands predominantly under urban land use, or
- TOF NON A/U: TOF on lands not predominantly under agriculture or urban land use.

Tree: A tree has been defined as a woody perennial with a single main stem; or, in the case of a coppice with several stems, having a more or less a definite crown. Bamboos, palms, and other woody plants meeting the above criteria are included in the definition of a tree.

The definition of "forest" accepted by India and communicated to UNFCCC in 2001 is as follows:

Forest: Forest is a minimum area of land of 0.05 ha, with tree crown cover (or equivalent stocking level) of more than 15 percent for trees with the potential to reach a minimum height of two meters at maturity *in situ* (Gera 2014).

However, a tract of land is recognized as forest by the Forest Survey of India (FSI) if it is legally proclaimed to be a forest under the forest law (Indian Forest Act, 1927 or the State Forest Act), and it is recorded/notified as forest in government records. FSI adopts this legal definition of "forest" and "forest area" that is also known as "recorded forest area." Recorded forest area includes reserved forest, protected forest, and un-classed forest areas including all such notified patches of land, even without any tree cover. FSI has published biennial State of Forest Reports since 1987 based on assessment and monitoring of forest cover during the previous two years. Forest cover, tree cover, TOF, and other related terms are defined and explained by FSI in the India State of Forest Report (ISFR) 2003 as follows (FSI 2003):

Forest Cover: All tree canopies that could be delineated and assessed from satellite data constitute forest cover. Forest cover includes canopies of all forest and tree crops larger than 1 ha in area, irrespective of land ownership, land

use, and type of tree species. Thus, all patches of trees exceeding 1 ha in area with canopy cover more than 10 percent, located both inside and outside the recorded forest area, are included in forest cover.

Trees Outside Forests: TOF implies all tree crops growing outside the recorded forest area. Such trees may be in block plantations, linear formations, or scattered. TOF in rural areas are called "TOF (Rural)" and those in urban areas are called "TOF (Urban)."

Tree Cover: The crown cover of residual TOF cover constitutes tree cover. Tree cover is the computed area covered by a crown of trees, which is too small to be delineated by digital interpretation of remote sensing data, used for forest cover delineation.

Scrub: All lands, generally in and around forest areas, that have bushes and/or poor tree growth, and that consist chiefly of small or stunted trees with canopy density less than 10 percent.

Tree: A perennial woody plant with a well-defined bole or trunk, including bamboo, palms, and fruit trees but excluding tall bushes, climbers, and non-woody plants like banana. For the purpose of assessing tree cover, only trees with a diameter at breast height (dbh) of 10 centimeters or more (taken at 1.37 meters from the ground) are considered (FSI 2003).

There are anomalies in the ISFR regarding reporting of area covered under TOF, as patches of TOF that are greater than 1 ha in area with canopy cover of more than 10 percent are included in the definition of forest cover. Thus, trees in this category in urban and rural areas – including agroforestry plantations; fruit orchards; and coconut, areca nut, and rubber plantations located outside recorded forest areas – that are actually part of TOF, get included in forest cover during FSI assessments. Moreover, while forest cover includes all areas with tree canopy covering more than 10 percent and land area exceeding 1 ha, tree cover reported by FSI is only a part of TOF representing a computed area based on tree canopy of all trees included in the assessment. The tree cover of all these trees are hypothetically brought together to constitute a block of tree land with 70 percent canopy density. Trees with less than 10 centimeters dbh are not included in FSI assessments of TOF or tree cover (FSI 2013). Thus, millions of trees being planted under agroforestry systems or on lands outside forest areas are left out of FSI TOF assessments until they attain 10 centimeters dbh.

EXTENT OF TOF

As TOF may be scattered or comprise small blocks and linear formations spread over large geographical areas, assessment of this resource at the country and regional levels is extremely difficult. The lack of uniform and universally accepted definitions of "forest" and "TOF" makes the global assessment of TOF difficult. FAO's Global Forest Resources Assessment 2000 devoted a chapter to highlight the vital role of TOF in providing a vast variety of products and key environmental services, but the assessment only used brief summaries based on specific studies about the extent of TOF in certain tracts of a few countries. Despite considerable progress, exact data on TOF across large areas at sub-national and national levels remains scarce. A review of the 38 large area assessments revealed that the TOF concept was just beginning to be considered

in national assessments. A global-scale TOF assessment (Zomer *et al.* 2009) provides the global magnitude of TOF on agricultural land, confirming that approximately 10 million km^2, or 46 percent of the total agricultural land, has more than 10 percent tree cover. Many countries have included TOF in FAO's National Forest Monitoring and Assessment Programme by successfully integrating TOF and TOF issues into their national forest and tree assessments (Foresta *et al.* 2013).

FSI has conducted TOF inventories since 1991. The 2001 assessment included the first report of tree cover. ISFR 2003 detailed the methodology for assessing TOF and tree cover based on random samples, covering 60 districts or approximately 10 percent of the total districts of India, and provided findings about the extent of TOF, tree cover, and main species. According to ISFR 2003, India's tree cover (computed area with 70 percent canopy density) was 9,989,600 ha or about 3.04 percent of the geographic area of the country – an increase of 1,842,400 ha compared to the 2001 assessment. However, this tree cover does not include patches of TOF that are 1 ha or more in area and trees less than 10 centimeters dbh. The total growing stock of wood in the country was estimated to be 6.414 billion m^3, which included 4.782 billion m^3 inside forests and 1.632 billion m^3 in TOF. The number of trees reported in TOF was 2.680 billion. The maximum growing stock in TOF was observed in the state of Andhra Pradesh, followed by Maharashtra and Gujarat (FSI 2003).

ISFR 2013 reported the tree cover in India as 9,126,600 ha, a decrease of 863,000 ha of tree cover reported in 2003 (FSI 2003). Maharashtra had a maximum tree cover of 914,200 ha followed by Gujarat, Rajasthan, Jammu, and Kashmir. However, the combined forest cover and tree cover for the whole country (as per ISFR 2013) was 78,916,400 ha, 24.01 percent of the geographical area, compared to 77,822,900 ha (as per ISFR 2003). This represents an increase of 1,093,500 ha. Growing stock in forest reported in ISFR 2013 was 4.173 billion m^3 and 1.484 billion m^3 in TOF, both of which are below the levels reported in ISFR 2003. There was a decrease of 147 million m^3 of growing stock in TOF. ISFR 2013 also devoted a separate chapter to trees in agricultural systems in India, a subset of TOF. The total tree green cover under agroforestry was reported to be 11,155,400 ha, with 1.023 billion m^3 wood volume and an estimated carbon stock of 280 million tons (FSI 2013). Thus, nearly 69 percent of the growing stock in TOF was under the agroforestry system.

Based on the inventory of forests and TOF carried out between 2008 and 2014, and interpretation of satellite data from 2013 to 2014 by FSI, major findings reported via the latest ISFR (2015) with respect to TOF included:

- The total forest and tree cover of the country was 79.42 million ha, which was 24.16 percent of the geographical area of the country. This included 70.17 million ha of forest cover, or 21.34 percent of geographical area of the country. Compared to the 2013 assessment report, forest cover increased by 0.38 million ha by 2015 (FSI 2015). Tree cover reported was 9.26 million ha. The tree cover reported in ISFR 2015 increased by 131,200 ha, nearly 1.44 percent more than tree cover mentioned in ISFR 2013.
- The total growing stock of India's forests and TOF was estimated to be 5.768 billion m^3, of which 1.573 billion m^3 constituted

TOF. Growing stock in TOF increased by slightly more than 88 million m^3 as compared with estimates reported in ISFR 2013. Estimated number of stems in TOF at the national level was reported as 5.419 billion (FSI 2015).

Comparative details related to tree cover, number of stems of all species, and growing stock in respect to TOF as reported by FSI in ISFR 2003, ISFR 2013, and ISFR 2015 are given in Table 3.1.

According to ISFR 2015, the forest cover reported inside the green-wash areas marked on maps prepared by the Survey of India, which nearly correspond to the recorded forest area, was 52.76 million ha (FSI 2015). The forest cover outside the green-wash areas was 17.40 million ha, and constituted part of TOF with a patch size of 1 ha or more. This inclusion of a subset of TOF in forest cover distorts reality, artificially inflating the forest cover area and correspondingly reducing the TOF cover area. Separate assessments of canopy cover, growing stock, annual increments, regeneration, fires, and other related aspects would provide more clarity on the same. Similarly, assessment and reporting of TOF, including patches of 1ha or more, would be useful.

MAJOR SPECIES IN TOF

The top five species contributing to the highest volumes of growing stock in TOF are mango (*Mangifera indica*, 12.51 percent), *Azadirachta indica* (7.31 percent), *Cocos nucifera* (5.53 percent), *Borassus flabelliformis* (4.57 percent), and *Madhuca latifolia* (3.48 percent). These are followed by *Butea monosperma*, *Bombax ceiba*, *Pinus kesya*, *Artocarpus heterophyllus*, and *Pinus roxburghii*, respectively. These top 10 species contribute 47.42 percent of the total growing stock of TOF in India. Other major species contributing significantly to TOF growing stock include *Ficus* spp., *Acacia* spp., *Eucalyptus* spp., *Shorea robusta*, *Syzigium cumini*, *Tectona grandis*, *Salix* spp., *Tamarindus indica*, *Terminalia arjuna*, *Albizzia* spp., *Zizyphus mauritiana*, and *Terminalia crenulata*. Poplars constitute 1.21 percent of the total number of TOF and 0.73 percent of growing stock of TOF. Various species of eucalyptus contribute 3.98 percent of total stems and 2.11 percent of growing stock of TOF in India (FSI 2015).

In terms of the number of stems, the top 10 species in TOF are *Mangifera indica*, *Areca catechu*, *Azadirachta indica*, *Cocos nucifera*, *Pinus kesya*, *Eucalyptus* spp., *Butea monosperma*, *Acacia nilotica*, *Tectona grandis*, and *Hevea brasiliensis*.

Table 3.1: Comparative analysis of tree cover, number of stems and growing stock of TOF

FSI Report	Tree Cover (in ha)	Number of stems of TOF (in millions)	Growing stock of TOF (in million m^3)
SFR 2003	9,989,600	2,680*	1,632
ISFR 2013	9,126,600	5,080	1,485
ISFR 2015	9,257,200	5,419	1,573

** Number of trees in tree cover estimates*

Commercial-scale poplar plantations are raised under agroforestry systems mainly in Punjab, Haryana, Uttar Pradesh, Uttarakhand, and Bihar. However, various species of poplars are also available both inside forests and in TOF in the hilly areas of north and east India (Jones and Lal 1989; Dhiman 2014). Details of the estimated number of stems of TOF and their growing stock as per ISFR 2015 are given in Annexure 3.1. The volume of growing stock in TOF is more than the corresponding volume of growing stock of forests in six states and four union territories of India including Gujarat, Rajasthan, Mizoram, Haryana, Bihar, Punjab, Delhi, Daman and Diu, Lakshadweep, and Puducherry. For example, the volume of growing stock in TOF and forests in Gujarat are 52 million m^3 and 22 million m^3, respectively. Rajasthan has a growing stock of 85 million m^3 in TOF and 38 million m^3 in forests. State-wise details of growing stock of forests and TOF in India (as per ISFR 2015) are given in Annexure 3.2.

However, it is important to note that the proportion of annual wood harvested from TOF resources versus growing stock varies by species. Plantations of fast-growing species (e.g., poplars, eucalyptus, *casuarina*, and *subabul*) primarily raised on agricultural lands are harvested at shorter rotation periods of three to six years, mainly for the production of logs for the plywood industry, poles, or pulpwood. Although precise data about the annual harvest of TOF species is not available, it is quite likely that the contribution of these four species to annual cut is far greater than yearly harvest of wood from any long-duration tree species like mango, jackfruit, coconut, borassus, jamun, tamarind, mahua, and ber that are retained over long periods for production of fruits or non-wood products.

ROLE AND IMPORTANCE OF TOF

TOF provide enormous benefits through the provision of industrial roundwood, timber, wood-based products, fruits, food, fiber, fuelwood, fodder, rubber, nuts, medicines, edible and non-edible oils, gums, resins, tannin, and innumerable other non-wood products. Like forests, TOF provide a range of environmental services, including rainfall interception and water supply regulation, conservation of soil and soil nutrients, wind protection and sand fixation, greening of the country and environmental amelioration through absorption of gases and fixation of CO_2, conservation of biodiversity, recreation, and education (Singh 2014). Other non-wood products obtained from trees that may be planted and maintained in orchards or as individual trees in farmers' fields, parks or along farm boundaries include fresh fruits (mango, apple, apricot, pear, peach, plum, citrus fruits, guava, jamun, jackfruit, figs, and ber), nutritious dry fruits (walnut, cashew, and almond), coconut, arecanut, tamarind, rubber, palm oil, plant parts (roots, bark, flowers, leaves, and fruits or seeds used in indigenous systems of medicine), tannin, gums, resins, and leaves used for fodder. Mahua (*Madhuca latifolia*) shade, flowers, and fruits are important for tribal communities and Neem (*Azadirachta indica*) fruits and leaves are used in preparation of medicines and pesticides. There is an urgent need for better awareness about the extent of TOF and the economic value of the vast array of products and environmental services they provide for ensuring holistic development, conservation, sustainable utilization, and scientific management of TOF resources.

TOF are a major source of renewable and sustainable supply of timber and fuel wood. Forest resources are becoming degraded due to unsustainable removal of fuelwood and illicit felling of valuable logs from forests. Thus, TOF resources not only provide a variety of primary products and environmental services, TOF make major contributions to indirect forest conservation and create opportunities for direct and indirect employment in wood-based industries and non-wood product processing. TOF resources have helped expand and increase the sustainability of such processing industries through significant local value addition to primary products obtained from TOF. These developments have also increased government revenues through taxes on such products.

A case study from Haryana about direct contributions of agroforestry plantations in the region is indeed revealing. In the forest-deficient state of Haryana, Yamunanagar town and its surrounding areas contain the highest concentration of veneer and plywood manufacturing units, with 400 factories that process about 12,000 m^3 or 10,000 tons of poplar and eucalyptus veneer-grade logs daily. The daily production of wood from agroforestry plantations in Yamunanagar alone is worth USD 0.3 million or INR 19.35 million. Value-added plywood products worth USD 1.20 million or INR 77.40 million (at the exchange rate of INR 64.50 per USD) are produced every day. Logging operations contribute 10,000 person-days of employment daily, and transporters receive INR 3 million worth of business daily from wood transport. After the Government of Haryana entered into an agreement with the plywood industry regarding sales tax/value-added tax, government revenues from agroforestry-generated products from Yamunanagar district increased by INR 120 million per year (Bhojvaid 2014). According to the Association of Plywood Industries of Yamunanagar, plywood manufacturers from the region contribute nearly 50 percent of the plywood production of the country, worth INR 25,000 million per year. According to the estimates of the Central Empowered Committee set up by the Honorable Supreme Court of India, the forest-deficient states of Punjab, Haryana, and Uttar Pradesh produce nearly 2.2 million m^3, 3.5 million m^3, and 4.2 million m^3 (respectively) of wood annually from TOF resources – using expanded clonal eucalyptus and poplar plantations under agroforestry systems (Sapra 2013; Lal 2014).

FSI (2011) estimates India's annual roundwood requirement by major wood-based industries (excluding pulp and paper) at 90.80 million m^3 logs, including 19.90 million m^3 processed by 3,457 plywood and veneer units. In contrast, the International Tropical Timber Organization estimates India's requirement of industrial logs to be between 90 and 130 million m^3 per year, and that by 2020, there will be an annual deficit of nearly 80 to 90 million m^3 logs per year. The ISFR 2011 estimated wood production from forests in India is 3.175 million m^3 and the potential production from TOF (largely from agroforestry plantations) is 42.775 million m^3 per year. Fuel wood is annually consumed in India at an estimated 216.42 million tons, of which forests contribute 58.75 million tons, or 27 percent, and the remainder of contributed by TOF and agricultural crop residues (FSI 2011; Lal 2014). Wood imports grew at an average of 12 percent annually between 1996 and 2005, and the value of wood and wood-based fiber imports into India during 2006 was USD 2.75 billion.

During 2010 to 2011, 10 million tons of paper was produced, including 3.10 million tons from pulpwood and bamboo. Industry sources project that by 2025, domestic production of paper and paperboards will be 22 million tons annually, including 6.10 million tons from wood-based production. That will require nearly 24.40 million tons of freshly harvested pulpwood annually, the bulk of which will be supplied by TOF resources (Lal 2014).

As India is a wood-deficient country, it requires huge net imports of wood and wood products to meet the country's requirements. According to data given in ISFR 2015, India exported 31,586 m^3 wood and 1,915 tons of wood products valued at INR 2,408 million and imported 6,717,557 m^3 wood and 412,874 tons of wood products valued at INR 133,675 million during 2014-2015. More than 80 percent of roundwood and pulpwood for veneers, plywood, hardboard, and wood-based pulp mills is supplied through agroforestry on private farm lands. If wood supplies from TOF resources had not sustained India's supply requirements, the net imported quantities of wood and wood-based products and their value would have been extremely high. Poplars and eucalyptus planted under agroforestry systems outside forests supply the bulk of the veneer-quality logs and roundwood, which is used by veneer, plywood, and panel products industries as well as wood-based pulp and paper mills. Pulpwood supplies are also supplemented by *Casuarina* and subabul (*Leucaena leucocephala*) plantations on farm lands in coastal areas and central/southern India. TOF resources of eucalyptus and *casuarina* plantations provide a large number of the poles required for rural housing, mining pit props, and shuttering support in most states of India.

Wood obtained from TOF is used in many forms, including round logs, poles, sawn timber, plywood, and wood-based panel products, joinery, and furniture. It is also used in the production of wood-based pulp for paper newsprint, paperboard production, and rayon-grade pulp for viscose fiber. Apart from the wide variety of products, TOF resources also provide all of the environmental services that forests do, and play a major role in climate change mitigation, carbon sequestration, ecological and food security, conservation of soil and water resources, greening of the country, and environmental amelioration. Carbon stored in such harvested wood and wood-based products remains locked in for a number of years, depending upon the durability and longevity of wood-based products and their recycling. Longevity of such products and storage of carbon for longer periods can be enhanced through seasoning and environmentally friendly preservative treatment of timber and wood products. Thus, scientific development and sustainable management of TOF resources will play an important role under REDD+ in developing countries like India.

Genetically improved clonal planting stock of poplars since 1984 and eucalyptus since 1992 (supported with improved practices for scientific management of plantations of these species under agroforestry systems) have revolutionized productivity of plantations with substantial improvements in the quality of produce (Lal 2010). Success stories of clonal eucalyptus and poplar plantations have demonstrated the huge potential of improving the productivity of plantations and quality of produce, both on suitable public and private lands (Lal 2003; Lal 2001). Superior clones of *Casuarina* have also been developed and

deployed in coastal regions and southern states, both on forest lands and private farm lands. India has huge untapped potential for holistic development of agroforestry plantations and large-scale deployment of field-tested superior clones, as well as genetically improved seeds for enhancing productivity of scarce land resources. TOF sourced products have also experienced tremendous improvements in quality and expansion. However, innovative changes in policies, sound institutional support, marketing reforms related to the sale of primary produce of TOF, and efficient technical extension services will be required for continued growth (Lal 2015). If India can restore large parts of its degraded lands through technology-based plantations based on genetically improved planting stock and superior clones that are supported with scientific silvicultural management, it can tap the full potential of agroforestry plantations. This would allow India to become self-sufficient in wood as well as many other primary products obtained from forests and TOF resources. Simultaneously, India can expand and conserve its valuable forests and TOF resources, and substantially enhance the values of environmental services provided by these vital renewable resources.

Total carbon stock in forests in India was estimated to be 7.044 billion tons in 2013 (as per ISFR 2015), an increase of 103 million tons compared with 6.941 billion tons during 2011 (as reported in ISFR 2013). Growing stock inside the forest areas (as per ISFR 2013) was 4.173 billion m^3 and the volume of growing stock in TOF was 1.484 billion m^3.
The growing stock of trees found in agroforestry systems was reported as 1.023 billion m^3 and their total carbon stock as 280 million tons. This assessment of carbon stock of trees in agroforestry systems seems to be a gross underestimate. If we assume the same ratio between total carbon stock and growing stock inside forests and TOF resources (as per ISFR 2013), total carbon stock in TOF resources should be 2.469 billion tons. Growing stock of TOF (as per ISFR 2015) was 1.573 billion m^3. Assuming the same ratio, the total carbon stock in TOF resources should be 2.616 billion tons.

TOF AND REDD+ IN INDIA

India played a positive and constructive role throughout the climate change negotiations leading to the evolution and present status of REDD+. Significant progress was made on the adaptation strategies with the newly launched Green Climate Fund (GCF) during COP 20 held at Lima in 2014. The Paris Agreement at COP 21 in 2015 called upon all parties to establish binding commitments to "Nationally Determined Contributions" and to pursue domestic measures to achieve the goals, including limiting the rise of global temperatures to well below two degrees Celsius. This agreement recognized positive approaches and incentives for REDD, the role of conservation, sustainable management of forests and TOF, and enhancement of carbon stocks. It recognized joint mitigation and adaptation approaches for sustainable management of forests and TOF, while reaffirming the importance of non-carbon benefits (Gera 2016). India has the legal framework and enabling policies in place for implementation of REDD+, including the Forest Conservation Act of 1980, Biological Diversity Act of 2002, and Forest Rights Act of 2006. India also took important steps for REDD+ implementation by developing the Green India Mission; setting up a REDD+ Cell in the Ministry of Environment, Forests, and Climate Change (MoEFCC); sponsoring

a scheme for "Intensification of Forest Management;" and reviewing the National Forest Policy. The National Bank for Agriculture and Rural Development is recognized by GCF as the National Implementation Entity in the area of climate change adaptation and mitigation in India (Gera 2016). FSI has already been monitoring and assessing both forest and TOF resources in India and publishing biennial reports, thus fulfilling the important requirement of measuring, reporting, and verification under REDD+.

Holistic development and sustainable management of both forest and TOF resources necessitates the adoption and implementation of climate change mitigation and adaptation strategies. The Paris Agreement recognizes the need for adequate and predictable financial resources from public, private, bilateral, and multilateral sources such as GCF for implementation of REDD+ strategies and projects. India must seize this opportunity and tap into all such sources through innovative projects for the time-bound restoration of 30 million ha of open degraded forests. This can be achieved through technology-based afforestation and reforestation projects. In addition to accessing bilateral and multilateral funds, the national and state governments should tap the corporate sector and wood-based industries for financial, technological, and professional management of resources. This can be accomplished by involving various stakeholders and the private sector through mutually rewarding agreements that do not jeopardize public land or adversely affect local communities. Reasonably productive plantations of suitable tree species based on genetically improved seeds and field-tested superior clones on degraded forest lands could be raised. This will provide far better environmental services and sustainable sources of income to local forest-dependent communities than the unsustainable and extremely poor benefits currently provided by the continuously degrading forest resource. Even if one-third of this vast land resource (i.e., 10 million ha) with reasonably deep soil can be planted with suitable improved planting stock of suitable species, and such plantations are managed with scientific silvicultural and sustainable management techniques, India can easily produce 100-150 million tons of fuel wood and pulpwood annually. These will also have immense indirect benefits of environmental services, including conservation of natural forests (Lal 2014).

Likewise, India still has vast untapped potential for integrated development of agroforestry plantations and wood-based industries. However, major hurdles currently hampering holistic growth of agroforestry plantations need to be addressed. The foremost important requirements include registration of nurseries, truthful labeling, and certification of the genetic quality of seedlings and clonal planting stock of tree species. These requirements should also be backed by statutory regulations and marketing reforms for sale of farm-grown wood. Technical extension services for agroforestry need major improvements to raise awareness among farmers about the benefits and economic returns of using genetically improved seedlings and field-tested, high-yielding clones supported with an improved package of practices for scientific establishment and management of agroforestry plantations. Regulating the price of the product is also important. Exploitation of farmers by unscrupulous traders, middlemen, and the wood-based industries from 2001 to 2005 (when the price of poplar wood crashed to less than INR 1,000 per ton and farmers

lost nearly INR 18,000 million trying to unload the wood) had disastrous results. The current decline in prices of farm-grown poplars and eucalyptus wood is again a matter of grave concern and price falls need to be checked by central and state governments immediately through suitable interventions.

Farmers and organizations wanting to raise and maintain trees in agroforestry plantations or horticulture gardens should benefit from the vast knowledge and experience gained during the last several decades to prevent mortality, enhance productivity, and improve quality of produce by adopting the following guidelines:

- Carefully select species and genetically improved clones to match the soil and agro-climatic conditions of the planting site.
- Deploy only the best available genetically improved, healthy, and vigorous clonal saplings or seedlings sourced from dependable and honest suppliers that supply only superior genetic quality planting stock. This is the most important prerequisite for high productivity, better produce quality, and high net returns. Cheap planting stock and spurious clones with poor genetic qualities undermine productivity, overall production, quality of produce, and profitability throughout the rotation period.
- Prevent mortality of young saplings through ensuring optimum moisture in the root zone, using prophylactic treatment against termites, and avoiding damage by excessive fertilizers is essential.
- Transplant clonal plants or improved seedlings in pre-planned irrigation channels on land with irrigation infrastructure, plant them early with the onset of monsoon rains in rain-fed areas, and use adequate soil and moisture conservation measures.
- Ensure timely weeding and soil working, and protect the growing seedling/saplings from fire damage, insects, diseases, grazing animals, and fast-growing crops.
- Maintain soil fertility and apply organic manures, fertilizers, and micro-nutrients as needed to address common deficiencies of plant nutrients like nitrogen, phosphorus, zinc, iron, boron, and manganese.
- Regularly monitor and evaluate plantations at periodical intervals. Timely scientific management interventions are essential for ensuring optimum availability of plant nutrients, moisture, and effective protection.

CONCLUSION

Reforesting degraded forest lands through technology-based plantations and holistic development of TOF resources should be given the highest priority under REDD+. This includes agroforestry plantations based on genetically superior seeds and high-yielding clonal planting stock of appropriate species. The adoption of improved practices for scientific development and sustainable management of plantations on degraded forest lands, agroforestry plantations, and other TOF resources with efficient technical extension services will support the above initiatives. Central and state governments could consider tapping financial, technological, and professional management resources of the private sector and other stakeholders for reforestation of degraded public lands and holistic development of agroforestry plantations on private lands through appropriate policies. Strong research and development support should be provided for all such projects, particularly on the development of genetically improved seedlings and clones of important

tree species with built-in monitoring and evaluation programs. The creation of large-scale jobs for rural employment in reforestation and agroforestry projects and industries based on farm-grown wood has the potential of becoming a major benefit of REDD+ in India. These initiatives will help India to ensure better conservation of biodiversity-rich natural forests; achieve self-sufficiency in wood, wood-based products, fuel-wood, and non-wood products on a sustainable basis; improve environmental services of forests and TOF; help in climate change mitigation; and benefit from international funding under REDD+.

REFERENCES

Bhojvaid, P. P. 2014. "Opportunities through Agro Forestry for Sustainable Development: A Case Study from Haryana, India." In *Sustainable Forest Management for Multiple Values: A Paradigm Shift*, edited by P. P. Bhojvaid and N. Khandekar, 161-168. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

Dhiman, R. C. 2014. "Poplars in India: Past, Present and Future." In *Sustainable Forest Management for Multiple Values: A Paradigm Shift*, edited by P. P. Bhojvaid and N. Khandekar, 183-205. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

FAO. 2010. *Global Forest Resources Assessment 2010: Main report*. FAO Forestry Paper 163. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO. 2015. *Global Forest Resources Assessment 2015*. Rome, Italy: Food and Agriculture Organization of the United Nations.

Foresta, Hubert de., E. Somarriba, A. Temu, D. Boulanger, H. Feuilly and M. Gauthier. 2013. *Towards the Assessment of Trees Outside Forests: A thematic report prepared in the framework of the global forest resources assessment*. Forest Resource Assessment Working Paper 183. Rome, Italy: Food and Agriculture Organization of the United Nations.

FSI. 2003. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2011. *India State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2013. *India State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2015. *India State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

Gera, M. 2014. "Climate Change and Indian Forests: Vulnerability, Mitigation and Adaptation Strategies." In *Sustainable Forest Management for Multiple Values: A Paradigm Shift*, edited by P. P. Bhojvaid and N. Khandekar, 13-34. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

Gera, M. 2016. *REDD-plus: An update*. Dehradun: Indira Gandhi National Forest Academy, Ministry of Environment, Forest and Climate Change, Government of India.

Jones, N. and P. Lal. 1989. "Commercial Poplar Planting in India under Agro-forestry System." *The Commonwealth Forestry Review* 68 (1): 19-26.

Lal, P. 2001. "Private sector forestry research: a success story from India." *Bois Et Forets Des Tropiques* 267 (1): 33-48.

Lal, P. 2003. "Clonal Eucalyptus Plantations in India." In *Eucalyptus in Asia: Proceedings of an international conference held at Zhanjiang, China, April 7-11, 2003*, edited by J. W. Turnbull, 16-21. Canberra: Australian Centre for

International Agricultural Research.

Lal, P. 2010. "Clonal Forestry in India." *The Indian Forester* 136 (1): 17-37.

Lal, P. 2014. "Clonal Plantations in India, Historical Perspective and Future Potential." In *Sustainable Forest Management for Multiple Values: A Paradigm Shift*, edited by P. P. Bhojvaid and N. Khandekar, 169-182. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

Lal, P. 2015. "Holistic Development of Agroforestry Plantations in India." In *National Workshop on 'Holistic Development of Agroforestry – Potential and Policy* Issues', February 13-14, 2015, Pantnagar, Uttarakhand.

Sapra, R. K. In discussion with the author, 2013.

Singh, S. P. 2014. "Payment for Forest Ecosystem Services: An Overview." In *Sustainable Forest Management for Multiple Values: A Paradigm Shift*, edited by P. P. Bhojvaid and N. Khandekar, 41-67. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

Smith, R. 2001. *Global Forest Resources Assessment 2000 Main Report*. Rome, Italy: Food and Agriculture Organization of the United Nations.

Zomer, R. J., A. Trabucco, R. Coe, F. Place, M. van Noordwijk and J. Xu. 2009. *Trees on farms: An update and reanalysis of agroforestry's global extent and socio-ecological characteristics*. Working Paper 179. Bogor, Indonesia: World Agroforestry Centre (ICRAF) Southeast Asia Regional Program. DOI: 10.5716/ WP14064.PDF.

FURTHER READING

FAO. 2002. *Trees Outside Forest - Towards a Better Awareness*. FAO Conservation Guide 35. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO. 2014. *Assessing and Promoting Trees Outside Forests (TOF) - In Asian Rice Production Landscapes*. Rome, Italy: Food and Agriculture Organization of the United Nations.

UNDP. 2009. *UN-REDD Programme*. New York, US: United Nations Development Programme.

ANNEXURE 3.1

Species-wise estimation of trees under TOF (FSI 2015)

Species	Number of Trees (in thousands)	Percent	Volume (in thousand cum)	Percent
Acacia nilotica	146,318	2.70	28,470	1.81
Acacia catechu	74,207	1.37	7,242	0.46
Acacia lenticularis	46,627	0.86	8,935	0.57
Albizzia species	31,985	0.59	10,637	0.68
Areca catechu	403,818	7.45	10,556	0.67
Artocarpus heterophyllus	83,829	1.55	38,885	2.47
Artocarpus hirsute	22,622	0.42	10,527	0.67
Azadirachta indica	320,243	5.91	115,084	7.31
Bombax ceiba	65,088	1.20	51,460	3.27
Borassus flabelliformis	104,484	1.93	71,981	4.58
Butea monosperma	182,343	3.37	53,748	3.42
Cocos nucifera	308,258	5.69	87,027	5.53
Dalbergia sisoo	67,637	1.25	17,741	1.13
Eucalyptus hybrid	27,080	0.50	6,353	0.40
Eucalyptus species	188,538	3.48	26,897	1.71
Ficus bengalensis	4,261	0.08	15,224	0.97
Ficus racemosa	6,968	0.13	8,170	0.52
Ficus religiosa	6,244	0.12	13,459	0.86
Ficus species	21,665	0.40	8,881	0.56
Gmelina arborea	31,910	0.59	9,926	0.63
Grevillia robusta	43,362	0.80	7,178	0.46
Grewia optiva	63,413	1.17	6,169	0.39
Holoptelia integrifolia	30,239	0.56	8,565	0.54
Hovea brasiliensis	108,757	2.01	12,836	0.82
Madhuca latifolia	27,508	0.51	54,790	3.48
Mangifera indica	454,150	8.38	196,824	12.51
Phoenix sylvestris	27,407	0.51	8,750	0.56

Species	Number of Trees (in thousands)	Percent	Volume (in thousand cum)	Percent
Pinus kesya	198,382	3.66	43,389	2.76
Pinus roxburghii	91,836	1.69	33,027	2.10
Populus species	65,545	1.21	11,448	0.73
Prosopis cineraria	33,299	0.61	9,889	0.63
Salix sp	48,074	0.89	18,517	1.18
Schima wallichii	62,773	1.16	10,221	0.65
Shorea robusta	67,152	1.24	24,835	1.58
Syzigium cumini	49,785	0.92	18,898	1.20
Tamarindus indica	17,585	0.32	15,419	0.98
Tectona grandis	116,575	2.15	18,728	1.19
Terminalia arjuna	24,190	0.45	11,928	0.76
Terminalia crenulata	27,396	0.51	9,327	0.59
Zizyphus mauritiana	76,636	1.41	10,665	0.68
Rest of Species	1,640,371	30.27	440,734	28.01
Total	**5,418,560**	**100.00**	**1,573,340**	**100.00**

ANNEXURE 3.2

State/Union Territory-wise volume of growing stock in forest and TOF in India (FSI 2015)

State / Union Territory	Volume of Growing Stock (thousand m^3)		
	In Forest	In TOF	Total
Andhra Pradesh	148,113	64,280	212,393
Arunachal Pradesh	413,118	89,102	502,220
Assam	143,672	33,018	176,690
Bihar	29,312	37,232	66,544
Chhattisgarh	362,878	82,077	444,955
Delhi	493	1,152	1,645
Goa	9,434	4,033	13,467
Gujarat	52,104	112,801	164,905
Haryana	5,381	15,383	20,764
Himachal Pradesh	317,576	21003	338,579
Jammu and Kashmir	236,816	147,082	383,898
Jharkhand	122,650	61,176	183,826
Karnataka	296,988	86,588	383,576
Kerala	154,985	49,063	204,048
Madhya Pradesh	276,883	91,919	368,802
Maharashtra	227,131	155,896	383,027
Manipur	51,383	9,015	60,398
Meghalaya	39,718	19,079	58,797
Mizoram	20,659	48,842	69,501
Nagaland	36,854	12,197	49,051
Odisha	243,966	79,910	323,876
Punjab	13,010	18,141	31,151
Rajasthan	38,247	84,993	123,240
Sikkim	25,276	2,037	27,313
Tamil Nadu	122,984	63,366	186,350
Telangana	57,386	37,596	94,982

State / Union Territory	Volume of Growing Stock (thousand m^3)		
	In Forest	In TOF	Total
Tripura	22,743	7,067	29,810
Uttar Pradesh	139,714	80,159	219,873
Uttarakhand	440,718	19,560	460,278
West Bengal	84,324	37,688	122,012
Andaman and Nicobar Islands	58,299	569	58,868
Chandigarh	334	91	425
Dadra and Nagar Haveli	1,805	751	2,556
Daman and Diu	1	114	115
Lakshadweep	0	58	58
Puducherry	92	302	394
Total	**4,195,047**	**1,573,340**	**5,768,387**

Chapter 4: FORESTS IN INDIA'S NORTH EAST

BK Tiwari and I Rynjah

INTRODUCTION

The forests of India are a source of a variety of goods and services, which range from medicinal herbs and leafy vegetables for the rural poor to timber for the international merchants; from sources of drinking water for the rural communities and megacities to sequestration of carbon contributing to the improvement of global climate. Environmental economists are increasingly realizing that, in regions with high forest cover, forests play an important role in the livelihoods of local communities, even more than estimated by conventional methods of economic survey, because a significant portion of goods and services provided by forests are non-commercialized and non-marketable.

The north-eastern region of India comprises eight states (Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura). The region is considered a geographical entity as it shares many commonalities of geographical features, political history, and culture of the people. The region is joined with the rest of India through a 20 kilometer (km) wide passage called the Siliguri Corridor, or chicken's neck. As a result, the region appears to be geographically separated from the rest of India. The states of the region have some common characteristics; the infrastructure is poor; agriculture is subsistence and traditional; and except for Assam, the region has no large industries. The region is hilly or mountainous and predominantly inhabited by tribal people. Except for Assam, all the states have very high forest cover and they together account for about 25 percent of India's forest cover. The region is very rich in biodiversity and as much as 50 percent of India's biodiversity can be found in these states. The region is also rich in endemic flora and fauna but the biodiversity is experiencing severe anthropogenic pressure. The region has therefore been included in two global biodiversity hotspots, namely, the Eastern Himalayas and the Indo-Burma Region.

This chapter provides an overview of the forestry sector and concludes with opportunities and challenges for improved management of the resource for climate change mitigation.

BRIEF OVERVIEW OF FOREST RESOURCES: AREA, DISTRIBUTION, DENSITY AND TYPES

This section presents a brief overview of the forest resources in the north-eastern states of India.

Forest Area and Cover

The India State of Forest Report (ISFR), 2015 lists the total forest cover of India as 701,673 sq. km. of which north-eastern India accounts for 171,964 sq. km. covering 65.59 percent of the total geographical area of the region. The region accounts for 24.50 percent of the forest cover of the entire country. The overall percentage of forest cover has remained stable during the past decade. However, ISFR 2015 has recorded a loss of 628 sq. km. of forest cover in the region between 2013 and 2015 (see Table 4.1).

Forest Density

Very dense, moderately dense, and open forests in north-eastern India constitute 14.81 percent, 43.85 percent, and 41.31 percent, respectively, of the total forest cover of the region. In the hilly states of Meghalaya, Mizoram and Nagaland, 78 percent of forests belong to the

Table 4.1: Forest Cover in the North-eastern States

States	Geographical Area (km²)	2015 Assessment				Percent of Geographical Area	Change (sq. km.)*
		VDF	MDF	OF	Total		
Arunachal Pradesh	83,743	20,804	31,301	15,143	67,248	80.30	-73
Assam	78,438	1,441	11,268	14,914	27,623	35.22	-48
Manipur	22,327	727	5,925	10,342	16,994	76.11	4
Meghalaya	22,429	449	9,584	7,184	17,217	76.76	-71
Mizoram	21,081	138	5,858	12,752	18,748	88.93	-306
Nagaland	16,579	1,296	4,695	6,975	12,966	78.21	-78
Sikkim	7,096	500	2,160	697	3,357	47.31	-1
Tripura	10,486	113	4,609	3,089	7,811	74.49	-55
Total	**262,179**	**25,468**	**75,400**	**71,096**	**171,964**	**65.59**	**-628**

Source: FSI 2015

Notes: Very Dense Forest (VDF): All lands with tree canopy density of 70 percent and above.

Moderately Dense Forest (MDF): All lands with tree canopy density between 40 and 70 percent.

Open Forest (OF): All lands with tree canopy density between 10 and 40 percent.

** As compared to 2013 assessment.*

Table 4.2: Administrative Classification of Forest Area in North-eastern India

State	Reserved (km^2)	Protected (km^2)	Unclassified (km^2)	Total area (km^2)	% of Total Geographical Area
Arunachal Pradesh	15,300	4,200	32,000	51,500	61.49
Assam	18,100	*	8,900	27,000	34.42
Manipur	1,400	4,100	11,800	17,400	77.93
Meghalaya	700	300	8,500	9,500	42.35
Mizoram	7,100	3,600	5,200	15,900	75.42
Nagaland	300	500	7,800	8,600	51.87
Sikkim	5,452	389	0	5841	82.31
Tripura	3,600	500	2,900	7,000	66.75
Total	**51,952**	**13,589**	**77,100**	**142,741**	-

* *Zero or insignificant*

Source: Poffenberger *et al.* 2007

open category and 22 percent are recorded in the dense category. Although the total area under forests may be high, the condition of the forests of the region is not good. Unlike the rest of India, more than 50 percent of the forest lands are categorized as Unclassed Forest, which implies that the rights and concessions of people are not yet settled (see Table 4.2). For all practical purposes, these forests are under the control of communities and the condition of such forests is not good. Also, at most places, these lands are under shifting cultivation. Due to a rapid increase in population, the per capita availability of forests in the north-eastern states is declining fast (see Table 4.3).

Table 4.3: Per Capita Availability of Forest Land (ha)

State	1981	1995	2001	2011	2015*
Arunachal Pradesh	10.88	6.00	6.23	4.8	3.72
Assam	0.13	0.14	0.10	0.08	0.08
Manipur	1.26	0.83	0.70	0.59	0.60
Meghalaya	1.17	0.54	0.67	0.058	0.32
Mizoram	3.68	2.32	1.96	1.7	1.44
Nagaland	1.85	0.71	0.67	0.65	0.43
Sikkim	NA	NA	0.59	0.54	0.95
Tripura	0.26	0.23	0.22	1.16	1.03

* *Population data as per 2011 census; NA: Not Available*

Source: Poffenberger *et al.* 2007

Table 4.4: Major Forest Types in the North-eastern States

State	Forest types
Assam	Evergreen Forests, Deciduous Forests, and Swamp Forests
Arunachal Pradesh	Tropical Evergreen Forests, Tropical Semi-evergreen Forests, Sub-tropical Forests, Pine Forests, Temperate Forests, Alpine Forests, Bamboo Brakes, and Savanna/Grasslands
Manipur	Montane Sub-tropical Forests, Wet Temperate Forests, Pine Forests, Wet Hill Forests, Semi-evergreen Forests, Teak Gurjan Forests, and Bamboo Brakes
Meghalaya	Tropical Forests, Sub-tropical Forests, and Temperate Forests
Mizoram	Tropical Wet Evergreen Forests, Tropical Semi-evergreen Forests, Montane Sub-tropical Forests, and Sub-tropical Pine Forests
Tripura	Eastern Himalayan Lower Bhabar Sal, Cachar Tropical Evergreen Forests, Moist Mixed Deciduous Forests, Dry Deciduous Forests, and Secondary Moist Bamboo Brakes **
Sikkim	Tropical Semi-evergreen Forests, Sub-tropical Broad-leaved Hill Forests, Himalayan Wet Temperate Forests, Sub-alpine Forests, Moist Alpine Forests, and Dry Alpine Scrub Forests***

** *http://forest.tripura.gov.in/forest-and-wildlife-resources-of-tripura*

*** *http://www.sikkimforest.gov.in/Forest.htm*

Source: Malhotra *et al.* 2004

Forest Types of the North-eastern Region of India

A variety of forest types are found in the north-eastern region due to the wide altitudinal, climatic, and edaphic variations. Table 4.4 shows the different forest types found in the region. Roy and Joshi (2002) have described 21 forest vegetation cover types and seven associated forest vegetation types using satellite remote sensing technology and a geospatial database. The tropical vegetation of north-east India typically occurs at elevations up to 900 meters. It embraces evergreen and semi-evergreen rain forests, moist deciduous monsoon forests, riparian forests, swamps, and grasslands. Evergreen rain forests are found in the Assam Valley, the foothills of the eastern Himalayas and the lower parts of the Naga Hills, Meghalaya, Mizoram, and Manipur, where the rainfall exceeds 2300 mm per annum. In the Assam Valley, the giant *Dipterocarpus macrocarpus* and *Shorea assamica* occur singly, occasionally attaining a girth of up to 7 meters and a height of up to 50 meters. The monsoon forests are mainly moist sal (*Shorea robusta*) forests, which occur widely in this region (Pandey and Misra 2009). Some of the giant trees of India are found in the forests on the south bank of the Brahmaputra.

Table 4.5: Altitudinal Distribution of Forest Types in North-eastern India

Forest type	Altitudinal range (m)	Important tree species found
Alpine	Above 3,500	*Rhododendron* spp., *Arenaria* spp., *Saxifraga* spp., *Macaranga denticulata*, *Callicarpa arborea*, *Festuca* spp., *Rhodiola* spp., *Rheum* spp.
Temperate	1,800-3,500	*Acer*, *Castanopsis*, *Populus*, *Tsuga*, *Abies*, *Cupressus*, *Pinus*, *Magnolia*, *Quercus*, *Exbucklandia*, *Populus ciliata*
Sub-tropical Pine	1,000-3,500	*Pinus roxburghii*, *P. merkusii*, *P. wallichiana*, *P. kesiya*
Sub-tropical broad-leaved	900-1,900	*Castanopsis*, *Michelia* spp., *Alnus* spp., *Schima* spp., *Quercus* spp., *Lyonia* spp., *Betula alnoides*, *Tsuga* spp.
Tropical wet evergreen	Up to 900	South Bank: *Dipterocarpus macrocarpus*, *Shorea assamica* North Bank: *Mesua ferrea*, *Altingia excelsa*, *Canarium*, *Syzygium*, *Quercus*, *Echinocarpus*, *Gnetum scandens*
Tropical semi-evergreen	Up to 600	*Terminalia myriocarpa*, *Bombax ceiba*, *Canarium strictum*, *Ailanthus grandis*

Source: Malhotra *et al.* 2004

KEY ECOLOGICAL FEATURES OF FORESTS

The key ecological features of these forests, including the major species, biodiversity, and other ecological factors, are discussed in this section.

Biodiversity

India, a megadiverse country with only 2.4 percent of the land area of the world, houses over 45,500 species of plants and 91,000 species of animals, accounting for about 7 percent of the world's flora and 6.5 percent of the world's fauna. The north-eastern region of India, constituting 5.2 percent of the total geographical area of the country, represents the transition zone between the Indian, Indo-Malayan, and Indo-Chinese bio-geographical regions. Being a meeting point of the Himalayan mountains and peninsular India, the region is the biogeographical gateway for much of India's fauna and flora and houses two out of the 34 global biodiversity hotspots. A diverse set of habitats coupled with long-term geological stability has allowed the development of significant levels of endemism in all animal and plant groups. Out of 5,800 vascular plant species, roughly 2,000 (i.e. 36 percent) are endemic to the region. At least 55 flowering plants endemic to this area are recognized as rare and endangered, such as the Pitcher Plant (*Nepenthes khasiana*). Of the 1,300 species of orchid documented worldwide, 700 species are found in the north-east region of India

(Poffenberger *et al.* 2007). About 63 percent of the genera of land mammals are found in this region indicating faunal diversity. The region is a rich centre of avian diversity; more than 60 percent of India's total bird species haves been recorded in the north-east. The region also hosts two endemic genera of lizards, and 35 endemic reptilian species, including two turtle species. Of the 240 Indian amphibian species, at least 68 species are known to occur in the north-east region, 20 of which are endemic. A large number of the people in the region are forest-dependent and rich biodiversity supports their livelihood and health care needs (Karki *et al.* 2005).

Ecological Services

The forested watersheds of north-east India are a source of clean potable water for the people living nearby. The cities of Shillong, Aizawl, and Kohima are almost fully dependent on water from these watersheds. Many villages of the region are dependent on spring water for their water supply. Most springs derive their water from the forested watersheds and people from north-eastern villages rate the quality of spring water better than tap water. The states of Sikkim and Meghalaya have developed large programs for rejuvenation of springs

Table 4.7: Floral and faunal diversity of North-eastern India

Floral Diversity	Total	7,500
	Orchid	700
	Citrus	64
	Conifers	28
	Bamboo	58
	Ferns	700
	Mosses	500
Faunal Diversity	Insects	3,624
	Mollusks	50
	Fish	236
	Birds	850
	Mammals	160
	Amphibians	64
	Reptiles	137

Source: Banerjea 2005

Table 4.6: Plant and animal diversity at Global, National and Regional scale

Group	Number of species in the world	Number of species in India	% of species in the World	Number of species in North-east
Mammals	4,629	350	7.6%	160
Birds	9,702	1,224	12.6%	541
Amphibians	4,522	197	4.4%	64
Reptiles	6,550	408	6.2%	137
Fishes	21,730	2,546	11.7%	236
Flowering plants	250,000	15,000	6%	7,500

through catchment area protection and forest regeneration.

Forests of the region are very rich in biodiversity. The sacred groves of Meghalaya, Arunachal Pradesh, and Sikkim are a treasure house of biodiversity. A small sacred grove about 5-50 ha in size may harbour 80 to 150 different species of trees and may contain a large number of rare, endangered, and threatened plant and animal species (Tiwari *et al.* 1998; Tiwari and Upadhaya 2017).

The agriculture in most fertile valleys is dependent upon nutrients from the forested hill slopes. The wet rice cultivation used by *Apatani* people in Arunachal Pradesh and the *Zabo* system practiced by Naga people of Phek district of Nagaland are a few examples of inter-dependence of forests and agriculture in north-east India. Forest products are important not only for subsistence, but they also generate supplementary income for the rural poor. The watersheds of north-eastern India are critical catchments that regulate hydrological flows to nearly 400 million people in Assam, West Bengal, and Bangladesh (Poffenberger *et al.* 2007). Forests of Dihang and Dibang valleys and higher reaches of Arunachal Pradesh play a significant role in regulating the flow of the Brahmaputra river and its tributaries.

Forests serve as storehouses of carbon. Large areas of forests in the Northeast are in a state of regeneration, falling in both open and moderately dense categories; the climate and soil are immensely favorable for forest growth. A huge opportunity exists for harnessing the carbon sequestration potential of the forests of the region. This potential is being realized by the Khasi Hills Community REDD+ Project of Hima Mawphlang, Meghalaya, which is the first REDD+ project of India where the benefits have started accruing to the people of the project area.

INSTITUTIONS, LEGAL PROVISIONS, AND TENURE ARRANGEMENTS

The variety of institutions, legal provisions, and tenure arrangements particular to the north-east India are discussed in this section.

Autonomous District Councils

The two types of Autonomous District Councils (ADCs) established in the different states in the north-east India are discussed below.

Autonomous District Councils Established under the Sixth Schedule of Constitution of India

In the states of Assam, Meghalaya, Mizoram, and Tripura, ADCs have been established under the provisions of the Sixth Schedule of the Constitution of India. The broad purpose of their establishment is to protect the interests of scheduled tribes relating to their lands and social issues and to provide them with the power of self-governance. These councils have elected representatives who have legislative, judicial, executive and financial powers. Assam has one Territorial Council and two Autonomous District Councils: (1) Bodoland Territorial Council, (2) Dima Hasao Autonomous District Council, and (3) Karbi Anglong Autonomous Council. Meghalaya has three ADCs: (1) Garo Hills Autonomous District Council, (2) Jaintia Hills Autonomous District Council, and (3) Khasi Hills Autonomous District Council. Mizoram has three ADCs: (1) Chakma Autonomous District

Council, (2) Lai Autonomous District Council, and (3) Mara Autonomous District Council. Tripura has one ADC: Tripura Tribal Areas Autonomous District Council.

Statutory Autonomous District Councils Established by the States

The states of Assam and Manipur have Statutory Autonomous District Councils that are established by the states through Acts passed by the State Legislative Assembly. The Statutory Autonomous Councils of Assam are: (1) Deori Autonomous Council, (2) Mising Autonomous Council, (3) Rabha Hasong Autonomous Council, (4) Sonowal Kachari Autonomous Council, (5) Thengal Kachari Autonomous Council, and (6) Lalung (Tiwa) Autonomous Council. The Statutory Autonomous Councils of Manipur are: (1) Sadar Hills Autonomous District Council, (2) Churachandpur Autonomous District Council, (3) Chandel Autonomous District Council, (4) Tamenglong Autonomous District Council, (5) Ukhrul Autonomous District Council, and (6) Senapati Autonomous District Council.

The Autonomous Councils consist of three-tier structures: (1) General Council, (2) Executive Council, and (3) Village Council. The councils are custodians of the culture, tradition, and customary laws of the tribal communities. While the Autonomous Councils established under the Sixth Schedule of the Constitution enjoy more powers and financial autonomy, the Statutory Councils mostly depend on the state governments for funds (ActionAid India 2016). Since land falls in the jurisdiction of the Autonomous Councils, all non-notified forests, such as community and private forests, fall under the control of the ADCs.

Legal provisions

North-eastern states have enacted several Acts and Rules related to forests and wildlife management. Some of these are listed below:

- Arunachal Pradesh Anchal Forest Reserve (Constitution and Maintenance) Act, 1975
- Arunachal Pradesh Anchal and Village Forest (Constitution and Maintenance) Amendment Act, 1984
- Arunachal Pradesh (Removal of Timber) (Regulation) Act, 1983
- Assam Forest Regulation, 1891
- The Assam Forest Protection Force Act, 1986
- Assam Land and Revenue Regulation, 1886
- The Assam Cattle Preservation Act, 1951
- The Assam Acquisition of Land for Flood Control and Prevention of Soil Erosion Act, 1955
- The Garo Hills Regulation, 1882
- The Goalpara Tenancy Act, 1928
- The Assam State Acquisition of Zamindary Act, 1951
- The Assam Rhinoceros Preservation Act, 1954
- The Elephant Preservation Act, 1954
- The Elephant Preservation (Assam Amendment) Act, 1959
- The Assam State Acquisition of Land belonging to Religious or Charitable Institutions of Public Nature Act, 1959
- The Assam National Parks Act, 1968
- Manipur Land Revenue and Land Reforms Act, 1960
- Meghalaya Forest Regulation (Application and Amendment) Act, 1973
- Meghalaya Forest (Removal of Timber) Regulation Act, 1981
- Meghalaya Tree Preservation Act, 1976

- The Meghalaya Wild Animals and Birds Protection Act, 1971
- Meghalaya Protection of Catchment Areas Act, 1988
- The Meghalaya Forest Authority Act, 1991
- Garo Hills District (AWIL) Fees Act, 1960
- The Meghalaya Wild Animal and Birds Protection Act, 1971
- Mizoram Forest Act, 1990
- Assam-Lushai Hill District (Acquisition of Chiefs' Rights) Act, 1954
- Nagaland Forest Act, 1968
- The Nagaland Forest Products Limited (Acquisition of Shares) Act, 1982
- Nagaland Jhumland Act, 1970
- The Nagaland Village and Area Councils Act, 1978
- The Nagaland (Ownership and Transfer of Land and its Resources) Act, 1990
- The Indian Forest (Tripura Amendment) Act, 1984
- The Indian Forest (Tripura Second Amendment) Act, 1986
- Tripura Forest (Regulation of Removal of Timber) Act, 1991
- The Tripura Land Revenue and Land Reforms Act, 1960
- Mikir Hills District (Forest) Act, 1957
- Mikir Hills (Jhum) Regulation Act, 1960
- Garo Hills District (Forest) Act, 1960
- The United Khasi and Jaintia Hills Autonomous District (Management and Control of Forest) Act, 1958
- Mizoram (Forest) Act, 1958
- The Pawi Autonomous District (Forest) Act, 1976
- The Lakher District Council Forest Act, 1981
- The Sikkim Forests, Water Courses and Road Reserve (Preservation and Projection) Act, 1988
- The Sikkim Regulation of Transfer and Use of Lands Act, 1975
- The Sikkim Land (Requisition and Acquisition) Act, 1977
- The Sikkim Water Supply and Water Tax Act, 1986
- The Sikkim Land Act, 2014

Traditional/customary forest management

In the north-eastern region, large percentages of forest areas are under community and private ownership, where government has little or no control. Table 4.8 presents the percentage of forestland under community control in northeastern states by the community. As in most of India, a large area of forests in the north-east is protected on religious grounds. Table 4.9 lists sacred groves reported in the north-east. According to some estimates, as much as 1,000 sq. km. of forest land in the state of Meghalaya is set aside as sacred groves. A total of 240 sacred groves have been recorded and are currently being mapped (Nongbri and Tiwari 2017). Most sacred groves exist in the vicinity of inhabited villages. Community forest management systems have existed in diverse forms throughout north-east India for centuries and continue to be the primary mode of forest conservation and protection in the region. Community forest protection has been a key mechanism in guarding the region's immense biodiversity. Such systems exist because of the prevalence of strong traditional institutions (Tiwari *et al.* 2013).

Table 4.8: Percentage of Forest Land under Community Control

State	% of Total Forested Area*	% of Total Community Control
Arunachal Pradesh	61.49	62
Assam	34.42	33
Manipur	77.93	68
Meghalaya	42.35	90
Mizoram	75.42	33
Nagaland	51.87	91
Sikkim	82.31	NA
Tripura	66.75	41

*NA: Not available, *As per administrative classification of forest area*

Source: Poffenberger *et al.* 2007

Table 4.9: Sacred Groves in North-east India

State	Number of sacred SGroves
Arunachal Pradesh	691[1]
Assam	40
Manipur	365[2]
Meghalaya	215[3]
Mizoram	NA
Nagaland	NA
Sikkim	56[4]
Tripura	NA

Source: [1]Malhotra *et al.* 2001; [2]Khumbongmayum *et al.* 2004; [3]Nongbri and Tiwari 2017; [4]Dash 2005; Dudley *et al.* 2005)

MAJOR JUDICIAL ORDERS AND DIRECTIONS

Supreme Court order on timber extraction, 1996

Following a petition filed by Shri. T. N. Godavarman Thirumulpad, the Supreme Court of India made the historic decision to ban the felling of trees. The verdict came on December 12, 1996 and had far-reaching implications. The Supreme Court ordered a complete ban on the felling of trees, except in accordance with the Working Plans of State Governments, as approved by the Central Government. The court also ordered that the felling of trees in any community lands would have to be done in accordance with the Working Schemes prepared for the community forests. It also ceased all non-forestry activities in any forest in the country without prior permission from

the Central Government. This implied that the running of saw mills of any kind, including veneer or plywood mills, and mining of any mineral are not permissible without prior approval of the Central Government. The Supreme Court ruling completely banned, with minor exceptions, tree felling in three states: Meghalaya, Mizoram, and Nagaland; and in parts of four other states, Arunachal Pradesh, Assam, Manipur, and Tripura. It also banned any transportation of felled trees and timber out of the north-eastern states. However, this ban was not applicable on the movement of certified timber required for defense or other government purpose.

This decision of the Supreme Court resulted in the collapse of timber market in the entire north-eastern region, which consequently led to a loss of revenue for the state governments. The ban affected the livelihoods of many forest-dependent communities. Those affected were both directly or indirectly involved in timber trade and other related activities, such as those working in the saw mills and plywood mills. This loss of livelihood resulted in more pressure on women to help meet the economic needs of the family. Another impact of the order was that it negated the indigenous system of natural resource management and use (Nongbri 2001). The order banned the transportation of all harvested trees and timber; therefore, all the extracted timber remained unsold for a long period of time (Supreme Court of India n.d.).

Supreme Court order on Environmental Clearance under Environmental Protection Act, 1986

On February 5, 2010, the Supreme Court of India restrained Lafarge company from mining limestone in Nongtrai, East Khasi Hills district of Meghalaya for its cement plant, stating that mining in the environmentally sensitive zone could not be allowed.

Lafarge had been commercially operating a 100 hectares limestone mine since October 2006 in Phlangkaruh, Nongtrai in East Khasi Hills district of Meghalaya. It sent the limestone across the India-Bangladesh border on a conveyor belt as raw material for its cement plant at Chhatak, Bangladesh, which processed 2 million tons per year. The matter gained momentum when the Shella Village Action Committee filed a petition alleging that Lafarge was mining on forest land, and did not have the required clearances. The Nongtrai Dorbar, however, argued that the Shella Village Action Committee, which claimed to represent the Shella villagers, had no right over the 100 hectares mines because they were under the jurisdiction of Nongtrai Dorbar.

The dispute over the Lafarge case was two-fold, regarding the nature of the land and whether the company had obtained forest clearance by means of misrepresentation. It was stated that the company obtained environmental clearance by falsely declaring areas covered with natural/virgin forest as "wasteland" and "non-forest" area. Lafarge made representations that the limestone mines did not involve the diversion of forest land and, to support that claim, provided letters from the Khasi Hills Autonomous District Council, the local authority with jurisdiction over the Nongtrai division, and a certificate from the Divisional Forest Officer of the Khasi Hills Division stating that the mining site was not in a forest area. Lafarge was also questioned about their Rapid Environmental Impact Assessment (EIA) for obtaining environment clearance, indicating the report was not based on a proper scientific study. However, Lafarge justified their stand

stating that scientific EIA was carried out by ERM India Private Limited, a reputed consultant.

With revised environmental clearance granted on April 19, 2010, and Stage-I forest clearance dated April 22, 2010, in July 2011, the Supreme Court allowed Lafarge Umiam Mining Pvt. Ltd. to resume limestone mining in Meghalaya's East Khasi Hills after 17 months. The court decided that the environment ministry's revised clearance to Lafarge was provided after adequate scrutiny.

Long-term Implications of the case

At the same time as the Supreme Court decided to lift ban on mining by Lafarge, the court issued several guidelines to be implemented by the government. It directed the union government to create a national regulator to grant clearances for similar projects and impose penalties on polluters under section 3(3) of the Environment (Protection) Act, 1986. The court also ordered that the Ministry of Environment, Forest and Climate Change (MoEFCC) prepare a Panel of Accredited Institutions, from which the project proponents should get the Rapid EIA done, and that the Terms of Reference should also be formulated by the MoEFCC. If the status of a particular area as a forest is questioned, the onus of inspection and ascertainment of the area's status falls jointly on the State Forest Department and the Regional Office of the MoEFCC. Additionally, the court suggested that the number of Regional Offices of the MoEFCC in the country be increased. Another innovative idea suggested by the court was the creation of a decision-support database, to ensure that clearances granted were consistent with the principles of sustainable development.

ISSUES RELATED TO SUSTAINABLE MANAGEMENT OF FOREST RESOURCES

Forests of north-east India are under severe pressure due to population growth and expansion of human habitations, encroachments on forest lands, loss of forest land for non-forest uses, shifting cultivation practices and degradation caused by illicit felling, fuelwood collection, lopping for fodder, removal of forest litter, and forest fires. Given the rich biodiversity of the region, dependence of people on the forests and the ecological services emanating from the forests, forest conservation and sustainable management are prime concerns. A number of strategic actions are required at various levels to address the underlying causes of forest degradation and to ensure that important environmental services are sustained and the livelihoods of 45 million people of the north-east are not undermined.

Sixth Schedule of Constitution of India

The states of Assam, Meghalaya, Mizoram, and Tripura enjoy certain rights and concessions provided to the tribal people of the region under Sixth Schedule of the Constitution of India. Most of the important functions related to forest management have been given to ADCs, which have powers to formulate and implement Acts and Rules relating to forest management. The ADCs have control and jurisdiction on all forests of the states that have not been notified under the Indian Forest Act, 1927. For example, in the state of Meghalaya, less than 10 percent of the forests are under the control of State Forest Department; the remaining forest areas are under the control

of ADCs. This poses a great challenge for management of forests by the states. The irony is that the government, which has ample expertise and resources, has less area under its control, and ADCs with scarce resources control most forests of these states. It poses a challenge to the sustainable and scientific management of forests under the control of ADCs. The ADCs often exercise their authority through traditional institutions. At least two-thirds of the region's forests are officially under the legal authority of the ADCs (Poffenberger *et al.* 2007; Chatterjee *et al.* 2011).

Forest Governance and Community Institutions

Forest administration in north-east India sharply differs from management in the rest of India because vast amounts of forests are under "community control" and "community ownership". It is difficult to generalize the capacity of local and indigenous resource management institutions in north-east India. While not all forests under the control of communities are in good condition; all are not experiencing deforestation and degradation either. It has been observed that weakening of local community institutions is occurring in many places across the region due to changing values and belief systems. Other major changes have been commercialization and privatization of land resources once held by the community, both of which have led to unsustainable forest management. To ensure sustainable forest management of community forests, it is necessary to formally recognize all the community forest areas and to enhance their effort by supporting and strengthening the traditional and customary laws for forest conservation. Further, external support in the form of financial and technical assistance to indigenous community institutions from government agencies will help conserve the forests under community ownership for many years.

Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights Act) 2006

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act (FRA) was enacted in 2006. The FRA is applicable in the entire country except the state of Jammu and Kashmir. The FRA seeks to recognize and vest rights for habitation and occupation in forest land for forest-dwelling Scheduled Tribes, as well as Other Traditional Forest Dwellers, who have been residing in such forests for generations but whose rights could not be recorded. The Act was considered an enabling legislation to undo the historical injustice done to these communities.

In the north-east region, the Act has been implemented in the states of Assam and Tripura. Large areas of forest lands have been allotted, through *patta,* to the forest dwellers in these states. While this may have a positive impact on the livelihood of the people, this has resulted in further encroachments, along with conversion of forest land into agricultural fields and human habitations. The Act contained provisions with noble objectives and included language about sustainable management of forests by involving the forest-dependent people in the process. However, it has emerged as a tool for giving *patta* of forest lands to people living in and near the forests. A study by the Rain Forest Research Institute, Jorhat, revealed that the Act has not achieved its objective relating to conservation of forests.

Shifting cultivation

According to MoEFCC, 600,000 families are practicing shifting cultivation on 3.8 million hectares of land (Kishwan *et al.* 2007). According to FSI (2015), shifting cultivation was the major cause of loss of forest cover in north-eastern states during 2013 to 2015. Even in areas such as Sikkim, where shifting cultivation has not been officially reported, the reason for loss of forest cover has been determined to be shifting cultivation. It is often described as "cafeteria system of cultivation" where dozens of varieties of cereals and vegetables, together with tree crops, are grown in a single field. Shifting cultivation continues to remain an important food production system in the hill regions of north-east India. Through their experiential knowledge gained over thousands of years, people of the region have found that in their climatic, edaphic, topographic, and socio-economic settings, this form of agriculture was the most appropriate. Further, shifting cultivation is prevalent because the modern agriculture, characterized by high input of energy and extraneous materials, does not fit into the socio-ecological system of the region.

Since independence, the Government of India, as well as state governments of the region, formulated policies and enacted laws to reduce areas under shifting cultivation. It has been a contentious issue in forestry management in the north-east. The government considers shifting cultivation as "a privilege subject to control, restriction and abolition by the state government and not to be a right" (Assam Forest Regulation 1891, 1995). At the same time, the laws enacted by the Autonomous District Councils consider shifting cultivation as a right held by the communities. Thus, the two law-making bodies look at shifting cultivation differently. Conflicting laws and policies affecting land and forests are numerous in the north-east due to its complex legal history. There is a need to bring greater consistency to the legal framework operating in the region. Nevertheless, in recent times the policy makers and researchers have felt that, in addition to encouraging farmers for settled cultivation, it is important to adopt technology, such as site-specific innovations and inventions, to enhance productivity of land under shifting cultivation. Several national and international agencies have implemented schemes and provided funds through the state governments and non-government organizations to enhance productivity in shifting cultivation areas and to control the degradation of lands. However, little has been done to collate and compile the policies and alternative options to shifting cultivation being promoted and presently being practiced in north-east India. To summarize, in most cases, two departments of state governments look at shifting agriculture differently: while agriculture department considers shifting cultivation (*jhum*) fields as a "jungle growth on agricultural land", the forest department considers the same land use as "agriculture on forest land". Thus, for sustainable management of forests of north-east, the issue of shifting cultivation needs to be resolved.

Encroachments

Another issue hampering sustainable forest management in the north-eastern region is the ongoing dispute related to inter-state borders, which affects forest management. It is reported that the forests on the disputed land on the Assam-Mizoram, Assam-Nagaland, Assam-

Arunachal Pradesh, and Assam-Meghalaya borders are degrading due to improper management. According to some estimates, about 2,500 sq. km. forests exist within those disputed lands.

Smuggling of Forest Produce and Insurgency

The north-east region contains 4,500 km of international border land, which is still open in large sectors. Illegal trade and smuggling of forest products drain the scarce resources of several states. This is particularly serious in the states bordering Bangladesh. In addition, the insurgency prevailing in several states interferes with proper management of forests. There are many examples where militants have caused destruction to forest resources. Also, militant hideouts are mostly found in forest areas, inhibiting movement of forest officials in such forests.

OPPORTUNITIES AND CHALLENGES FOR REDD+ IMPLEMENTATION

The forestry regime in India's north-east region is unique. The extent of community ownership, both *de facto* and *de jure*, of forests is very high. In several states, the community forests and lands are being increasingly privatized; thereby causing a significant increase in the private forests. Implementation of REDD+ can help deliver valuable financial instruments to make conservation of these forests profitable for its stakeholders, and also stabilize the change in ownership by providing benefit to the communities from protection and regeneration of degraded forests.

Opportunities for REDD+

The region contains areas of remarkable forest cover, with rich biological, as well as cultural, diversity and favorable climatic conditions. The land tenure system, strong community institutions, local governance system in tribal areas, traditional forest management systems, and the presence of supportive government and non-government organizations provides a favorable condition for development and execution of REDD+ projects. Some of the characteristics of the north-eastern region that favor implementation of REDD+ are described below.

Deforestation and Degradation: A large area of land is under forest cover, but more than 75 percent of land falls under moderately dense or open forest categories. This indicates that these forests are experiencing degradation or deforestation. In 2013, it was reported that in the eight north-eastern states, 71,800 ha of forest land was experiencing forest degradation. Nagaland (20,100 ha) followed by Arunachal Pradesh (11,900 ha) offers the maximum potential for the "reducing deforestation" option under REDD+ and further within Nagaland, the maximum potential for reducing deforestation is found in the district of Tuensang (loss of 12,200 ha). In Arunachal Pradesh, Tirap district (loss of 5,100 ha) may be a potential area for REDD+ (see Murthy *et al.* 2013). This study listed potential benefits of implementing REDD+ in the region. However, several in-depth field survey-based studies will be required before the sites can be identified for action.

Community Control: Most of the forests are under community control and can be

easily brought into the REDD+ program by strengthening the institutional mechanisms and by providing proper managerial, technical, and financial support. Community-centric management of forests ensures high community involvement and lesser expenses on protection. The community-based projects that enable benefits to go directly to poorer sections of the society attract high-end buyers of carbon credit and fetch a higher price. Thus, the net benefit can be much higher than the REDD+ activity on government-managed forests. The Khasi Hills REDD+ Project implemented in Hima Mawphlang is a living example of this (Poffenberger 2015).

Protected Areas: Several Protected Areas in the region are experiencing forest degradation due to various reasons, including poor governance and resource extraction by the local people. These are also potential sites for a REDD+ project that could bring together the State Forest Department and community members residing on the fringes of these Protected Areas.

Learning from success stories: There is ample opportunity to learn from the Khasi Hills REDD+ project. Some site-specific modifications will be required but a template is available, which can be adapted in all community forest areas of the region after suitable modifications.

Challenges for REDD+

Implementing a REDD+ project in the north-eastern region may be a challenge because of the complexity of the process, which requires knowledge and multiple skill sets that few organizations possess. Such a project will require mobilization of the community to participate in its development and to become project proponents. The level of confidence between the people and the government is generally low. Community members are suspicious of the government and unless the government can gain their trust, a government-initiated project will not be successfully implemented on community land.

Another constraint likely to affect a REDD+ project is the fast growth of population in the region. Some states are growing at a rate of more than 2.5 percent per year. This population increase will result in increased dependence on forest resources and may further accelerate deforestation. Degradation of land and resources is also being accelerated due to privatization and commercialization of forest land.

Implementation of REDD+ may also be subject to the limitations of the existing traditional institutions that lack technical understanding of the program. These traditional institutions have limited capacities in terms of scientific knowledge and practices pertaining to natural resource management. In many cases, people need to be educated about the complex relationship between forest, biodiversity, water, and soil.

External constraints may include problems in securing financing for project development and initial implementation. During the first few years, no funding may be available and keeping the interest alive during this period will be the greatest challenge for the project managers. Technical assistance will need to be provided, or existing human resources may need to be trained to ensure that data collection and analyses are scientifically performed.

REFERENCES

ActionAid India. 2016. *Functioning of Autonomous Councils in Sixth Schedule of North Eastern States*, 44. New Delhi: Action Aid Association.

Banerjea, P. 2005. "North-east of India - Cradle of Naturenomics TM." In *Nature and Economics: Nurturing Interdependence*, edited by Ao, Alem, B. Sahgal, D. Kripalani, G. Narang, K. Popat, K.K. Singh, P. Sukhdev, P. Banerjea, R. Barthakur, R. Bhattacharya, S. Salian, S. Menon and Y. Kurani, 96-102. Balipara Foundation.

Chatterjee, S., S. Ghosh, J. Sarma, S. K. Barik, B. K. Tiwari, and K. C. Das. 2011. "Community conserved areas in North-East India: some observations in Assam, Meghalaya and Arunachal Pradesh." *Indian Forester* 137 (8A): 48-61.

Dash, S. S. 2005. "Kabi sacred grove of North Sikkim." *Current Science* 89 (3): 427.

Dudley N., L. Higgins-Zogib, and S. Mansourian 2005. "Linking Faiths and Protected Areas to Support Biodiversity Conservation." In The Arguments for Protection Series - Beyond Belief, 91-95. Woking, UK: World Wide Fund for Nature.

FSI. 2015. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment, Forest and Climate Change, Government of India.

Karki, M., B. K. Tiwari, A. Badoni, and N. Bhattarai. 2005. "Creating livelihoods and enhancing biodiversity-rich production systems based on medicinal and aromatic plants: preliminary lessons from South Asia." *Acta Horticulturae* 678: 37-43.

Khumbongmayum, M. D., M. L. Khan, and R. S. Tripathi. 2004. "Sacred groves of Manipur – Ideal centers for biodiversity conservation." *Current Science* 87: 430-433.

Kishwan J., D. Pandey, A. K. Goyal and A. K. Gupta. 2007. *India's Forests*. New Delhi: Ministry of Environment and Forests, Government of India.

Malhotra, K. C., Y. Gokhale, S. Chatterjee and S. Srivastava. 2001. *Cultural and Ecological Dimensions of Sacred Groves in India*. New Delhi: Indian National Science Academy and Bhopal: Indira Gandhi Rashtriya Manav Sangrahalaya.

Malhotra, K. C., S. K. Barik, B. K. Tiwari and R. S. Tripathi. 2004. *Joint Forest Management in North-east India: A trainer's resource book.* Shillong, India: Regional Centre, National Afforestation and Eco-Development Board, North-Eastern Hill University.

Murthy, I., N. Sharma, and N. H. Ravindranath. 2013. "Harnessing REDD+ opportunities for forest conservation and carbon stock enhancement in the North-eastern States of India." *Natural Science* 5 (3): 349-358.

Nongbri, T. 2001. "Timber Ban in North-East India: Effects on Livelihood and Gender." *Economic and Political Weekly* 36 (21): 1893-1900.

Nongbri, B. and B. K. Tiwari. 2017. "Sacred Groves: A treasure House of Culture, Biodiversity and Natural Resource Conservation by Indigenous People of Meghalaya." In *Souvenir cum Resource Book on Traditional Farming and Indigenous Food of North East India*, 7-13. Umiam, Meghalaya: ICAR Research Complex for North Eastern Hill Region.

Pandey, S. N. and S. P. Misra. 2009. *Taxonomy of Angiosperms*. New Delhi: Ane Books Pvt. Ltd.

Poffenberger, M., S. K. Barik, D. Choudhury, V. Darlong, V. Gupta, S. Palit, I. Roy, I. Singh, B. K. Tiwari and S. Upadhayay. 2007. "Indigenous forest stewards of North-east India." *Community Forestry International*: 64.

Poffenberger, M. 2015. "Restoring and Conserving Khasi Forests: A Community-Based REDD Strategy from North-east India." *Forests* 6: 4477-4494.

Roy, P. S. and P. K. Joshi. 2002. "Tropical forest cover assessment in North East India: Potentials of temporal wide swath satellite data (IRS 1C-WiFS)." *International Journal of Remote Sensing* 23 (22): 4881-4896.

Supreme Court India. n.d. *The Judgments Information System*. Accessed June 18, 2017. http://judis.nic.in/.

Tiwari, B. K., S. K. Barik, H. N. Pandey, and R. S. Tripathi. 1998. "Biodiversity value, status, and strategies for conservation of sacred groves of Meghalaya, India." *Ecosystem Health* 4: 20-32.

Tiwari B. K., H. Tynsong, M. M. Lynrah, E. Lapasam, S. Deb and D. Sharma. 2013. "Institutional arrangement and typology of community forests of Meghalaya, Mizoram and Nagaland of North-East India." *Journal of Forestry Research* 24 (1): 179-186.

Tiwari, B. K. and K. Upadhaya. 2017. "Sacred Groves of Meghalaya: A tradition in transition." In *Proceedings of the Seminar on Conserving the Sacred Groves of North East India: Perceptions, Practices and Policy Implications*, March 4-5, 2016. Bhopal: Indira Gandhi Rashtriya Manav Sanghralaya (In Press).

FURTHER READING

Datta Ray, B., and K. Alam. 2002. *Forest Resources in North East India.* New Delhi: Omsons Publications.

MoEF. 2006. *Report of the National Forest Commission*, 421. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2009. *State of Environment Report*. New Delhi: Ministry of Environment and Forests, Government of India. Accessed June 6, 2017.
http://www.indiaenvironmentportal.org.in/files/StateofEnvironmentReport2009.pdf.

State Laws of India Project. n.d. *The Sikkim Forests, Water Courses and Road Reserve (Preservation and Projection) Act, 1988*. Accessed June 10, 2017. http://www.lawsofindia.org/statelaw/2061/TheSikkimForestsWaterCoursesandRoadReservePreservationandProjectionAct1988.html.

Chapter 5: India's Position on REDD+

Jagdish Kishwan

INTRODUCTION

This chapter describes the evolution of, and India's current position on REDD+. It begins with an explanation of REDD+ and its origins in the Conferences of Parties (CoP) to the United Nations Framework Convention on Climate Change (UNFCCC). It then explains India's approach to climate change mitigation and green growth across relevant sectors of its economy. Following those explanations for the reader, the chapter provides a detailed explanation of India's Strategy and Action Plan, as well as policies, measures, and guidelines for REDD+ implementation in India.

BRIEF OVERVIEW OF REDD+ EVOLUTION (INTERNATIONAL)

As forests contribute to a sizable portion of global greenhouse gas (GHG) emissions but can also serve as GHG sinks, mitigation of climate change through the forest sector is a global focal area. Reducing emissions from deforestation and forest degradation and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries (REDD+) has evolved in the last 15 years, and its initiation can be traced back to its introduction during UNFCCC COP side events in 2002. Since then, the UNFCCC has made important decisions on REDD+ at COPs held in Bali, Cancun, Durban, Warsaw, and Paris. COP 13 in Bali marked a watershed when REDD transformed into REDD+. The Cancun Agreements developed at COP 16 described for the first time the five eligible REDD+ activities.[1] At COP 17 in Durban, negotiations entered the crucial phase of identifying the basic elements for REDD+ implementation in developing countries, including financing, safeguards, reference levels, and measuring, reporting, and verification (MRV). At the insistence of Bolivia at COP 18 at Doha, Qatar, the need for valuation of non-carbon benefits (NCBs) was flagged, but members failed to achieve progress on financing REDD+ results-based actions. The COP also could not arrive at an agreement on MRV modalities. COP 19 in Warsaw finally clinched the agreement on REDD+, with decisions made on seven financial and technological requirements for implementing all phases of REDD+, including fully measured, reported, and verified results-based actions. Since the most important decision of COP 20 was related to

REDD+, this COP is known as the "Warsaw REDD+ COP" and the decision as the "Warsaw REDD+ Framework." COP 21 in Paris put its stamp of acceptance of REDD+ by devoting Article 5 of the Paris Agreement to the subject.

India's contributions in all COP decisions related to REDD+ have been exceptional. India has led the transformation of REDD into REDD+ through the Bali Action Plan and the inclusion of Article 5 on REDD+ in the Paris Agreement.

KEY ELEMENTS OF INDIA'S CLIMATE CHANGE POLICY

India has taken up the challenge of checking its emissions by initiating a number of studies and reports to lead the country's development of a low-carbon trajectory. The Government of India (GOI) demonstrated a landmark action when it launched the National Action Plan on Climate Change (NAPCC) in June 2008. The plan spelled out the eight national missions:

- National Solar Mission
- National Mission for Enhanced Energy Efficiency
- National Mission on Sustainable Habitat
- National Water Mission
- National Mission for Sustaining the Himalayan Ecosystem
- National Mission for a "Green India"
- National Mission for Sustainable Agriculture
- National Mission on Strategic Knowledge for Climate Change

These missions are housed in different GOI ministries and departments and are at various stages of implementation. Two missions that are relevant to the country's forest sector are the National Mission for Sustaining the Himalayan Ecosystem and the National Mission for a "Green India", or the Green India Mission (GIM). The GIM has not made much progress as it requires a clear implementation plan allocating afforestation, plantation, and conservation responsibilities and targets to states. However, as the Parliament passed the Compensatory Afforestation Fund Management and Planning Authority Act in 2016, it is expected that GIM implementation will soon gain momentum.

New Missions in NAPCC

Seeing gaps in the feasible actions it could take to pursue climate change commitments, the GOI has proposed four more national missions encompassing wind energy, health, coastal resources, and waste-to-energy (MOEFCC 2011). Salient features of the four additional missions are described below:

Wind energy

- To be modelled on the National Solar Mission
- To be serviced by the Ministry of New and Renewable Energy
- To produce 50,000 to 60,000 megawatts of power by 2022

Health

- To assess impacts of climate change on human health
- To build capacities to respond to these impacts
- To be led by the Ministry of Health and Family Welfare

Coastal resources

- To prepare an integrated coastal resource management plan
- To map vulnerabilities along the entire shoreline
- To be led by the Ministry of Environment, Forest, and Climate Change (MOEFCC)

Waste-to-energy

- To incentivize efforts to harness energy from waste
- To lower dependence on coal, oil, and gas
- To make energy production more environmentally friendly

Work to operationalize the health and coastal resources missions has been initiated, whereas some reservations are being expressed about the implementation of the waste-to-energy mission. The obstacle for that Mission is the collection, segregation and assured supply of waste to the energy plants, as well as the problem of institutionalization of the process.

State Action Plans on Climate Change

Indian state governments have formulated State Action Plans on Climate Change (SAPCCs). The MOEFCC's National Steering Committee on Climate Change has endorsed SAPCCs (MoEFCC n.d.) for 32 states and union territories (UTs). Since the states and UTs did not follow a common format when preparing their SAPCCs, it is difficult to carry out a comparative quantitative analysis. However, based on the information available on the MOEFCC website, some qualitative inferences can be drawn. For example, all 32 states and UT SAPCCs include forest and biodiversity as one of the sectors to address climate change. Of the 32 SAPCCs, 12 states/UTs have proposed allocating greater than or equal to 15 percent of the budget to forest sector, and 11 have proposed less than or equal to 10 percent. This shows that more than 20 states/UTs have agreed to greater than or equal to 10 percent allocation for the forest and biodiversity sector in their proposed SAPCCs. This is significant because the states must focus on other critical sectors as well (health, water, agriculture, energy, and habitation), which directly impact citizens' well-being and livelihoods. In absolute terms, the lowest proposed outlay for the forest sector in the SAPCCs is for Puducherry at INR 29.78 crores[2] and the highest is for Assam with an outlay of INR 19,826.5 crores (MOEFCC n.d.).

India's realization of the forest sector's potential role in off-setting emissions is evidenced by its support for the National Mission for a "Green India". This mission's overarching objective is to increase forest and tree cover by five million hectares and improve the quality of forest cover in another five million hectares (MOEFCC 2014) by 2020. Later, India's Planning Commission, in *The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth* included a chapter on "Carbon Sequestration." This chapter highlights the potential role the forest sector can play in reducing the Emission Intensity (EI) of the gross domestic product (GDP), claiming that investment in the forest sector doubly reduces EI: first, by increasing the forest carbon sink, and second, by increasing the GDP (Planning Commission 2014).

The Bureau of Energy Efficiency[3] (BEE) was set up in 2002 within the overall framework of the 2001 Energy Conservation Act. The bureau's emphasis is on developing policies and strategies that self-regulate and are based

on market principles. The primary objective is to reduce the energy intensity of the Indian economy. BEE runs an appliance rating scheme to rate and label electrical appliances according to efficiency in electricity consumption. The rating guides the consumer and provides information on future energy and money savings the appliance can provide.

BEE also runs a Perform, Achieve and Trade (PAT) market mechanism covering eight categories of energy-intensive large industries. PAT encompasses energy savings that could be traded by designated consumers (industrial units) in sectors such as thermal power, iron and steel, and cement. Designated consumers that are not able to meet the energy savings target under PAT may be given the option to offset the deficit by carrying out afforestation to neutralize the emissions equivalent to the deficit in energy savings. This would have the double benefit of neutralizing the emissions and improving the environment.

Intended Nationally Determined Contributions/Nationally Determined Contributions: Based on its experience and performance in social, industrial, and economic fronts, India submitted its Intended Nationally Determined Contributions (INDCs) to the UNFCCC in October 2015. These INDCs are now recognized as India's Nationally Determined Contribution (NDC) to addressing climate change. The important elements of the NDC are:

- To reduce the EI of GDP by 33-35 percent of the 2005 level by 2030;
- To achieve 40 percent cumulative electric power installed capacity from non-fossil fuel energy resources by 2030, with the help of technology transfer and low-cost international financing, including from the Green Climate Fund (GCF); and
- To create an additional carbon sink of 2.5 to 3 billion tons of carbon dioxide equivalent (CO_2eq) through additional forest and tree cover by 2030.

Of relevance to the forest sector, and thereby to REDD+, is the third element listed. Conserving and developing existing natural forests, growing trees on non-forest land, and incorporating a tree component into agroforestry practices can help achieve this huge task. Selecting species for afforestation and reforestation that meet the needs of private landowners and forest-dependent citizens and address the climate change imperatives are critical to reaching this goal.

Finance Commission Award: In India, fiscal transfers are made from the central government to the states based on a formula. Factors within that formula are known as "weightage." For the first time in 2015, the Fourteenth Finance Commission (FC) recommended that weightage be added for forest cover (7.5%), recognising an ecological fiscal transfer.

During the tenure of the Twelfth FC (2005 - 2010), INR 10 billion (approximately USD 220 million at the 2005 exchange rate) was for the first time set aside as grants to states for maintenance of forest cover. This grant was over and above the normal expenditure incurred by states in the forest sector. Although the Twelfth FC did not link weightage for forest cover for devolution of central revenues to the states, it did make an important change by highlighting the ecological role of forests and the importance of their maintenance for generation of ecosystem services. The

Thirteenth FC (2010-2015) increased the grant amount to INR 50 billion (approximately USD 1.1 billion at the 2010 exchange rate). Although the grants awarded for the forest sector by the Twelfth and Thirteenth FCs were smaller than those awarded by the Fourteenth FC, they were tied to spending on forest sector activities, which is not the case with the most recent award. It would have further helped forestry if a certain proportion of financial resources received on account of a state's forest cover were tied to designated projects and programs related to the forest sector.

EVOLUTION OF KEY ELEMENTS OF INDIA'S POSITION ON REDD+ AT THE CONFERENCES OF PARTIES TO UNFCCC

India played a key role in shaping the evolution of REDD+, consistently campaigning for conservation and expansion of forest and tree cover to be regarded as equally important to other REDD+ activities. India's contribution during evolving COP negotiations is summarized below.

Nairobi COP

(COP 12, 2006) India introduced the concept of "Compensated Conservation" in this COP to complement the prior exclusive focus on "Avoided Deforestation."

Bali COP

(COP 13, 2007) India's push for inclusion of conservation and increment of forest cover as a policy approach to reduce emissions from deforestation was recognized, and given effect in the Bali Action Plan (Para 1(b) (iii) of Bali Action Plan) as "… Policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests, and enhancement of forest carbon stocks in developing countries." The subject of the above paragraph has come to be known as "REDD-plus" or "REDD+" (MOEFCC 2014).

Poznan COP

(COP 14, 2008) The Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA) Chair (UNFCCC, 2008) prepared and issued a note on the "ideas and proposals on paragraph 1 of the Bali Action Plan" based on submissions made by countries. India in its submissions said that all elements of para 1 (b) (iii) of the Bali Action Plan should be treated with equal importance. The gist of India's submissions to the UNFCCC, and of the interventions made in the AWG-LCA and Subsidiary Body of Scientific and Technological Advice meetings can be summarized as an argument to treat all elements of para 1 (b) (iii) of the Bali Action Plan equally. A revision of the text of the Bali Action Plan validated that argument. It is worth mentioning here that the negotiators spent considerable time fine-tuning the text, including the placement of punctuation marks, as this had implications for interpretation of the decision.

On the provision of positive incentives, India suggested a comprehensive set of modalities to provide positive incentives for reduced deforestation and also for conservation, sustainable management of forests, afforestation and reforestation, and increasing forest cover.

Copenhagen COP

(COP 15, 2009) In Copenhagen, heads of many States, including the former Indian Prime Minister Dr. Manmohan Singh, met and produced the Copenhagen Accord. The main achievement of the Copenhagen Accord was to establish the GCF. The accord, *inter alia*, stated, "In the context of meaningful mitigation actions and transparency on implementation, developed countries commit to a goal of mobilizing jointly USD 100 billion dollars a year by 2020 to address the needs of developing countries." As regards REDD+, the Accord said,

> We recognize the crucial role of reducing emission from deforestation and forest degradation and the need to enhance removals of greenhouse gas emission by forests and agree on the need to provide positive incentives to such actions through the immediate establishment of a mechanism including REDD-plus, to enable the mobilization of financial resources from developed countries … Scaled up, new and additional, predictable and adequate funding as well as improved access shall be provided to developing countries, in accordance with the relevant provisions of the Convention, to enable and support enhanced action on mitigation, including substantial finance to reduce emissions from deforestation and forest degradation (REDD-plus)…

After the Accord, India adopted the strategy of ensuring that the entire range of activities included in REDD+ were defined in the agreements of future COPs.

Cancun COP

(COP 16, 2010) By this point, many developed and developing countries, including India, wanted clarity as to which activities in the forest sector could be called REDD+ activities. In Cancun, governments agreed to accelerate action to curb emissions from deforestation and forest degradation in developing countries with due technological and financial support. The parties also agreed on the list of forestry activities that qualify for positive incentives under REDD+. Paragraph 70 of the decision 1/CP.16 of the Cancun Agreements describes the five REDD+ activities:

> "Encourages developing country Parties to contribute to mitigation actions in the forest sector by undertaking the following activities, as deemed appropriate by each Party and in accordance with their respective capabilities and national circumstances:
>
> - Reducing emissions from deforestation;
> - Reducing emissions from forest degradation;
> - Conservation of forest carbon stocks;
> - Sustainable management of forests;
> - Enhancement of forest carbon stocks."

In the above paragraph, activities relating to the "plus" part of REDD+ are indicated at (c), (d), and (e). In Para 1 (b) (iii) of the Bali Action Plan on REDD+, (c) above is referred to as "the role of conservation." In the Cancun Agreements, this had changed to a measurable activity, "conservation of forest carbon stocks." The REDD+ mechanism agreed to by parties at Cancun COP and contained in decision 1/CP.16 includes a number of principles and clauses concerning safeguards such as:

- actions being consistent with national forest programs,
- need for good forest governance,

- respect for the rights of indigenous peoples and members of local communities,
- protection and conservation of biological diversity and ecosystem services,
- involvement of all stakeholders,
- addressing risk of reversals, and
- actions to reduce displacement of emissions.

Also, countries implementing REDD+ are required to follow safeguards ensuring, for instance, the full participation of indigenous peoples, local communities, and other stakeholders. These concerns have been addressed by adding the following text on safeguards:

"Actions are consistent with the conservation of natural forests and biological diversity, ensuring that REDD+ actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits."

The Cancun Agreements also prescribe a system for providing information on how the safeguards are being addressed and respected throughout the implementation of the REDD+ activities, while respecting sovereignty.

Durban COP

(COP 17, 2011) At COP 17 in Durban, negotiations on REDD+ centered on four areas: finance, safeguards, reference levels, and MRV of carbon emissions and/or removals from forest activities. Parties adopted a decision on REDD+ safeguards, requiring submission of "a summary of information on how all the safeguards established at COP 16 are being addressed and respected throughout the implementation of the REDD+ activities." Decisions on forest reference levels were that forest reference emission levels (FREL) (a measurement of the trend in emissions from a geographical area) and/or forest reference levels (FRL) (a measurement of trend in emissions and removals from a geographical area) are required to be established as benchmarks for assessing performance of a country's REDD+ activities. Durban negotiations could not clearly establish a financing mechanism and the issue of MRV of REDD+ actions was also left largely unanswered. In Durban, Nationally Appropriate Mitigation Actions (NAMAs) were accepted as a mechanism for developing country parties (non-Annex I) to achieve self-imposed, and currently voluntary, emission reduction goals. A range of mitigation activities, including REDD+, were accepted as eligible NAMAs.

Doha COP

(COP 18, 2012) At the Doha COP, in discussions concerning methodological guidance for activities relating to REDD+, parties stressed that much work needed to be done on this issue. Despite intense negotiations, no agreement was reached among the parties on MRV. No concrete decision could be reached on the issue of REDD+ finance, and parties agreed to undertake a program on results-based financing in 2013 to support full implementation of the activities referred to in decision 1/CP.16, paragraph 70 (REDD+ activities). It was also decided here that the program would contribute to ongoing efforts to scale up and improve the effectiveness of finance for REDD+ activities, taking into account decision 2/CP.17, paragraphs 66 and 67, and a wide variety of sources in paragraph 65, including:

- Ways and means to transfer payments for results-based actions;
- Ways to incentivize non-carbon benefits; and
- Ways to improve the coordination of results-based financing.

Warsaw COP

(COP 19, 2013) In 2013, parties at the Warsaw COP agreed on a REDD+ framework. The framework reaffirmed that new, additional, and predictable results-based financing should be provided to developing countries for the implementation of REDD+. Financing could come from a variety of sources. A results-based progression must occur for all phases of actions and activities of REDD+ as agreed at COP 16 (Cancun). The result-based actions have to be fully measured, reported and verified. This includes development and implementation of national strategies, or action plans, and capacity building.

To operationalize REDD+, parties adopted seven related decisions that are collectively referred to as the "Warsaw Framework" for REDD+. Subsequently, the board of the GCF, deliberating for the first time on REDD+ to address emissions from the forest sector, adopted a decision that requests for proposals (RFPs) include guidance consistent with the Warsaw Framework for REDD+ and other REDD+ decisions under the UNFCCC.

Lima COP

(COP 20, 2014) Many countries and international civil societies expressed the need for further guidance from the UNFCCC on reporting safeguards, and Bolivia introduced a paper on joint mitigation and adaptation approaches.

Paris COP

(COP 21, 2015) All countries who had actively participated in shaping the Warsaw Framework on REDD+ were finally able to celebrate when REDD+ was highlighted in the Paris Agreement's Article 5. The agreement's preamble recognized the importance of conserving and enhancing greenhouse gas sinks and reservoirs to combat climate change. Article 5 exclusively refers to REDD+ as a potential mechanism of mitigation. The article is comprised of the following two paragraphs:

1. Parties should take action to conserve and enhance, as appropriate, sinks and reservoirs of greenhouse gases as referred to in Article 4, paragraph 1(d), of the Convention, including forests.
2. Parties are encouraged to take action to implement and support, including through results-based payments, the existing framework as set out in related guidance, and decisions already agreed under the Convention for: policy approaches and positive incentives for activities relating to reducing emissions from deforestation and forest degradation, and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries; and alternative policy approaches, such as joint mitigation and adaptation approaches for the integral and sustainable management of forests, while reaffirming the importance of incentivizing, as appropriate, non-carbon benefits associated with such approaches.

Supplementary efforts

India's efforts to realize REDD+'s ultimate form in various COPs would not have been fruitful had its representatives not worked on the sidelines, lobbying with influential country groups interested in REDD+ negotiations. In this regard, India's REDD+ team's good working relationship with the Coalition for Rainforest Nations should be mentioned. It was also advantageous to serve in the role of co-chair with Brazil of the G-77 & China coordination on land use, land-use change, and forestry. Involvement in these coordination meetings enhanced the knowledge and skills required to push the REDD+ agenda in UNFCCC negotiations. Meetings on the sidelines with the European Union, the United States, France, and many other developed countries provided the much-needed insight on these important countries' positions on various aspects of REDD+.

One important element of REDD+ that exists in the agreements of the UNFCCC but, of late, has been neglected by negotiators is the "measurement of conserved stocks." Focus needs to be brought back on this important element, which is intended to incentivize developing countries if they can successfully keep the existing forest carbon stocks intact.

FUTURE DIRECTION FOR REDD+ IN INDIA

With the foundation for REDD+ laid in international agreements, the process that India is to follow and through which the country can access results-based payments (RBP) is clearer. This section explains India's status as of this writing and provides recommendations for REDD+ readiness activities in line with UNFCCC requirements.

National Strategy and Action Plan for REDD+

The UNFCCC mandates that developing countries demonstrate their preparedness to participate in REDD+ implementation through creation of proper and adequate policy, institutional, administrative, financial, technological, monitoring, and measuring infrastructure. In other words, a country should possess trained human resources staff, scientific and technological expertise, and efficient measuring and recording devices and systems. To ascertain that the participating countries have the requisite capability, capacity, institutional systems, and technological backup, UNFCCC has mandated formulation of certain documents and systems by each country. Often described as the four key elements or pillars of REDD+, these are:

- National REDD+ Strategy (NRPS)
- National Forest Reference Level (NFRL)
- Safeguards Information System (SIS)
- National Forest Monitoring System (NFMS)

These are also prerequisites for accessing finance through the GCF.

Finance

Green Climate Fund REDD+ Expert Workshop

At its fourteenth Board Meeting on October 12–14, 2016, in Songdo, South Korea, the GCF requested that the Secretariat develop RFPs for developing countries for RBPs related to Phase 3 of REDD+ implementation. In

addition to Phase 3, the GCF is considering to support RFPs for Phase 1 (preparation for REDD+ implementation) and Phase 2 (REDD+ demonstration for pilot implementation).
The GCF organized a GCF REDD+ Expert Workshop from April 21–24, 2017, in Bali, Indonesia. The following topics were discussed:

- Elements of an RFP for REDD+ RBP: access modalities, size of RFP, double financing and double payment, use of proceeds, ownership, legal title and implications for NDCs, eligibility date for payments and length of RFP, scale, forest reference emission levels and/or forest reference levels for REDD+, operationalization of Cancun safeguards
- Further guidance to engage with the GCF in Phase 1 and Phase 2 of REDD+

In light of the discussions held at the REDD+ Expert Workshop, India is in a good position to submit proposals to seek GCF financial assistance for Phases 1 and 2 once the GCF releases a solicitation.

Key Takeaways

The lessons learned and possible follow-up actions for India following the GCF Expert Workshop are summarized below:

- *Results-based Payments of Phase 3:* To apply for REDD+ RBPs through an RFP, a country must have in place all four key REDD+ elements highlighted in the Cancun Agreements: NRPS, NFRL, SIS, and NFMS.
  - After the four requirements are in place, India could seek incentives for REDD+ actions already implemented subject to guidance currently being finalized by the GCF. The payments will be available for performance over and above the NFRL.
- *REDD+ Readiness Financing for Phases 1 and 2:* Based on the deliberations of the Expert Workshop, GCF readiness financing can be leveraged for the following actions:
  - Supporting the institutions of the National Designated Authority and National Focal Point at the central level;
  - Undertaking certain studies and surveys to facilitate implementation of REDD+; and
  - Strengthening GOI institutions for MRV and capacity building.

Key Features of the Reference Document on REDD+ in India

A step towards developing a readiness framework in India and accessing results-based financing in various forms, the "Reference Document for REDD+ in India" lays out the roadmap for understanding and implementing REDD+ in the country (MOEFCC, 2014). It is a guidance document to help channel the actions of all stakeholders for a purposeful implementation of REDD+ in India. It highlights the roles and responsibilities of different stakeholders, including the central and the state governments, the MOEFCC, relevant ministries and departments, forestry institutions, civil society, and communities. It provides policy guidance on the government's intention to give high priority to the participation of forest-dependent communities in REDD+ implementation and share incentives with them. The document also contains information on the formulation of national forest reference levels and other methodological guidance for MRV of the forest carbon stocks.

The GOI adopted the Reference Document in December 2014, but many additional measures need to be put in place in order to operationalize REDD+. The first step will be to draft and finalize the four key elements of REDD+ required by the UNFCCC. The MOEFCC is working to prepare these. A committee of REDD+ experts from different organizations is responsible for preparing drafts of these documents for MOEFCC's consideration and approval.

Implementing REDD+ in India

Once policy formulation is completed and monitoring systems and reference levels are finalized, India will have to incentivize as well as implement policies and measures that result in reduced emissions and increased carbon sequestration from the forest sector.

Forest Management, REDD+, and Mitigation

It is essential to demystify REDD+ and understand how forest management and REDD+ in the Indian context are related. India negotiated for the "+" elements of REDD+ because of the climate benefit of increasing forest biomass and associated soil organic carbon (SOC), as a result of a national policy framework that favors the social and environmental value of forest ecosystem services. These services can be supported through forest sector activities that result in a net positive gain in forest growing stock. If actions are taken to increase the growth of vegetation, reduce waste, promote soil and water conservation, reduce forest fires, keep insect and pest infestations under control, and encourage floral and faunal diversity, while meeting the needs of forest-dependent communities, and if net addition of biomass and SOC result, one has achieved the REDD+ objective. Simply, any forest activity or action that helps to raise biomass, and thereby forest carbon stocks, will qualify as a REDD+ activity. It is worth noting that additions to forest carbon stocks and SOC will be assessed with respect to the NFRL benchmark.

Forestry/REDD+ Activities

Many Indian State Forest Departments (SFDs) and senior authorities seek clearer understanding of REDD+ and the activities that qualify under the REDD+ umbrella. Requests have been made for a list of activities that support or counter the REDD+ performance. In order to provide guidance on this to the lowest level, it is advisable to prepare an illustrative list of forestry activities that would also qualify as REDD+ activities. Examples of both beneficial and detrimental activities for REDD+ are given below:

Beneficial activities:

- Afforestation
- Reforestation
- Planting of trees
- Planting of perennial hedges
- Creation of urban forests and tree groves
- Establishment of orchards
- Reduction of damage to forests due to fires, insects, and pest attacks
- Conservation of natural grasslands
- Optimization of livestock numbers to reduce grazing in forest
- Increased use of sustainably sourced wood fixtures, like beams, panelings, wall blocks, doors, window frames, and shutters in construction
- Increased use of sustainably sourced wooden furniture

- Treatment of wood to increase the lifespan of wooden products
- Planting of avenue trees on roadsides
- Decrease in use of fuelwood by forest-dependent communities by:
  - Promoting use of fuelwood-saving cookstoves
  - Providing alternate energy sources, e.g., hydro-electric power, compressed natural gas, and solar power

Detrimental activities:

- Cutting of trees in an unsustainable manner
- Cutting of orchards
- Increased number of unproductive livestock
- Increased grazing on forest land
- Conversion of grasslands into agriculture or human habitats
- Rampant forest fires
- Burning of wooden articles
- Unchecked insect and pest infestation of forest and other tree crops including orchards
- Increased dependence on natural forests for extraction of fuelwood
- Promotion of unsustainable fuelwood consumption
- Unchecked spread of invasive species into natural forests

Policies and Measures for Effective REDD+ Implementation in India

The NDC target of creating an additional sink of 2.5-3.0 billion tons of CO_2eq is huge, and meeting this international commitment will require concerted, country-wide effort. However, achieving this target is not impossible. Innovative policy, institutional, technological, and financial measures will be required to create a roadmap for success.

Some suggestions for success are:

- Link targets of increased forest and tree cover in each state and UT with the Fourteenth FC Award:
  - Although the Forest Survey of India (FSI) has carried out a study that indicated the scope of improvement in forest cover at the national level, divided into different forest group types, it will be difficult at this stage to translate these findings into targets for each state and UT. However, in light of 1) the devolution of additional funds proposed by the Fourteenth FC to the states attaching a weightage of 7.5 percent of the state's forest cover, 2) a significant afforestation component within the National Mission for a clean Ganga , and 3) the GIM target of improving 5 million ha of forest cover and 5 million ha of additional forest and tree cover, it would be reasonable for the GOI to direct states and UTs to improve at least 15 percent of their present forest cover and add 15 percent more area of forest and tree cover by 2030. This would translate into improvement of about 10 million ha of existing forest cover, with an addition of 11.25 million ha of new forest and tree cover in the states and UTs by 2030. Of the new area to be added, 80 percent (or approximately 9 million ha) should be on non-forest land.[4] The state targets would also subsume the achievements of tree plantation schemes and projects being implemented by other central government ministries and departments like the Ministry of Rural Development, Ministry of Agriculture, and Ministry

of Panchayati Raj (but excluding the National Highway Authority of India). This target would be applicable to each state and UT individually, and would be subject to review after every two years.

- Make use of quality planting material mandatory in forest plantations by SFDs.
- Finalize a list of actions and activities that contribute to REDD+ implementation in the country, and circulate them to the states and UTs.
- Establish a REDD+ safeguards mechanism in the states and the centre.
- Strengthen the REDD+ Cell in the MOEFCC.
- Create REDD+ Nodal Points or Cells in states and UTs.
- Designate FSI as the organization to collect and submit REDD+ measurements to UNFCCC.
- Designate the Indian Council of Forestry Research and Education, Indira Gandhi National Forest Academy, and Indian Institute of Forest Management as capacity building and awareness raising organizations among relevant stakeholders, including all levels of SFDs and other line departments.
- Create a consortium of stakeholders representing relevant central and state government ministries and departments, civil society, local communities, forest dwellers, and academia and experts to address policy and institutional issues related to REDD+ implementation in the country.

Performance Trading

Some states are likely to face constraints while pursuing their allotted targets of improvement in, and addition of forest and tree cover. Some states are likely to exceed the allotted targets. These states should be allowed to trade their surplus achievement in improved and/or added forest and tree cover with states unable to achieve their targets. The recipient deficit states could pay the provider state(s) a fee for the services received. The central government should formulate a scheme to facilitate this trading among the states. The scheme could be based on the Perform, Achieve, and Trade Scheme of the BEE and could be known as Trading of Performance by States in Forest and Tree Cover (TOPS-FTC).

INDCs and NAMAs: Implications for REDD+ in India

NAMAs that affect the forest sector are also eligible under REDD+, as long as climate benefits are not double-counted. India has not submitted any NAMAs to the UNFCCC, though two are currently being developed: on reduction of fuelwood consumed by locals in rural areas of Assam and on conversion of waste into energy. In the forest sector, there is potential for NAMAs addressing emission-intensive practices and themes, including:

- Introduction of alternative renewable energy and appliances for use in rural dwellings to replace fuelwood consumption.
- Development and introduction of fuelwood-saving cookstoves.
- Introduction of trees on a pilot basis in urban areas, peri-urban areas, non-forest areas, highly degraded fringe forests, and community and agroforestry lands.
- Grafting of indigenous wild saplings in forest and non-forest lands to increase carbon sink.

CONCLUSION

India contributed tremendously to the development of REDD+ at the international level through the debates and negotiations of the UNFCCC COPs; to pursue REDD+, the same intensity of commitment domestically is needed. The following suggestions for next steps are critical for that progress.

First, to pursue REDD+, India needs to submit four key documents (i.e. the NRPS, NFRL, SIS and NFMS) to the UNFCCC to become eligible for recognition of its REDD+ performance, and to receive funds from GCF for all phases of REDD+ implementation. Second, forest and tree cover targets following a landscape approach for the states and UTs fixed by the MOEFCC, with provisions for the supportive policy, technological and financial resources needed, are needed. Third, a performance trading scheme should be formulated by the GOI, and made operational. Fourth, an apex steering committee comprising representatives from relevant ministries and departments of central and state governments with a mandate to guide implementation of REDD+ following a landscape approach needs to be constituted immediately. The committee could also have a fair representation of academia and civil society. This committee could forge convergence in the working of different actors in the government around the target of additional CO_2 sink of 2.5 to 3.0 billion tons by 2030 by the GoI to the UNFCCC.

REFERENCES

MOEFCC. 2011. *National Action Plan on Climate Change*. New Delhi: Prime Minister's Council on Climate Change, Government of India.

MOEFCC. 2014. *Reference Document for REDD+ in India*. New Delhi: Ministry of Environment, Forest, and Climate Change, Government of India.

MOEFCC. n.d. "State Action Plan on Climate Change." *Ministry of Environment, Forest, and Climate Change* website. Accessed September 30, 2017. http://www.moef.nic.in/ccd-sapcc.

Planning Commission. 2014. *The Final Report of the Expert Group on Low Carbon Strategies for Inclusive Growth*. New Delhi: Planning Commission, Government of India.

UNFCCC. 2008. Revised note by AWG-LCA Chair titled "Ideas and proposals on paragraph 1 of the Bali Action Plan." *Report of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention*. UNFCCC document FCCC/AWGLCA/2008/16/Rev.1.

FURTHER READING

Biello, D. 2013. "400 PPM: Can Artificial Trees Help Pull CO_2 from the Air?" *Scientific American*. https://www.scientificamerican.com/article/prospects-for-direct-air-capture-of-carbon-dioxide/.

Biswas, S., S. Bala, and A. Mazumdar. 2014. "Diurnal and seasonal carbon sequestration potential of seven broadleaved species in a mixed deciduous forest in India." *Atmospheric Environment* 89: 827-834.

Kissinger, G., M. Herold, and V. De Sy. 2012. *Drivers of Deforestation and Forest Degradation: A Synthesis Report for REDD+ Policymakers*. Vancouver, Canada: Lexeme Consulting.

MOEFCC. 2015. *India: First Biennial Update Report to the United Nations Framework Convention on Climate Change*. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India.

MOEFCC. 2015. *Low-Carbon Lifestyles*. New Delhi: Ministry of Environment, Forest, and Climate Change, Government of India.

Streck, C., N. Harris, J. Hayward, and S. Brown. 2013. *Analysis of Approaches for REDD+ Verification*. US Department of State.

Zyga, L. 2009. "Synthetic Tree Captures Carbon 1,000 Faster Than Real Trees." *PhysOrg.com* website. *https://phys.org/news/2009-07-synthetic-tree-captures-carbon-faster.html.*

SECTION II

SUSTAINABLE FOREST ECOSYSTEM MANAGEMENT

This section presents some ideas for sustainable management of forest ecosystems for a range of goods and services. This section has three chapters. The first chapter (Chapter 6) discusses how ecosystem approach could be incorporated in the forest working (management) plans. The second chapter (Chapter 7) discusses issues related to biodiversity conservation in the REDD+ context. The third and final chapter (Chapter 8) draws on Forest-PLUS experience from its pilot landscapes, and discusses tools and methods for inventory and sustainable harvest of NTFPs.

Chapter 6: Ecosystem Approach and Working Plans

R.D. Jakati[1]

INTRODUCTION

In India, traditional forest management was based on two basic principles (i) sustained yield, and (ii) normal forests. For over a hundred years, forest management was based on these principles, but gradually evolved to the principles of Sustainable Forest Management (SFM), which have been guiding forest management ever since. Internationally, the fifteen principles of SFM were recognized and adopted at the United Nations Conference on Environment and Development (UNCED) in 1992.

Ecosystem Approach (EA) to management was adopted under the Convention on Biological Diversity (CBD) in 1992. This approach lays down twelve general principles for the management of an ecosystem. Both the approaches, SFM and EA, are oriented to conserve the flora and fauna. SFM principles are broad-based, while the ecosystem approach principles are directed towards local level forest management with focus on the forest ecosystem.

This chapter makes an argument for the use of the Ecosystem Approach in the Working Plan system. It does this by describing the Working Plan system in India. It then provides the salient points of the twelve principles of ecosystem approach to management; after each principle, the provisions of National Forest Policy, 1988 and those of National Working Plan Code, 2014 which support implementation of the principles, are described. After identifying gaps in the present system, suggestions for further improvement of the working plan system have been made at the end.

WORKING PLAN SYSTEM

India has a long tradition of more than one hundred years of preparation of forest working plans. The nature, the contents and the legality of these documents have undergone metamorphic changes, especially during the last two decades. Working Plans were originally a written plan for systematically harvesting forests, keeping in view the concept of sustained yield and normal growing stock. As general awareness regarding multiple-use forestry grew, new technologies were

made available for collecting necessary data, and society became more aware of the environmental needs, the contents of such plans underwent many changes.

The first common Working Plan Code was formulated in 1891. After more than one hundred years, the Code was revised in 2004. The next revision was felt necessary soon thereafter and the revised Code was adopted in 2014. The principles of sustainable forest management adopted in the Rio Conference followed by the twelve principles adopted by CBD in 2003, transformative technologies like remote sensing, and better knowledge of ecosystem conservation necessitated these changes. At present, the working plans made by the working plan officers (WPOs) are discussed in the State Forest Departments and are approved by the Regional Chief Conservators of Forests of the Government of India. The approval of management plans was necessitated after the directions of the Hon'ble Supreme Court of India to that effect, the forest being on the concurrent list of the Constitution of India.

As per the current working plan code, the working plan is broadly divided into two parts. The first part containing twelve chapters is the summary of facts on which proposals are based; and the second part, which prescribes the future management, has as many chapters as the number of working circles[2] plus one. The extra one is the chapter on general constitution of working circles and the justification of making working circles. The twelve chapters of the first part describe the area, locality factors, forests and their vulnerability, composition, past management and the effect of it on forests, growth and yield, socio-economic status of the people living in and out of forests and their relationship with forests. Each chapter on a working circle gives the general status, management prescriptions, and demand limits which can be put on the resource.

Although the contents of the working plans have improved a lot, there are some gaps which are necessary to be filled up for the management to be on the lines of the ecosystem-based management of forests. The next sections treat the current alignment of Indian laws and regulation with the principles of an ecosystem approach.

ECOSYSTEM APPROACH AND ITS BASIS IN INDIA

In this section, the salient points of twelve principles of the Ecosystem Approach and the most relevant implementation guidelines from the CBD are described. After the selected implementation guidelines, the basis in Indian laws and regulation for implementation of the principle in the working plan is explained.

Principles

- Principle 1. Objectives of management are a matter of societal choice.
- Principle 2. Decentralize management to the lowest appropriate level.
- Principle 3. Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems.
- Principle 4. There is a need to understand and manage the ecosystem in an economic context.
- Principle 5. Conservation of ecosystem structure and function in order to maintain the ecosystem services is a priority target.
- Principle 6. Manage ecosystems within the limits of their functioning.
- Principle 7. Management should take place

at appropriate spatial and temporal scales.

- Principle 8. Because of varying temporal scales and lag effects, objectives of management should be set for the long-term.
- Principle 9. Management should recognize that change is inevitable.
- Principle 10. Seek balance between conservation and use of biodiversity.
- Principle 11. Ecosystem Approach to consider all sorts of knowledge/ information on scientific, indigenous, local innovations and practices.
- Principle 12. Involve all relevant sectors of society and science.

Principle 1. Objectives of management are a matter of societal choice

Selected Implementation Guidelines

- Involve all stakeholders including the poor, landless and women.
- Define the boundaries in time and space.
- Decision making: who takes the decision, informed decision making, consider policy and laws of the land.
- Assess effect of Ecosystem Approach to Forest Management (EAFM) practices on society, at the national level.

Indian policy(ies) and regulation(s)

Constitutional Provisions

The Constitution of India provides in Article 48 A:

- Protection and improvement of environment and safeguarding of forests and wildlife.
- The State shall endeavor to protect and improve the environment and to safeguard the forests and wildlife of the country.

Article 51 A (g) Fundamental Duties: "It shall be the duty of every citizen of India to protect and improve the natural environment including forests, lakes, rivers and wildlife, and to have compassion for living creatures."

The government owns most of the forest resources in India. Although management of the forests vests with the State Governments, these are managed within the framework of the national policy.

National Forest Policy (1988)

The National Forest Policy (NFP) lays down the basic objectives, the essentials of forest management and the strategy for conservation, restoration and sustainable utilization of the forest resource. The NFP 1988, in the Preamble, cites "serious depletion" of forests which has resulted from relentless pressure "for fuel wood, fodder, timber, inadequacy of protection measures, diversion of forest lands to non-forest uses without ensuring compensatory afforestation and essential environmental safeguards, and the tendency to look upon forests as revenue earning resource". The NFP 1988 starts with the statement on the depletion of forest resources and ends with strategies for conservation of forests, maintenance, sustainable utilization, restoration and enhancement of the natural environment. It is, thus, clear that the NFP 1988 is generally oriented towards restoration of depleted forests.

In a major difference from the previous policies, the NFP 1988 made the revenue from forests subordinate to ecological security, forest conservation and restoration. This policy laid emphasis on people's participation, including of those living near forests, in the management of the forests. The policy, in order to restore

the forests and reduce pressure on natural forests, emphasized "increasing substantially the forest/tree cover in the country through massive afforestation and social forestry programs, especially on all denuded lands and unproductive lands"; and "creating a massive people's movement with the involvement of women, for achieving the policy objectives and to minimize pressure on existing forests".

National Working Plan Code (2014)

The Preamble to the National Working Plan Code, 2014 focuses on environmental stability, biodiversity monitoring and management, restoration of ecological balance of disturbed areas, and the protective and socio-economic functions of the forest. The Working Plan Code of 2014 in paragraph 4 says "There has been a paradigm shift in the objectives of management of forests and forest management has become more people-centric and oriented to provide the goods and services from forests on a sustained basis …".

In Paragraph 8 of the Code, it is stated, "Joint Forest Management is sharing of responsibilities, authority, and usufruct between the village community or the forest user group and the Forest Department on the basis of a memorandum of understanding (MoU) between the two". Paragraph 5 of the code deals with the involvement of stakeholders, the Participatory Rural Appraisal exercise and the preparation of micro-plans. Paragraph 9 of the code on community forest management deals with the community forest rights recognized under the provisions of Forest Rights Act, 2006 exercised within the frame of sustainable management. Paragraph 53 of the code on consultation with local stakeholders requires "The head, territorial circle during the Preliminary Working Plan Report (PWPR) preparation to hold consultation with local people's forum, Joint Forest Management Committees (JFMCs), village Panchayats and Forest Development Agency (FDA) about the expectations of people who are dependent on forests and try to accommodate the same to the extent that they are compatible with the technical feasibility of sustainable management of forests."

It is, thus, clear that both the NFP 1988 and the National Working Plan Code, 2014 lay emphasis on citizens' involvement and participation in the management of forests to reflect the societal choice of objects of management.

Principle 2. Decentralize management to the lowest appropriate level

Selected Implementation Guidelines

- Authority and responsibility should go hand-in-hand.
- Management should have sufficient expertise, resources and authority to fulfill the responsibility.
- An institutional mechanism for decentralized management needs to be developed.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP 1988 states that the basic objectives which govern the policy, *inter alia* include "meeting the requirements of fuel wood, fodder, minor forest produce and small timber of the rural and tribal populations." The policy requires the management to "create a massive people's movement with the involvement of women, for achieving these objectives and to minimize pressure on existing forests."

The strategy under the NFP (paragraph 4.10, Forest Extension), states that a "forest conservation program cannot succeed without willing support and cooperation of the people. It is essential, therefore, to inculcate in the people a direct interest in forest, their development and conservation, and to make them conscious of the value of trees, wildlife and nature in general. The strategy further directs involvement of farmers and interested people, by providing opportunities to learn agri-silviculture and silviculture techniques to ensure optimum use of their land and water resources." The NFP in paragraph 4.6 directs the management to associate with the tribal population in protection, regeneration and development of the resource.

National Working Plan Code (2014)

The National Working Plan Code, 2014, in Chapter I paragraph 4 states that "there has been a paradigm shift in the objectives of management of forests and forest management has become more people-centric and oriented to provide the goods and services from forests on a sustainable basis… The working plan should be in consonance with general planning which is village based. Therefore, the working plan should encompass the village as a unit and realign the compartments accordingly."

In paragraph 5, the Code directs preparation of micro-plans and eco-development plans. The micro plans are to be approved by the Working Plan Officer / Divisional Forest Officer (DFO) / FDA and implementation of these micro-plans is to be reviewed at least once in two years by the FDA. In chapter II paragraph 8, the Code states that "Joint Forest Management (JFM) is sharing of responsibilities, authority and usufruct between the village community or the forest user group and the forest department on the basis of a MoU between the two."

Principle 3. Ecosystem managers should consider the effects of their activities on adjacent and other ecosystems

Selected Implementation Guidelines

Ecosystems are not closed, activities in one affect the other.

- There is time lag in what you do and its effect on others. This needs to be understood and the management systems need to be redesigned.
- Environment Impact Assessment of activities needs to be carried out and a feedback mechanism put in place in order to monitor effects; and the ones which are effective, are kept in place.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP 1988 basically deals with restoring depleted forests, and increasing the tree cover for maintaining ecological balance. This is in view of what has been stated in the Preamble: "serious depletion of forest resources in the country".

In paragraph 4.3.1 of Management of State Forests, the policy states that "the schemes and the projects which interfere with forests that clothe steep slopes, catchments of rivers, lakes and reservoirs, geographically unstable terrain and such other ecologically sensitive areas, should be severely restricted." This is regarding the use of forest land for non-forestry purposes. This requires the users of forest land to pay for regeneration and compensatory afforestation.

Paragraph 4.3.2 is regarding the requirement of miners, who are allowed to mine in forests, to repair and re-vegetate the affected areas.

Paragraph 4.3.3 restricts introduction of exotic species "unless long-term scientific trials undertaken by specialists in ecology, forestry, and agriculture have established that they are suitable and have no adverse impact on native vegetation and environment."

Paragraph 4.5 deals with the care for wildlife and provision of corridors for maintaining the genetic diversity of the populations.

Under the policy, for the provision of creating a massive people's movement for regenerating and developing forest lands, the Ministry of Environment, Forest and Climate Change (MOEFCC) has issued extensive guidelines for JFM on good forest lands.

The eco-development activities around protected areas include the assessment of human-wildlife conflict leading to damage of life, crops, and domestic animals. These have been incorporated in the National Working Plan Code, 2014.

Principle 4. There is a need to understand and manage the ecosystem in an economic context

Selected Implementation Guidelines

- Reduce market distortions which affect biodiversity conservation and give incentives for biodiversity conservation.
- Internalize costs and benefits of ecosystem management in the general accounting system to the maximum extent possible.
- Develop the social and economic context of ecosystem management.
- Economic valuation of goods and services (ecosystem services) should be used in an accounting system at national and regional/ state level.

Indian Policy(ies) and Regulation(s)

Forest Conservation Act (1980)

In India, the conversion of forest land to non-forestry uses is controlled by the Forest Conservation Act (FCA), 1980. FCA is a regulatory act, not prohibitory. It is the will of the government which prevails; the media and the activism on the part of judiciary play their own role, depending upon the circumstances. The forest policy requires that users of the forest land pay for the land and the cost of afforestation, besides going through a rigorous process of justification for alternate land use.

The forests have rich biological resources of high market value. Some of them include timber like teak, sal and other species like sandalwood and red sanders, and a host of medicinal plants and wildlife products – tiger skin, bones, rhino horn – all of which have great market value with poor people living around such valuable resource. Grazing and free fuel wood requirements of the rural community are mostly met from forests. The price the country pays for the free use is through the degradation of the site and direct loss of the resource. Incentives for conservation of this resource are too costly to afford. The NFP and the management, therefore, have always promoted strong protection mechanisms, in addition to involvement of people for conservation by giving them sources of livelihood. The whole NFP is built around the main theme of restoration of the depleted forest resource of the country. Efforts have been made to incorporate the value of goods and services into national accounting, but so

far only the estimated values of direct benefits of timber, small wood and firewood have been incorporated. The values of intangible benefits have not been accounted for in the national accounts.

Principle 5. Conservation of ecosystem structure and function in order to maintain the ecosystem services is a priority target

Selected Implementation Guidelines

- Understand the ecosystem structure, composition and function, and try to assess ecosystem services.
- Define and explain conservation, including the social and economic benefits of conservation, to guide policies.
- Understand how disturbance affects ecosystem integrity.
- Apply instruments and techniques to maintain and restore ecosystem services.
- Monitor the population of vulnerable species in a management plan, and consider response measures and actions.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP in the basic objectives 2.2 states that the "maintenance of environmental stability", and "restoration of ecological balance" are the basic objectives governing the national policy.

In paragraph 3, the essentials of forest management, the policy states that the "existing forests and forest lands should be fully protected and their productivity improved."

In paragraph 4.3.2 the policy states, "No forest should be permitted to be worked without the Government having approved the management plan…"

The paragraph 4.14 on the Forest Survey and database of the policy states "the inadequacy of data regarding forest resources is a matter of concern… priority needs to be accorded to completing the survey of forest resources in the country on scientific lines and to updating information."

National Working Plan Code (2014)

The Working Plan Code, 2014, in Chapter 2 paragraph 6 says, "objectives include conservation of forest and reducing forest degradation, maintenance and enhancement of ecosystem services including ecotourism, enhancement of forest productivity, together with establishment of regeneration to improve forest health and vitality as per ecological and silvicultural requirements of the species, progressively increasing the growing stock and carbon sequestration potential."

The Code in Paragraph 7 on Biodiversity Conservation and Development, states "Functional diversity is considered to be one of the main factors determining the long term stability of an ecosystem and its ability to recover from major disturbance. Assessment of status of plants and faunal species and their periodic monitoring can be helpful in formulating strategies for conservation, maintenance and enhancement of overall biodiversity through sustainable management and use practices."

However, the methodology for studying the structure, composition and functionality of the forest ecosystem has not been elaborated in the code. These types of studies are generally not found in the working plans written in the country. Occasionally, distribution curves for forests of one or two of the working circles are drawn but further analysis and their

relationship with the prescriptions are not elaborated.

The criteria and indicators of SFM were evolved in Bhopal, India. However the process does not incorporate the study of the structure, composition and functionality of the forest ecosystems, which is important to assess the health of the forest ecosystem.

Principle 6. Manage ecosystems within the limits of their functioning

Selected Implementation Guidelines

- Know the limits of natural productivity and harvesting; and if knowledge is limited, apply the precautionary principle.
- Adaptive management – understand the limits of ecosystems.
- Harvest but within limits and monitor, have a regular feedback mechanism.
- Develop, formulate and implement regulatory mechanisms.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP 1988, in a major departure from the previous policies, made the revenue from forests subordinate to the attainment of ecological security of the country. The whole policy revolves round restoring the seriously depleted forests of the country. The policy recognizes that the ecosystems have been harvested beyond their capacity. The principle aim of the policy was to ensure environmental stability and maintenance of ecological balance.

Paragraph 3.1 of the policy states (the essentials of forest management) "Existing forests and forest lands should be fully protected and their productivity improved."

Paragraph 3.4 of the policy states that "provision of sufficient fodder, fuel and pasture, especially in areas adjoining forests, is necessary in order to prevent depletion of forests beyond sustainable limit…"

Paragraph 4.3.3 states "In order to meet the growing needs for essential goods and services which forests provide, it is necessary to enhance forest cover and productivity of the forests through the application of scientific and technical inputs."

The paragraph 4.3.4 on rights and concessions deals with provision of fuel, fodder, construction timber and minor forest produce to meet the requirements of tribal, scheduled castes and other poor living near forests. "However, the area which such consideration should cover, would be determined by the carrying capacity of the forests."

Paragraph 4.3.4.1 states that the rights and concessions, including grazing, should always remain related to the carrying capacity of forests.

In paragraph 4.6, the policy admits that one of the major causes of degradation of forests is illegal cutting and removal by contractors and their labor.

The paragraph on grazing (paragraph 4.8) states, "Grazing in forest areas should be regulated with the involvement of community". The paragraph also directs prevention of forest fires and arresting the encroachment of forests.

The paragraph 4.12.1 on forestry research calls for "increasing the productivity of wood and other forest produce per unit area per unit

time by the application of modern scientific and technological methods."

National Working Plan Code (2014)

The working plan code 2014, paragraph 3 states that all forests are to be "sustainably managed under the prescriptions of a working plan/ scheme".

Paragraph 6 of the Code states the objectives of Forest Management Planning. It mentions "progressively increasing the growing stock and carbon sequestration potential, maintenance of biological diversity, sustainable yield of forest produce …"

Paragraph 25 on growth data and carbon sequestration recommends establishment of a grid-based network of permanent sample plots "to provide necessary data base for growth/ increment".

Paragraph 69 of the Code on Growing stock estimation states "… The growing stock of trees must be so managed that it regularly provides the greatest quantity of the desired products including intangible benefits…"

Paragraph 70 and 71 on Assessment of Non-Timber Forest Products (Including Medicinal and Aromatic Plants) recommend the WPOto undertake survey, sampling and assessment for estimation of few prioritized species of Non-Timber Forest Products (NTFPs) to start within the selected grids. The paragraphs further state the methodology for estimating the production of fruits, flowers, leaves, etc., of NTFPs.

Paragraph 84 of the Code describes a chapter-wise and paragraph-wise format for writing the working plan. In part one of the Code there are 12 chapters giving a general description of forests, the tract dealt with, the past system of management, working of JFMCs, policy and legal provisions, growth and yield and statistics of carbon stocks. Part two of the Code gives the details of the formation of various working circles and paragraph-wise details of the format for the prescriptions and their basis.

Paragraph 87 of the Code gives the details for the evaluation of the potential for sustainable NTFP management.

Paragraph 88 of the Code incorporates the steps for the management of wildlife outside the Protected Area. It also includes steps to promote and regulate ecotourism with regard to tourism influx and carrying capacity.

Paragraph 90 (N+3).4 on NTFP plot, lays down the methodology for developing a safe harvesting protocol for NTFP species.

It can be seen that various steps have been enumerated in the Code for management of forests within sustainable limits. What is optimum for the forests in terms of ideal structure and composition needs to be researched and incorporated in the system, in view of the depleted nature of stocking of forests and composition, to achieve optimum carbon sequestration.

Principle 7. Management should take place at appropriate spatial and temporal scales

Selected Implementation Guidelines

- Management processes and institutions should be designed to match the scales of the aspects of the ecosystem being managed, and to transcend those scales.

- Connectivity between areas should be promoted (corridors, and for gene flow, integration and interaction of genes, species and ecosystems).
- Regional coordination is required to sort out inter-sectoral and cross-sectoral issues.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

Enhanced understanding of ecosystem processes at spatial and temporal scales is important. The NFP stresses upon improving and restocking forests for the future and paragraph 4.5 highlights the need for the provision of corridors to maintain the genetic diversity of the artificially separated parts of the system. In the policy, the reference to the spatial and the temporal scale on which the forests should be managed is not defined.

National Working Plan Code (2014)

The working plan code delves into writing working plans for the forests of a division.

Paragraph 4 of the Code states that "The working plan should be in consonance with general planning, which is village-based. Therefore, the working plan should encompass the village as a unit and realign the compartments accordingly.

Paragraph 89(vi) states that the WPO may make suggestions for changes in the establishment including administrative set up and man power, if the current arrangements are not found to be satisfactory.

The Code recommends, in paragraph 90, establishment of permanent preservation plots, sample plots for monitoring the growth and to study the changes with time.

In paragraph 81, the Code states that a socio-economic survey be carried out to know the dependence of locals on forests; for which villages falling within a 3 kilometer (km) distance from forests have to be considered.

Principle 8. Because of varying temporal scales and lag effects, objectives of management should be set for the long term

Selected Implementation Guidelines

- Adaptive management should consider trade-offs between short-term gains and long-term loss or gains.
- Capacity to monitor low frequency changes in ecosystem structure and functioning should be built.

Indian Policy(ies) and Regulation(s)

Neither the NFP 1988, nor the Working Plan Code 2014, explicitly state anything regarding the time frame of management, but it is implied that the forests are to be managed for all times to come unless used partly for non-forestry purposes following the due process of law. Indian forests have been seriously depleted and all efforts are to be made to restore them. Working plans are generally prepared for a period of ten years and then revised.

National Working Plan Code (2014)

Paragraph 9 of the National Working Plan Code, 2014 reiterates the definition of sustainable use as defined in the Biodiversity Act, which states "sustainable use means the use of the components of biological diversity in such a manner and at such a rate that does not lead to the long-term decline of the biological diversity, thereby maintaining its potential to meet the needs and aspirations of the present and the future generations."

Paragraph 53 of the Code on consultation with local stakeholders requires "The head, territorial circle during PWPR preparation to hold consultation with local people's forum, JFMCs, village Panchayats and FDA about the expectations of people dependent on forests and try to accommodate the same to the extent they are compatible with the technical feasibility of sustainable management of forests."

Paragraph 84 in Chapter 1, item 1.4 recommends, "A mid-term review of the working plan should be undertaken for mid-course correction by the consultative committee under the chairmanship of the Principal Chief Conservator of Forests and Head of Forest Force (PCCF (HoFF)) with representation from RAPPCF (MOEFCC)". It further adds that based on the performance of the working plan prescription, the plan period may be extended up to 5 years.

Principle 9. Management should recognize that change is inevitable

Selected Implementation Guidelines

- The traditional disturbance regime may be important for ecosystem structure and functioning, but long-term changes like the climate change may bring about significant changes in the ecosystem.
- Long-term inflexible decisions are likely to be ineffective and may be detrimental.
- Use traditional knowledge and practices to enable better detection of ecosystem changes so as to develop adaptive measures.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP in paragraph 4.12 emphasizes the need to carry out research in various aspects with the intention of improving forest management by incorporating the results obtained through research.

Strategy 4.13, Forest Education, of the NFP states the "Specialized and orientation courses for developing better management skills by in service training need to be encouraged taking into account the latest development in forestry and related disciplines".

National Working Plan Code (2014)

Paragraph 9 of the National Working Plan Code, 2014 reiterates the definition of sustainable use as defined in the Biodiversity Act, which states "sustainable use means the use of the components of biological diversity in such a manner and at such a rate that does not lead to the long-term decline of the biological diversity, thereby maintaining its potential to meet the needs and aspirations of the present and the future generations."

Paragraph 25 of the Code states that a "network of grid based permanent sample plots should be identified and established in different strata of the forest to provide necessary database for growth/increment. These permanent sample plots are necessary to assess the role of forests as source or sink for greenhouse gases on a long-term basis, and to study carbon sequestration".

Paragraphs 80 and 81 of the Code deal with socio-economic surveys to be conducted by the WPO to assess the dependence of people living in the fringe (within 3 km distance) on forests. These surveys are repeated at the time of revision of the working plan, since socio-economic changes also take place at a rapid rate and influence forests. These are to be

reflected in the working plan. As stated earlier, the WPO is required to meet with the people or their committees to know the requirements of the people and try to accommodate them, to the extent possible, in the management of forests falling within the boundaries of their village.

Paragraph 90 of the Code (N+3).1 states that "Sufficient number of preservation plots should be created and maintained for preserving represented patches of existing forests in their present form and preserving such selected plots from all forms of disturbance so as to allow progression towards climax forms and to study and correlate vegetation change matrix with the impact of climate change."

Paragraph 98 Appendix IV of the code requires the list of the research plots / preservation plots to be recorded in the working plan.

Principle 10. Evolve balance between conservation and use of biodiversity

Selected Implementation Guidelines

- Management for conservation and sustainable use are not inherently incompatible and can be integrated both at spatial and temporal scales
- Biodiversity resources are important in providing goods and services; they are critical because they play a key role in providing ecosystem services and other services.
- Integration of conservation and use both at spatial and temporal scales.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The Preamble to the NFP 1988 reiterates the meaning of conservation as "preservation, maintenance, sustainable utilization, restoration and enhancement of the natural environment."

The basic objectives stated in the policy in paragraph 2.1 include "restoration of ecological balance that has been adversely disturbed by serious depletion of forests of the country."

The basic objective in paragraph 2.2 states "The principal aim of Forest Policy must be to ensure environmental stability and maintenance of ecological balance… the derivation of direct economic benefit must be subordinate to this principal aim."

The NFP is built around the premise that the forests of the country are depleted; and there is a need to restore these for the environmental stability and ecological security of the country. Detailed strategies in all the aspects of forest resource management have been enumerated and briefly described. The forest policy recommends as a strategy creating a massive afforestation movement, including undertaking agro-forestry, to reduce pressure on the forests.

National Working Plan Code (2014)

Paragraph 53 of the National Working Plan Code 2014: Consultation with local stakeholders requires that "The head, territorial circle during PWPR preparation will hold consultation with local people's forum, JFMCs, village Panchayats and FDA about the expectations of people dependent on forests and try to accommodate the same to the extent that they are compatible with the technical feasibility of sustainable management of forests."

This, thus, tries to integrate the expectations of the people in the management of resources to the extent that it's technically feasible.

Principle 11. Ecosystem Approach should consider all sorts of knowledge and information from scientific, indigenous, local innovations and practices

Selected Implementation Guidelines

- No single organization can understand and optimize management and ecosystem functioning and address all issues.
- Consider all information available to all stakeholders and treat local knowledge with respect.
- Implications of different "world views" should be evaluated.
- Promote and implement applied research and integrate the same in decision making.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

The NFP was drafted before the 1992 CBD and has no reference to local knowledge and practices.

National Working Plan Code (2014)

In the National working Plan Code of 2014, Paragraph 84 Chapter vii sub paragraph 8.4 requires the documentation of indigenous traditional knowledge and incorporation of the same in micro-plans and other prescriptions of the plan. Sub paragraph 8.5 requires the details of cultural sacred groves along with ownership, status of management and interventions to conserve them, be provided in the appendix. Sub paragraph 8.6 requires the areas inside and adjoining designated forests – which have eco-tourism potential or are being visited by tourists – be identified and documented for effective eco-tourism management.

Sub paragraph 8.7 requires recording of prevalent social customs relevant to forests.

Paragraph 53 of the National Working Plan Code on consultation with local stakeholders requires the "The head, territorial circle during PWPR preparation to hold consultation with local people's forum, JFMCs, village Panchayats and FDA about the expectations of people dependent on forests and try to accommodate the same to the extent that they are compatible with the technical feasibility of sustainable management of forests."

During the meeting with the local stakeholders, the discussions may not be limited only to sharing or restrictions on the use of resource, but may be broad-based to record local relevant knowledge for use in management of the forest concerned.

Principle 12. Involve all relevant sectors of society

Selected Implementation Guidelines

- Biodiversity conservation and management is complex and has side effects and implications, so all expertise at international, national, regional, local levels as appropriate should be involved. It requires a wide range of management skills including those not involved in biodiversity conservation and management.
- Incorporate agriculture, fisheries, and other relevant sectors, other than the ones which are involved in primary production and may have a major role, but are not recognized traditionally.
- Evolve a mechanism to involve all explicitly in decision making.

Indian Policy(ies) and Regulation(s)

National Forest Policy (1988)

In view of the serious depletion of forest resources, the NFP 1988 in Paragraph 2 of basic

objectives requires "increasing substantially the forest/tree cover in the country through massive afforestation and social forestry programs, especially on all denuded, degraded and unproductive lands. This implies that for afforestation on land outside forests, it requires synergy/coordination with other sectors of the economy. The policy further requires "Creating a massive people's movement with the involvement of women, for achieving these objectives and to minimize pressure on existing forests."

Strategy 4.2 of the NFP on Afforestation, Social Forestry and Farm Forestry recommends undertaking massive plantation on all denuded and degraded lands; plantation on roads, railway lines, rivers and streams and canals and on other unutilized lands under state/corporate, institutional or private ownership. Green belts should be raised in urban/industrial areas as well as in arid tracts…"

The policy requires "undertaking plantation of tree crops on village and community lands not required for other productive uses and the revenue generated through such programs should belong to the panchayats where such lands vest in them; …beneficiaries would be entitled to usufruct and would, in turn, be responsible for their security and maintenance." These provisions require coordination with other sectors of general state administration. The policy further recommends amendment or modification to land laws to facilitate and motivate individuals and institutions to undertake tree farming.

The policy restricts and cautions the use of exotic tree species "unless long-term scientific trials undertaken by specialists in ecology, forestry, agriculture have established that they are suitable and have no adverse impact on native vegetation and environment." These efforts also call for inter-sectoral discussion and decision making.

The provision of restriction of use of forest lands for non-forestry use has multi-sectoral linkages with all other sectors of the economy. The provision of supply to industrial units and incorporation of forestry as a discipline in agriculture universities implies coordination with corresponding departments.

National Working Plan Code (2014)

The National Working Plan Code 2014 in paragraph 27 on Trees Outside Forests (TOF) emphasizes the important role played by trees outside forests. "The focus of forestry/forest area is on production forestry, revitalization of the rural economy and expanding economic opportunities through innovations. This requires inter-sector synergy and convergence. The WPO may, therefore, prepare a separate strategy as a new chapter to address the concepts and issues related to TOF. Inter-sectoral coordination is required for agro-forestry with agriculture department, industry department, and animal husbandry department for cattle grazing, transport department for not plying through forest during certain period of the day/night, and for limiting the speed of vehicles through forest.

Paragraph 53 of the Code, consultation with local stakeholders, requires that the "The head, territorial circle during PWPR preparation will hold consultation with local people's forum, JFMCs, village panchayats and FDA about the expectations of people dependent on forests and try to accommodate the same to

the extent that they are compatible with the technical feasibility of sustainable management of forests."

PRIORITY AREAS TO ENABLE AN ECOSYSTEM APPROACH IN INDIA

Given the policies in India that support the Ecosystem Approach, below are detailed some priority areas necessary to lay the foundation for an ecosystem approach to forest management. They are paraphrased from the CBD and contextualized for India.

Focus on the functional relationships and processes within ecosystems

Biodiversity conservation and the maintenance of human well-being depend on the functioning and resilience of natural ecosystems. Ecosystem functioning and resilience, in turn, depend on inter-relationships within and among species, between species and their abiotic environments, and on the physical and chemical interactions within these systems. To restore the key structures and ecological processes rather than just individual species, it is necessary to understand, to the maximum extent possible, the mechanism of ecosystem functioning.

Given that the loss of genetic diversity predisposes populations and species to local extinction, the conservation of ecosystem composition and structure requires monitoring of population sizes of vulnerable and economically important species. Management of ecosystem processes has to be carried out despite incomplete knowledge of ecosystem functioning.

Enhance benefit sharing

Many stakeholders with strong interests in the ecosystem but having limited political and economic influence, may be marginalized from the relevant economic systems. To counter this, more equitable sharing of benefits is advised. National and sub-national policies, laws, and regulations, including subsidies, may provide incentives for unsustainable management of ecosystems. Economic systems, therefore, need to be redesigned to accommodate environmental management objectives. Deriving economic benefits is not necessarily different from attaining biodiversity conservation and improving environmental quality.

Use adaptive management practices

Change in ecosystems is both natural and inevitable, and therefore, management objectives should not be construed as fixed outcomes, but rather the maintenance of natural ecological processes. In this regard, it should be noted that:

Ecosystems change constantly as a result of natural processes. Those changes include shifts in species composition, population abundance, and physical characteristics. Such changes are not necessarily constant, and usually difficult to predict at any point in time. It is therefore inadvisable to select an appropriate outcome or future state of an ecosystem as a static management goal. Instead, in addressing this, management should focus on maintaining the natural processes which drive those changes.

Ecosystem management must therefore involve a learning process that will help to adapt methods and practices to improve the ways

in which these systems are being managed and monitored. Flexibility is also needed in policy-making and implementation. Long-term, inflexible decisions are likely to be ineffective or detrimental.

Ensure inter-sectoral cooperation

The integrated management of land, water and living resources requires increased communication and cooperation, between sectors, at various levels of government (national, provincial, local), and private sector stakeholders. Further incorporation of the ecosystem approach as an integral part of planning in, among others, the agriculture, fisheries, forestry and other natural resource management sectors potentially affecting biodiversity and ecosystem functioning, should be encouraged. Sectors other than the primary production sectors may also have major effects, but are often less recognized in this respect. These include sectors such as the judicial sector, which affects governance, as well as those such as energy and transport, which are managing or affecting resources either directly or indirectly. For example, the cultivation of soya beans as a principal crop in place of *Arhar* cotton, of which the agriculture residue was used as fuel in rural areas of Hoshangabad in the past, has increased dependence of rural communities on forests for fuel wood.

Procedures and mechanisms should be established to ensure effective participation of all relevant stakeholders and actors during the consultation processes, decision making on management goals and actions.

Effective implementation of the ecosystem approach may require involving multi-disciplinary professional and scientific expertise, including such disciplines as economic, social and natural sciences. When assessing the costs and benefits of conserving, maintaining, using and restoring ecosystems, the interests of all relevant sectors should be taken into account for equitable sharing of benefits according to national law. When addressing the issue of market distortions that adversely affect biodiversity, it will require establishing dialog with other sectors.

In India, laws regulating forests have been amended from time to time to consider the interest of forests and wildlife but inter-sectoral dialogue, for example, with agricultural sector or transport sector which has fragmented the important biodiversity habitats has not been initiated.

Gaps in data collection and interpretation

An ecosystem approach has not been implemented to date in India. Data for this management is necessary. Some priority gaps are identified here.

Structure and composition of forest ecosystems

Different forest types have different species composition. Composition also changes with site quality to some extent. At the time of making enumeration (inventory), which is done at the time of revision and preparation of the working plan, the data of composition of different forest types by site quality may be compiled. The genetic variation of the species may also be recorded to the extent possible. From the tables of diameter distribution of different species structural and compositional studies can be carried out for reflecting on the past management and making future

management prescriptions. Sukachev (1954) at the World Forestry Congress, in his paper "Forest types and their significance for forest economy", said forest types should form the basis of study and classification. For the comparison of present composition and structure, the data of preservation plots which reflect the true natural structure and composition of the forest type can be used.

Mortality

Climate change is going to affect or has already started affecting the composition of forests. The rate of change may be different for different species in different forest types. Some species may go locally extinct. The mortality rate of different species by different diameter classes has to be compiled for making management prescription.

Benefit sharing

Socio-economic data is generally collected at the time of revision of working plan. The dependence of various strata of society on the forest resources may be quantified for equitable sharing of benefits and for monitoring the trends of forest dependence.

Trees outside forests

Similarly, the promotion of agro-forestry/ tree cultivation has positive impact on the conservation of forests in the neighborhood. The data relating to such developments outside forests are necessary for studying the impacts on forest resources and their management.

DESIRABILITY OF IMPROVED MANAGEMENT AND CONCLUSIONS

It is quite often stated that fire and grazing are the two most serious degrading locality factors. It is true. But how far our systems of forest management have contributed to the site degradation is a difficult question to answer. Some of our good forest areas, measured on the basis of basal area, are depleted. They appear well stocked because of the presence of a relatively large young and pole crop. The number of big trees is very small. It seems that most forests had been harvested at shorter intervals like the forests that have been worked under the coppice system. Normally, the job of a WPO ends at calculating the increment the forest puts on and recommending removal of equal to or less than the gross increment accrued. However, it may be remembered that even the depleted forests put on some increment. It is incorrect to recommend removal of increment if the forest is depleted. In fact, the forest growing stock needs to be built up and the site conditions allowed to recuperate in case of depleted forests. Such decisions can be taken if the WPO knows the level of stocking. Generally knowing that a forest is depleted and so recommending removal only part of increment, intuitively, is incorrect and unscientific. The officer should incorporate the study of structure and composition of the forest under management that is at the heart of ecosystem-based silviculture. The analysis of the forest stand which is generally written in the chapter on the forests or in the chapter on the statistics of growth and yield needs to incorporate such studies on which management prescriptions can be based.

Another important aspect which needs to be made part of working plan is the study of inter-sectoral linkages. Developments outside forests directly influence the forest resources and their management. Some examples of inter-sectoral linkages which have been mentioned earlier in

this chapter need to find place in the working plans.

Normally, working plans are written for the management of forests of a Forest Division. But there is a need to look beyond the boundaries of a Forest Division. This is because:

- Developments outside forest influence the forest resource condition.
- The NFP aims at increasing forest and tree cover to 33 percent, which is possible if tree cultivation takes place outside the forest boundary. It is also known that if agro-forestry is promoted, the pressure on natural forests reduces. The promotion of agro-forestry as a tool to conserve forest resource, and therefore, should find place in the working plans.
- Under the direction of the Supreme Court of India, licensing of saw mills has been limited to the wood production capacity of the Division or district. These sawmills and wood-based industries may or may not use wood obtained from forests. It is, therefore, necessary to undertake surveys of wood resource outside forest boundaries in the Division and district to monitor the pressure on forests. In view of this, it is quite often pleaded that working plans be written for the geographical area of the Forest Division and be called the natural resource management plan.

REFERENCES

CBD. 1992. *Convention on Biological Diversity*. United Nations. https://www.cbd.int/doc/legal/cbd-en.pdf.

CBD. 2003. "Ecosystem Approach: Further elaboration, guidelines for implementation and relationship with sustainable forest management." *Report of the Expert Meeting on the Ecosystem Approach*. UNEP/CBD/SBSTTA/9/INF/4.

MoEF. 1980. *Forest Conservation Act (FCA), 1980*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 1988. *National Forest Policy 1988*. New Delhi: Ministry of Environment and Forests, Government of India.

MoTA. 2006. *Forest Rights Act, 2006*. New Delhi: Ministry of Tribal Affairs, Government of India.

MOEFCC. 2014. *National Working Plan code 2014*. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India.

United Nations. 1992. *Report of the United Nations Conference on Environment and Development (Rio de Janeiro, 13-14 June, 1992).* Annex III. General Assemble A/CONF.151/26 (Vol. III). http://www.un.org/documents/ga/conf151/aconf15126-3annex3.htm.

Chapter 7: REDD+ and Biodiversity Conservation: Safeguards and a Scope for Synergy

Sanjeeva Pandey

INTRODUCTION

As REDD+ (Reducing Emissions from Deforestation and Forest Degradation) has evolved over the course of international negotiations and through the experience of REDD+ pilots, there is now consensus that management for the climate benefits of forests should not come at the expense of biodiversity. Arguments for this note that biodiversity has its own intrinsic value, it supports a range of ecosystem services that are not associated with climate change, and diverse ecosystems and forests are more resilient and thus less risky investments in land-based carbon sequestration. This chapter summarizes the relationship between, and debate over, biodiversity conservation and REDD+. The initial sections provide a background on international decisions on REDD+ and biodiversity, including the REDD+ safeguards. The relationship between biodiversity conservation and climate change is also discussed. The second half of the chapter covers how biodiversity conservation and REDD+ can be integrated in India; and reviews India's environmental safeguards framework and explores the scope for synergies. The chapter concludes with recommendations for integrating biodiversity conservation into implementation of REDD+ in India.

A BRIEF OVERVIEW OF REDD+ ENVIRONMENTAL SAFEGUARDS: KEY CONCEPTS

In 1992, the United Nations Conference on Environment and Development (UNCED) held a major conference in Rio de Janeiro: the Rio Earth Summit. Three conventions were adopted at this conference: (1) the UN Framework Convention on Climate Change (UNFCCC), (2) UN Convention on Biological Diversity (CBD), and (3) UN Convention to Combat Desertification. The Ramsar Convention on Wetlands was adopted in 2012 (Rio+20 2012).

The UNFCCC became effective in March 1994, with the goal to prevent "dangerous" human interference with the climate system. The ultimate objective of the UNFCCC is to stabilize greenhouse gas concentrations "at a level that would prevent dangerous anthropogenic (human induced) interference with the climate system."[1] The objective also states that "such a level should be achieved within a time-frame sufficient to allow

ecosystems to adapt naturally to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner" (ibid).

REDD+ has been negotiated under the UNFCCC since 2005.[2] More than 300 initiatives have emerged in the past five years, experimenting with the concept of REDD+ in the Amazon forests of Peru and Brazil, the Congo Basin, Tanzania, Vietnam, and Indonesian Borneo (CIFOR 2014). It is seen as an initiative to tackle climate change by keeping carbon locked in standing forests. In the 2007 Bali Climate Change Summit (Conference of Parties [COP] 13), one of the key elements of the Bali Road Map was financing, such as paying people in developing tropical countries to protect their forests through carbon credits, which they could sell on an international carbon market.

The main challenges for REDD+ come from multilevel governance in the face of missing regional linkages with respect to finance and benefit distribution, setting reference levels; measurement, reporting, and verification (MRV); land policy; and safeguards. Project-based regional initiatives often are in contrast with existing coordination and information sharing systems, inter-sectoral government programs, as well as concerns over accountability, equity and justice (ibid).

7.2.1 Various UNFCCC and Other International Decisions, Initiatives, and Procedures for Integrating Environmental Safeguards, Especially Biodiversity Conservation, In REDD+

COP 3 (Kyoto Protocol) 1997 and COP 7 (Marrakesh) 2001

Linked to UNFCCC is the Kyoto Protocol, an international agreement which commits its parties to set internationally binding emission reduction targets. It was adopted in Kyoto, Japan in December 1997 and came into force in February 2005 (Kyoto Protocol 1997). The Kyoto Protocol is important in recognizing the role of developed countries as major polluters of the atmosphere due to 150 years of emissions from industrialization. Accordingly, the protocol adopted at COP 7 (Marrakesh, 2001) pointed out the role of developed nations under the principle of "common but differentiated responsibilities" (Marrakesh Accords and COP 7). It commits the parties to reduce greenhouse gas emissions, based on the facts that (1) global warming exists, and (2) human-made CO_2 emissions have caused it. UNFCCC and the Kyoto Protocol have made carbon a tradable commodity.

Under the Kyoto Protocol, eligible forestry activities include afforestation and reforestation for lands which have not been forested for at least 50 years, or have not contained forests since December 31, 1989. These activities were expected to lead to the Clean Development Mechanism (Kyoto Protocol IPCC 2007). Opportunities to conserve biodiversity through REDD+ (Harvey *et al.* 2010) were to come through many meetings, negotiations, and decisions of UNFCCC.

First and Second Workshops (Rome and Cairn) 2006-2007 and COP 12 (Nairobi) 2001

The Indian negotiating stand was made clear in the UNFCCC's First Workshop on REDD in Rome (2006), Second in Cairns (2007), and COP 12 in Nairobi (2006). COP 12 was very

important for India, because it led countries with (i) conservation history, and (ii) use of technology. With 150 years' experience in scientific forestry (starting in 1870s), India finds its place among countries that should be implementing the "compensated conservation" mechanism. This also marked the beginning of monitoring and evaluation of forests for their conservation values in terms of biodiversity and related ecosystem services (*National REDD+ Policy and Strategy draft*).

COP 15 (Copenhagen) 2009

COP 15 in Copenhagen in December 2009 was a major breakthrough toward financing REDD+ projects for tropical forest conservation and sustainable management – at scales never before seen (estimated at USD 1.2–10 billion annually; Miles & Kapos 2008).

There was clear intent in the Copenhagen Accord to get REDD going without delay. The accord called for the "immediate establishment of a mechanism including REDD+." Moreover, the importance of finance was recognized, with a resolution stating that "In the context of meaningful mitigation actions and transparency on implementation, developed countries commit to a goal of mobilizing jointly USD 100 billion dollars a year by 2020 to address the needs of developing countries" (UNFCCC 2009). A significant portion of such funding was to flow through the Green Climate Fund to support mitigation activities in developing countries, including REDD+.

COP 16 (Cancun Agreements) 2010

At Cancun, the COP (16) agreed that actions needed to be results-based, and fully measured, reported and verified. From a biodiversity perspective, the COP affirmed that the implementation of REDD+ activities should include the promotion and support of a number of safeguards (decision 1/CP.16).

The Cancun agreements were important as they emphasized the consistency of actions to align with the conservation of natural forests and biological diversity, ensuring that REDD+ actions are not used for the conversion of natural forests, but are instead used to incentivize the protection and conservation of natural forests and their ecosystem services, and to enhance other social and environmental benefits (COP 16/CMP 6). The CBD COP 10 identified possible indicators to assess the contribution of REDD+ to achieve CBD objectives. This COP 10 was important

Table 7.1: Categorization of forested nations

Forested Nations can be divided into two groups	
Nations with Decreasing Forest Cover	Bolivia, Brazil, Burma, Cambodia, Cameroon, Democratic Republic of the Congo, Ecuador, Indonesia, Mexico, Nigeria, Sudan, Tanzania, Venezuela, Zambia, Zimbabwe
Nations with Increasing Forest Cover	Algeria, Chile, China, Côte d'Ivoire, India, Morocco, Tunisia, Uruguay, Vietnam

Source: FAO 2005; Rudel K. Thomas 2005.

as it focused on the relationship between biodiversity conservation and ecosystem services – particularly services associated with climate change mitigation (COP 10 decision X/33).

COP 19 (Warsaw Framework) 2013

Negotiators at COP 19 in Warsaw agreed on seven decisions relating to REDD+, known as the "Warsaw Framework for REDD Plus." These included methodological guidance for activities relating to national forest monitoring systems, and MRV of REDD+ activities (COP 19 of UNFCCC).

COP 21 (Paris) 2015

The agreements from COP 21 (Paris) included the requirement that all parties put forward their best efforts through nationally determined contributions (NDCs) and strengthen these efforts in the years ahead (UNFCCC, Paris 2015). However, it was recognized that developing countries would need financial support from developed countries to implement most of the 165 listed NDCs. The concern, here, is "that even if all the NDCs were implemented, estimates show that the planet would warm up by about 3°C from pre-industrial temperatures which is well above the goal of staying below a 1.5°C or a 2°C rise. This implies that all the NDCs ought to be implemented, and the support required should be provided, so that countries can build the trust and confidence needed to further raise the bar for future targets" (Byravan 2017).

BIODIVERSITY CONSERVATION AND CLIMATE CHANGE

Overlapping international negotiations at the UNFCCC on REDD+ was the growth of a body of research and consensus on the importance of a broader set of ecosystem services. The Millennium Ecosystem Assessment (MEA) in the early 2000s popularized the concept of ecosystem services in four broad categories: (i) provisioning, such as food and water production; (ii) regulating, such as climate change mitigation; (iii) cultural, such as recreational and spiritual benefits from natural sites; and (iv) supporting, such as pollination and nutrient cycles. All four services derive from native biological diversity, which is often threatened because of proliferating invasive alien species (World Resources Institute 2005)

Biodiversity and ecosystem services are interrelated. Modern research on ecosystem services supports the contention that climate change is triggered as we lose native biological diversity. The following five tenets discuss this point further:

- **Native vegetation** has greater capacity to provide ecosystem services under changing environmental conditions. Three important indicators of a natural forest are that it exerts influence on the local climate, maintains the water regime, and shelters wildlife and produces wood (Meher-Homiji 1997). However, invasive alien species can adversely affect this "naturalness." The introduction of so many exotic species (e.g., *Lantana, Parthinium*, Wattles, *Eucalyptus*, and numerous others) in Himalayan and other forests, including protected areas, are diminishing the capacity of natural ecosystems. Conversely, the diversity of indigenous species can decrease the probability of invasions of non-native species, many of which have had substantial economic, conservation, and societal consequences (Naeem *et al.* 2012).

- **Biological insurance** emphasizes rare species conservation. The extinction of native species in temperate ecosystems can cause a cascade of other extinctions, accelerating the rate of community change (Jain *et al.* 2014).
- **Biodiverse systems,** on average, store more carbon and do so more reliably (Bunker *et al.* 2005).
- **Biodiversity is multidimensional** as it supports livelihoods, spiritual well-being, climate regulation, and carbon sequestration, in a natural ecosystem (Flynn *et al.* 2011).
- Thus, **more ecosystem functions and services need more local species** (Zavaleta *et al.* 2010). If the indigenous biodiversity is compromised, ecosystems collapse. There are many examples of industrial waste killing wetlands and rivers, and of fumes in the atmosphere killing plants and animals and resulting in air pollution.

ASSESSMENT OF INDIA'S EXISTING ENVIRONMENTAL SAFEGUARDS FRAMEWORK WITH A FOCUS ON BIODIVERSITY CONSERVATION: STRENGTHS AND WEAKNESSES FOR IMPLEMENTING REDD+

How tightly are concerns about climate change and biodiversity conservation linked in India, and what is their basis in policy and regulation? India is one of the world's mega-biodiversity countries (8.1% of world's biodiversity exists in India). The country also supports 16 percent of the world's human as well as 18 percent of the world's cattle populations (IISc 2001). "In fact, an estimated 70% of India's population is dependent locally on natural ecosystems for subsistence means of livelihood, including fuel, housing, food, water, and security of health. Consequently, the country's biodiversity faces immense pressures" (MoEF 2011).

India's existing environmental safeguard framework involves legal provisions, government orders, and international conventions. The Environment Protection Act of 1986 provides for the protection and improvement of the environment. This Act stresses that the Environmental Impact Assessment (EIA) is an important management tool to ensure optimal use of natural resources for sustainable development. There are other relevant acts and policies to further strengthen India's environment, such as Air (Prevention and Control of Pollution) Act of 1981, EIA Notification of 1994, Forest (Conservation) Act of 1980, and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act of 2006.

India pushed for REDD+ as a financing mechanism to combat climate change through carbon sequestration and the promotion of sustainable management of forests at COP 16 in Cancun in 2010. Per the Cancun decisions, all activities pertaining to conservation, forest carbon stocks, and sustainable management of forests will be eligible for REDD+ financing. As noted earlier, in addition to the UNFCCC, other biodiversity-focused conventions include the CBD, UN Convention to Combat Desertification, and Ramsar Convention on Wetlands (Locke and Mackey 2009), which can be linked with REDD+. All of these conventions need to safeguard indigenous biodiversity and promote benefits from biodiversity.

Globally, the CBD was signed by 150 government leaders at the 1992 Rio Earth Summit. The CBD views biodiversity from a humanistic perspective, with an emphasis on people and their need for food security, medicines, fresh air and water, shelter, and a clean and healthy environment (CBD 1992). Access to Benefit Sharing (ABS) is one of CBD's fundamental objectives.

To realize the CBD objective, "India enacted Biological Diversity Act 2002, an umbrella legislation to conserve biodiversity and associated knowledge as well as facilitating access to them in a sustainable manner and through a just process" (Kannaiyan 2007). Further, to implement India's Biological Diversity Act (2002), the National Biodiversity Authority (NBA) was established in 2003. The Government of India, in collaboration with the Norwegian government, established a Centre for Biodiversity Policy and Law (CEBPOL) in the NBA, [in] Chennai, to develop professional expertise in biodiversity policies and laws and develop capacity building.

Challenges and Opportunities for Synergy between REDD+ and Biodiversity Conservation in India

The forestry sector of India is a net sink which removes around 6.5 percent of the country's annual emissions. There are many projects in India which should help the shift to a national REDD+ with appropriate changes in forest policy, based on India's 150-year history of forest management. The following points should be considered:

- The scope for synergy between REDD+ and biodiversity conservation in India is often adversely affected due to compartmentalization of environmental and developmental agendas. REDD+ research at the Center for International Forestry Research (CIFOR) indicates, "One of the advantages of a jurisdictional approach, in theory, is that it houses the purview of environmental stewardship and economic development, along with ostensible mechanisms of accountability, in one place," (CIFOR 2014). It is imperative that developmental and environmental activities are integrated and carefully thought through. Unfortunately, the Ministry of Environment and Forest and Climate Change is often considered an impediment to the government's developmental plans.
- Cohesive strategies for REDD+ and biodiversity conservation in India are often hindered due to lack of coordination among multiple ministries and government departments with overlapping purviews or outright contradictory objectives. "It is not uncommon to have a payment for environmental services program that rewards conservation, on the one hand, and on the other hand, massive subsidies for agriculture for cash crops that make it very attractive to deforest," (Ravikumar et. al 2015). The result is that different ministries are often working against each other.
- There is collaboration between REDD+ and biodiversity conservation if they do not contradict the long-standing social and environmental norms of society. For example, the introduction of any new policy under REDD+ and biodiversity conservation should not adversely affect vulnerable populations, livelihoods, social justice, and indigenous biodiversity. "Proponents generally believe they are in

a position to elevate the concerns of local people to national-level policy discussions, but it is also important that local people participate in and choose their own representatives in these processes," said Anne Larson (CIFOR 2016).

- To combat the threat of invasive alien species, efforts need to stem from government policies for greater conservation benefits. There are safeguards proposed for ensuring REDD does not harm indigenous or local communities. Social and environmental impact assessments could also be required of REDD projects to avoid or mitigate negative impacts on biodiversity.
- Synergy between REDD+ and biodiversity conservation in India can best be achieved through working with communities. Joint Forest Management Committees exist at the community level, but need to build more capacity and autonomy for integration with REDD+ requirements. Likewise, schemes such as the Mahatma Gandhi National Rural Employment Guarantee Act (MNREGA) need to be more effective for regular employment for people living at poverty levels. As well, women's empowerment, alternative ecologically friendly income-generation activities, and people-friendly governance can help reduce pressures on local biological diversity and aid implementation of REDD+.

In India, where community-based programs such as Joint Forest Management are not operating as effectively as envisaged, it may be difficult to implement a REDD+ mechanism requiring a community–based legal framework. It is often difficult to define and understand the ownership of carbon resources and assignment of property titles for emission reductions. Furthermore, competent public authorities to act in this regard may be absent.

Governance and Coherence with the Country's National Climate Strategy and Priorities in Mitigation or Adaptation

- REDD+ is possible under good governance: forests with secure land tenure, effective laws and policies, and empowered committed local communities whose rights are respected. REDD+ recognizes and respects the rights of indigenous peoples and local communities as part of the Social and Environmental Safeguards (WWF 2011). India has its own National Action Plan on Climate Change and eight national missions to address climate change (one of them being the National Mission for Green India). These plans can work with the REDD+ system to align with the sub-national State Strategy and Action Plan for Climate Change. It can be coherent with the international studies such as Providing Regional Climates for Impacts Studies (PRECIS), **a** regional climate modelling system based on the third generation of the Hadley Centre's regional climate model (HadRM3), together with user-friendly data processing and a visualization interface (Pal *et al.* 2007).
- India has a 150-year history of scientific forest management. However, the forestry sector needs to be revamped to face the modern challenges of climate change and ecosystem services. REDD+ pilot projects at the sub-national level exist in India and can provide critical information for national

REDD+ implementation. Lessons learned from these disparate pilots can help shape the nature of the negotiations on REDD+ in national and international forums.

A pilot REDD+ project in Himachal Pradesh (Rampur Landscape) emphasized increased use of proven technologies for low-carbon or carbon-neutral energy. This could be done by widespread use of low-carbon energy technologies, fuel saving and fodder enrichment technologies, improved management information systems, etc. Such experiences can be of greater use in applying the REDD+ system on a larger scale. The project also demonstrated livelihood generation through marketing of mushrooms produced by the local communities. It showed that markets can drive better environmental management through high social and environment standards (WWF 2011).

RECOMMENDED GUIDELINES FOR INTEGRATING BIODIVERSITY CONSERVATION IN REDD+ PROJECTS AND PROGRAMS

A field practitioner may adopt UNFCCC and the Cancun Agreements, specifically that REDD+ demonstrably contributes to greenhouse gas emission reductions with national goals, working toward a global objective. A REDD+ goal should not be achieved at the expense of biodiversity conservation (e.g., agricultural expansion in highly biodiverse grasslands to take pressure off forests). Strategies should immediately prioritize forests with the highest biodiversity to minimize or avoid their loss. As a principle, REDD+ has to maintain and enhance forest biodiversity and ecosystem services (WWF 2011). The MA (Fekete *et al.* 2010) focuses on the role of biological diversity in providing four major ecosystem services (Provisioning, Regulating, Cultural, and Supporting) around the world. The regulating service focuses on the influence of forests with diverse flora and fauna on the local climate. If we change the forest's composition from diverse to monoculture, its capacity to regulate local climate, yield water, and provide goods such as timber and non-timber forest products is compromised. This may also cause a rise in atmospheric temperature as has been predicted by the IPCC reports (Parry *et al.* 2007). A forester needs to be cognizant of linkages between biodiversity conservation and climate change.

A REDD+ project or program in India should consider the following guidelines:

- **Watershed catchment protection and improvement:** To maintain and improve forest health for its climate mitigation and adaptation benefits, use Joint Forest Management to engage major stakeholders. This can be done through a partnership between the government and project representatives and villagers through a legally recognized committee such as Joint Forest Management Committees (JFMCs).
- **Loss of biodiversity:** By and large, anthropogenic influences have been a major cause of biological diversity loss. For example, in the Himalayan state of Himachal Pradesh, local biodiversity is impacted due to an exponential increase in urbanization and agriculture, and the construction of roads to open up the remote areas. In addition, forest fires and climate changes can adversely affect biological diversity. Identification of these factors that can add to biodiversity loss

can help plan for the reversal of such processes.

- **REDD+ in aid to biodiversity conservation:** REDD+ can help implement safeguards, which could include planting of only local species, avoiding monocultures, forbidding the felling of old growth forests, and barring plantations of exotics and uprooting of invasive alien species (COP 16/CMP 6). The Government of Himachal Pradesh spends a sizeable amount on *Lantana* (an invasive alien species) removal. Similarly, the Government of Jammu and Kashmir has ordered all the Russian Poplars in the state be cut (as it has caused serious respiratory problems). Other alien species such as *Eucalyptus*, Poplars, *Jacaranda, Leucinia, Robinia*, etc. can also be removed and replaced by native species which are more beneficial to the local ecology.
- **Invasive alien species:** REDD+, as a system, has to be clear on invasive alien species, which include microbes, plants, and animals, all non-native to an ecosystem and which cause economic or environmental harm, and/or adversely affect the ecosystem and human health. "In particular, they cause decline or elimination of native species – through competition, predation, or transmission of pathogens and the disruption of local ecosystems and ecosystem functions" (CBD website on invasive alien species). Invasive alien species, introduced and/or spread outside their natural habitats, have affected native biodiversity in almost every type of ecosystem on earth and are one of the greatest threats to biodiversity (Wittenberg 2001).
- **Ecosystem approach to forest management (EAFM):** Monocultures in forestry are now seen as very different from biodiverse forest areas. They are bereft of interdependent ecosystem processes, which need a multitude of floral and faunal species. A forest spread over a larger landscape with its intact biological diversity is expected to mitigate/minimize the risks of climate change by enhancing resilience of the forest ecosystems (Simberloff 1998). EAFM is expected to maximize and sustain impact by (i) developing sustainable institutional frameworks and capacity for its stated objectives at the regional and community levels; (ii) creating an appropriate policy and legal framework, which remedies the numerous policy failures that have led to unsustainable and inequitable exploitation of the forest resource; and (iii) improving the sustainable financial basis for the state through exploring the potential of increased use of proven technologies for low-carbon or carbon-neutral energy. EAFM seeks use of "natural resources, whilst maintaining the biological richness and ecological processes necessary to sustain the composition, structure and function of the habitats or ecosystems concerned" (Barnes *et al.* n.d.). Important within this process is setting explicit goals and practices that anticipate the needs of the future, regularly updated in the light of monitoring and research activities. (O'Hara 2016).

  EAFM requires new information – different from the management practices to enhance timber production. The shift toward ecosystem services will need to have more nuanced information about interrelations of various indigenous floral and faunal components of an ecosystem (Korzukhin 1996). In addition, EAFM will

have to ensure the role of civil society, including local user groups, women groups, and nongovernmental organizations for the sustainability of efforts and results. There will be options to review and change EAFM during its implementation to ensure its sustainability. An early impact assessment can further ensure this aspect.

- **Protected Area management** in India can be prioritized to adopt EAFM and the related REDD+ system. For example, the Great Himalayan National Park in the Kullu district of Himachal Pradesh has recently (2014) been designated as a World Heritage Site for its biodiversity values. The ecosystems being preserved in the vast park landscape are contributing to water provision, hydro-electricity, community-based ecotourism, and many religio-cultural values. The park acts as reservoir of local biological values, and is well protected under the Indian Wildlife (Protection) Act of 1972 against any developmental activity.

REFERENCES

Barnes, C., B. Laura and M. Kate. *Exploring an Ecosystem Approach to Management: A Review of the Pertinent Literature*. Washington, DC, USA: National Oceanic and Atmospheric Administration, U.S. Department of Commerce.

Byravan. S. 2017. "An unequal burden." *The Hindu* website. http://www.thehindu.com/opinion/op-ed/an-unequal-burden/article18526280.ece.

Bunker, D. E., F. DeClerk, J. C. Bradford, R. K. Colwell, I. Perfecto, O. L. Phillips, M. Sankaran, S. Naeem. 2005. "Species loss and above ground carbon storage in a tropical forest." *Science* 310: 1029-1031.

CBD. https://www.cbd.int/convention/.

CBD. What are Invasive Alien Species?. https://www.cbd.int/invasive/WhatareIAS.shtml.

CBD. 2010. Decision X/33. https://www.cbd.int/decision/cop/?id=12299.

CIFOR. 2014. "REDD on the ground new book offers insights lessons from across the tropics." *Center for International Forestry Research* website. Accessed August 18, 2017. http://blog.cifor.org/25546/redd-on-the-ground-new-book-offers-insights-lessons-from-across-the-tropics?utm_source=November+2014&utm_campaign=NEWS+UPDATE+Special+COP+English+&utm_medium=email#.VIAD5MtEiUk.

CIFOR. 2016. "Local projects shape national REDD+ strategies." *Forests News* website, April 13, 2016. https://forestsnews.cifor.org/41064/local-projects-shape-national-redd-strategies?fnl=en.

FAO. 2005. *Global Forest Resources Assessment 2005.* Rome: Food and Agriculture Organization of the United Nations.

Fekete, B. M., D. Wisser, C. Kroeze, E. Mayorga, L. Bouwman, W. M. Wollheim, and C. Vörösmarty. 2010. "Millennium Ecosystem Assessment scenario drivers (1970-2050): Climate and hydrological alterations." *Global Biogeochemical Cycles*, 24 (4).

Flynn F. B., N. Mirotchnick, M. Jain, M. I. Palmer and S. Naeem. 2011. "Functional and phylogenetic diversity as predictors of biodiversity – ecosystem-function relationships." *Ecology* 92 (8): 1573-1581.

Harvey C. A., B. Dickson and C. Kormos. 2010. "Opportunities for achieving biodiversity conservation through REDD." *Conservation Letters* 3: 53-61.

IISc. 2001. "Biodiversity profile for India." *Centre for Ecological Sciences, IISc website*. http://ces.iisc.ernet.in/hpg/cesmg/indiabio.html.

Jain, M., F. D. Flynn, C. M. Prager, G. M. Hart, C. M. DeVan, F. S. Ahrestani and S. Naeem, S. (2014). "The importance of rare species: a trait-based assessment of rare species contributions to functional diversity and possible ecosystem function in tall-grass prairies." *Ecology and evolution*, *4*(1), 104-112.

Kannaiyan. S. 2007. "An Overview on Biological Diversity Act – 2002." *International Biodiversity Day-2007 Souvenir*: 1-11.

Kevin L. O'Hara. 2016. "What is close-to-nature silviculture in a changing world?" *Forestry: An International Journal of Forest Research*. 89 (1): 1-6.

Korzukhin M. D., Michael T. Ter-Mikaelian, and R. G. Wagner. 1996. "Process versus empirical models: which approach for forest ecosystem management?" *Canadian Journal of Forest Research,* 1996, 26 (5): 879-887.

Locke, H. and B. Mackey. 2009. "The Nature of Climate Change." *International Journal of Wilderness* 15: 7-13.

Meher-Homiji, V. M. 1997. "Biodiversity Conservation Priorities." *Indian Journal of Forestry* 20 (1): 1-7.

Miles, L., and Kapos V. 2008. "Reducing Greenhouse Gas Emissions from Deforestation and Forest Degradation: Global Land Use Implications." *Science* 320: 1454-1455.

MoEF. 2011. *Environmental and Social Management Framework Biodiversity Conservation and Rural Livelihood Improvement*. New Delhi: Ministry of Environment and Forests, Government of India.

Naeem S., J. E. Duffy, E. Zavaleta. 2012. "The Functions of Biological Diversity in an Age of Extinction." *Science* 336: 6087.Pal, J. S., *et al*. 2007. "Regional climate modeling for the developing world: the ICTP RegCM3 and RegCNET." *Bulletin of the American Meteorological Society* 88 (9): 1395-1409.

Parry M., O. Canziani and J. Palutikof. 2007. *Contribution of Working Group II to the fourth assessment report of the Intergovernmental Panel on Climate Change*. Cambridge, UK: Cambridge University Press.

Ravikumar, A., Larson, A. M., Duchelle, A. E., Myers, R., & Tovar, J. G. 2015. "Multilevel governance challenges in transitioning towards a national approach for REDD+: Evidence from 23 subnational REDD+ initiatives." *International Journal of the Commons*, 9(2), 909-931. http://doi.org/10.18352/ijc.593

Rudel, T. K., O.T. Coomes, E. Moran, F. Achard, A. Angelsen, J. Xu, and E. Lambin. 2005. "Forest Transitions: Towards a Global Understanding of Land Use Change." *Global Environmental Change*, 15 (1): 23-31.

Simberloff D. 1998. "Flagships, Umbrellas, And Keystones: Is Single-Species Management Passi In The Landscape Era?" *Biological Conservation* 83 (3): 247-257

UNFCC website. http://unfccc.int/2860.php.

Wittenberg, R., Cock, M.J.W. (eds.) 2001. Invasive Alien Species: A Toolkit of Best Prevention and Management Practices. CAB International, Wallingford, Oxon, UK, xvii - 228. World Resources Institute. 2005. "Ecosystems and Human Well-Being: Wetlands and Water Synthesis." In *Millennium Ecosystem Assessment 2005*. Washington, DC: World Resources Institute.

WWF. 2011. "Living Forests Report." *WWF* website. http://wwf.panda.org/about_our_earth/deforestation/forest_publications_news_and_reports/living_forests_report/.

Zavaleta E.S., J. R. Pasari, K. B. Hulvey and G. D. Tilman. 2010. "Sustaining multiple ecosystem functions in grassland communities requires higher biodiversity." *Proceedings of the National Academy of Sciences* 107 (4): 1443-1446.

FURTHER READING

Key Resources (books, documents, websites, videos, etc.)

Aggarwal, A. 2001. "Implementation of forest rights act, changing forest landscape, and politics of REDD+ in India." *Resources, Energy, and Development* 8 (2): 131-148.

Aggarwal, A., V. Paul, and S. Das. 2009. *Forest Resources: Degradation, Livelihoods, and Climate Change, Looking Back to Change Track*. New Delhi: TERI.

Bahuguna, V. K., K. Mitra, D. Capistrano, and S. Saigal. 2004. *Root to Canopy: Regenerating Forests through Community*

State Partnerships, New Delhi: Winrock International India and Commonwealth Forestry Association.

Centre for Biodiversity Policy and Law. n.d. Accessed October 7, 2017. http://nbaindia.org/cebpol/.

Davidar, P., S. Sahoo, P. C. Mammen, P. Acharya, J. Puyravaud, M. Arjunan, P. Garrigues, K. Roessingh. 2010. "Assessing the extent and causes of forest degradation in India: where do we stand?" *Biological Conservation* 143 (12): 2937-2944.

FSI. 1996. *Demand and Supply of Fuelwood, Timber and Fodder in India*. Dehradun: Forest Survey of India, Ministry of Environment and Forest, Government of India.

FSI. 2009. *State of Forest Report*. New Delhi: Forest Survey of India, Ministry of Environment and Forests, Government of India.

GIZ. 2011. *A practitioner's guide for successful implementation of REDD* (Reducing Emissions from Deforestation and Forest Degradation). Eschborn, Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH.

Gundimeda, H., P. Sukhdev, R. K. Sinha, and S. Sanyal. 2007. "Natural resource accounting for Indian states - illustrating the case of forest resources." *Ecological Economics* 61 (4): 635-649.

ICFRE. 2011. Indian Forest Congress, Ministry of Environment and Forests. http://ify-india.icfre.gov.in/indiaforest.html.

Khushoo, T. N. 1986. "Environmental Priorities in India and Sustainable Development". *Indian Science Congress*, Calcutta, India.

Kishwan, J., R. Pandey, and V. K. Dadhwal. 2012. "Emission removal capability of India's forest and tree cover." *Small Scale Forestry* 11 (1): 61-72.

MoEF. 1999. *National Forestry Action Plan*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2006. *Report of the National Forest Commission*. New Delhi: Ministry of Environment and Forests, Government of India.

MOEF. 2009. *Asia-pacific forestry sector outlook study II: India country report*. Working Paper APFSOS II/WP/2009/06, Bangkok, Thailand: FAO. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2014. *National REDD+ Policy and Strategy (draft)*. New Delhi: Ministry of Environment and Forests, Government of India.

Pachauri, R. and R. K. Batra, eds. 2001. *Directions, Innovations, and Strategies for Harnessing Action for Sustainable Development*. New Delhi: TERI.

Pisupati, B. 2011. "Safeguarding India's Biological Diversity: The Biological Diversity Act, Farmer's Forum." *India's Agriculture Magazine*.

Poffenberger, M. 2000. *Community and Forest Management in South Asia - A Regional Profile of the Working Group on Community Involvement in Forest Management, Forest, people and policies*, Geneva, Switzerland: IUCN.

Rawat, V. R. S. 2011. "REDD Plus in India: from negotiations to implementation," in *Proceedings of the Pre-Congress Workshop of 1st Indian Forests Congress*, ICFRE, Dehradun.

Ravindranath, N. H., R. K. Chaturvedi and I. K. Murthy. 2008. "Forest conservation, afforestation and reforestation

in India: Implications for forest carbon stocks." *Current Science* 95 (2): 216-222.

Ravindranath, N. H., N. Srivastava, I. K. Murthy, S. Malaviya, M. Munsi and N. Sharma. 2012 "Deforestation and forest degradation in India – implications for REDD+." *Current Science* 102: 1117-1125.

Sharma, and Smita Chaudhry. 2013. "An Overview of Indian Forestry Sector with REDD+ Approach." *ISRN Forestry*. Volume 2013, Article ID 298735, 10 page http://dx.doi.org/10.1155/2013/298735.

Singh, P. P. 2008. "Exploring biodiversity and climate change benefits of community-based forest management." *Global Environmental Change* 18 (3): 468-478.

Singh, S. 2001. *India: Assessing Management Effectiveness of Wildlife Protected Areas in India*. IUCN. http://www.iucu.org/themes/forests/protected area/India.pdf.

Singh, S. J., F. Krausmann, S. Gingrich, H. Haberl, K. Erb, P. Lanz, J. Martinez-Alier and L. Temper. 2012. "India's biophysical economy, 1961-2008. Sustainability in a national and global context." *Ecological Economics* 76: 60-69.

Sinha, B., C. P. Kala and A. S. Katiyar. 2010. *Enhancing Livelihoods of Forest Dependent Communities Through Synergizing FDA Activities with Other Development Programmes*. Bhopal: Indian Institute of Forest Management.

Sud, R., J.V. Sharma and A. K. Bansal. 2012. *International REDD+ Architecture and Its Relevance for India*. New Delhi: TERI.

Sukhdev, P., R. Prabhu, P. Kumar, A. Bassi, W. Patwa-Shah, T. Enters, G. Labbate and J. Greenwalt. 2012. "REDD+ and a Green Economy: Opportunities for a mutually supportive relationship." *UN-REDD Programme Policy Brief*.

TERI, 2013. *International Architecture of REDD+: Implications for India*. New Delhi: TERI.

The World Bank. 2006. *Alleviating Poverty through Forest Development*. The World Bank. http://www.worldbank.org/ieg.

UNCSD. n.d. "Rio+20 - United Nations Conference on Sustainable Development." *UN Conference on Sustainable Development* website. Accessed August 08, 2017. https://web.archive.org/web/20140803220514/http://www.uncsd2012.org/index.html.

United Nations Conference on Environment and Development (UNCED), *Canada and the Earth Summit*, 1992.

UNFCCC. 2009. 13th Session of SBSTA. http://unfccc.int/resource/docs/2009/sbsta/eng/misc01a01.pdf.

UNFCCC. 2009. "Copenhagen Accord." UNFCCC website. http://unfccc.int/meetings/copenhagen_dec_2009/meeting/6295.php.

UNFCCC. 2010. Cancun Climate Change Conference- November 2010 COP 16/CMP 6. http://unfccc.int/meetings/cancun_nov_2010/items/6005.php.

UNFCCC. 2013. COP 19 of UNFCCC. http://unfccc.int/meetings/warsaw_nov_2013/session/7767.php.

UNFCCC. 2014. COP 21 of UNFCCC. http://unfccc.int/meetings/paris_nov_2015/meeting/8926.php.

UNFCCC.2010. Decision 1/CP.16. https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf.

WWF. n.d. http://wwf.panda.org/about_our_earth/teacher_resources/webfieldtrips/ecological_balance/.

Chapter 8: Managing Forests for Non-Timber Forest Products

Jogindra Kumar[1]

INTRODUCTION

Non-Timber Forest Products (NTFP) are literally any and every natural product harvested from the forest except timber. NTFPs are, "all the biological material (other than industrial round wood and derived sawn timber, wood chips, wood-based panels and pulp) that may be extracted from natural ecosystems, managed plantations, etc., and be utilized within the household, be marketed, or have social, cultural or religious significance" (Wickens 1991).

A closely related term is Non-Wood Forest Products (NWFP), defined by the Food and Agriculture Organization (FAO) as "products of biological origin other than wood derived from forests, other wooded land and trees outside forests." NWFP may be gathered from the wild, or may be produced – on forest plantations, via agroforestry schemes, and from trees outside forests (FAO 1999). The term "NWFP" excludes all woody raw materials. NTFPs, however, also generally include fuelwood and small woods.

In the Indian context, NTFP and Minor Forest Produce (MFP) are used interchangeably. The Indian Forest Act (IFA)[2] has defined "forest produce" as:

- The following, whether or not found in or brought from a forest:
  - Timber, charcoal, catechu, wood-oil, resin, natural varnish, bark, lac, mahua flowers, *mahua* seeds, kuth, and myrobalans. and
- The following, when found in or brought from a forest:
  - Trees and leaves, flowers and fruits, and all other parts or produce of trees not cited previously herein
  - Plants that are not trees (including grass, creepers, reeds, and moss), and all parts or produce of such plants
  - Wild animals and skins, tusks, horns, bones, silk, cocoons, honey, wax, and all other parts or produce of animals
  - Peat, surface soil, rock, and minerals (including limestone, laterite, mineral oils, and all products of mines or quarries).

However, the definition of MFP in the Forest Rights Act, 2006 (FRA) differs from the definition of MFP in IFA 1927. The former defines MFP as "all non-timber forest produce of plant origin including bamboo, brushwood, stumps, cane, *tussar*, cocoons, honey, wax, lac, *tendu* or *kendu* leaves, medicinal plants and herbs, root tubers and the like."

IMPORTANCE OF NON-TIMBER FOREST PRODUCTS

NTFPs often grow on common land or are easily accessible to general community members. Many can be harvested by application of benign techniques and have properties useful for medicinal purposes. Processing and marketing often require low levels of capital investment and accessible skills.

Departments involved with rural development and tribal development regard NTFPs as vehicles for developing livelihood models for eradication of poverty. Research institutions indicate interest in NTFPs as means for understanding ethnobotany, ecology, and economics of these, while development organizations regard NTFPs as means for generating subsistence and cash income to benefit the forest-dependent community. Conservation-oriented groups want to preserve gene pools or a few individual species of NTFPs, or regard NTFPs as instruments to help achieve conservation under regimes of low-intensity management. Strong commercial interest in NTFPs has been evident – not only because of valuable products deriving from these, but also because of the niche they can provide for firms seeking to establish a socially and environmentally friendly image. A few firms also market their philanthropic image to consumers by claiming that they support poor people and forest conservation.

Ecological Importance of NTFPs

NTFPs relate to the ecosystem in the following ways: provision of products (food, water, fiber, fuel, biochemical, medicines, and genetic resources); crucial association with targets of regulation (climate, erosion, disease, water, and natural hazards); and support for natural processes (soil formation, photosynthesis, primary production, water production and uptake, and nutrient cycling).

For example, NTFPs play an important role in regulating ecological processes of forests, and in maintaining species diversity. NTFPs also provide safety nets to timber species from threats by herbivores.

Economic Importance of NTFPs

NTFP collection has been a traditional activity of indigenous people and forest-dependent persons residing in and around forests for purposes of consumption and subsistence. NTFPs not only are important for conservation of biodiversity, but also contribute significantly to economies of different nations. They also help provide insurance and risk mitigation to forest-dependent communities.

Millennium Ecosystem Assessment (MEA) estimated that forests provide a home to almost 350 million people, of which 60 million are indigenous people almost wholly dependent on forests (MEA 2005). Forest goods and services contribute directly to local livelihoods through inputs to agriculture, as products to consume and sell locally (Cavendish 2000;

Eliasch 2008), and as inputs to wider production value chains (Stoian 2005). Households in and around forests are estimated to derive significant proportions of their annual incomes from forest resources (Vira and Kontoleon 2010). Some 80 percent of people living in developing countries depend on NTFPs for primary health and nutritional needs (Lebedys 2008). Exact figures vary, but some recent work on the extent of household income derived from forests or NTFPs is summarized in Table 8.1.

Additionally, NTFPs contribute significantly to generation of employment worldwide. FAO has estimated that NTFPs can generate 4 million man-years of employment annually (FAO 2002). In India, an estimated 100 million people – particularly tribal communities, landless laborers, and marginal farmers – derive 20-24 percent of their annual income from collection and marketing of NTFP/MFP (MoEF 2010). NTFPs provide direct income to the women in the family who spend significant time collecting and selling various NTFPs.

If properly managed, the NTFP sector could create millions of workdays annually in India. The NTFP sub-sector has a growing market, with Indian National Rupee (INR) 10 billion worth of current exports, out of which only about 25 percent now reaches NTFP collectors[3].

Socio-Cultural and Political Importance of NTFPs

NTFPs play a very significant role in developing political capital. A large number of indigenous people collect *tendu* leaves from forest areas in India. In the mid-1980s, annual production of *tendu* leaves was supposedly stable at around 300,000 metric tons (Gupta 1991). However, by the mid-2000s, *Tendu* plucking was providing 106 million person-days of employment in collecting activities, and 675 million person-days

Table 8.1: Evidence of NTFP-derived income (Strassburg 2012)

Source	Region	Percentage of Household income derived from forests
Bahuguna 2000	South Asia	48.7% of household income
Fisher 2004	Southern Africa	30% of household income
	China	1.7% of household income in commercial plantation system, 12.2% in subsistence system
Kamanga et al. 2009	Southern Africa	15% of total household income
Levang et al. 2005	South-east Asia	30% of total household income
Mamo et al. 2007	East Africa	39% of total household income
Shaanker and Ganeshaiah 2004	South Asia	16-59% of household income at three sites

in secondary processing (World Bank 2006). State governments of Madhya Pradesh, Chhattisgarh, and Odisha have nationalized *tendu* leaves with an intent to regulate prices and trade. MFP federations provide bonafide collectors incentives (bonuses and accident insurance). Periodic elections for three-tier cooperatives at village, district, and state levels are keenly contested by people with political ambitions.

CHARACTERISTICS OF NTFPS AND CHALLENGES IN MANAGEMENT

After introduction of scientific forestry in India during the 1860s, the focus of forest administration shifted toward management of timber products. NTFPs became a by-product of forests, and local communities were granted customary rights and privileges to collect those items.

Until independence, NTFPs were either harvested by contractors or agents appointed by princely estates, or by the British Government, or Zamindars (landlords). The sole objective of harvesting was to maximize revenue. After independence, the Zamindari system was abolished, and the "Nistari" system was introduced. In the Nistari system, community members could collect NTFPs free of cost, and timber and bamboo at concessional rates.

After the new forest policy of 1988, communities were involved in management of degraded forest patches under Joint Forest Management (JFM). JFM Committees (JFMC) were sanctioned to collect non-nationalized NTFPs from forest areas under their management. Restrictions on movement and sale of those NTFPs were abolished in many parts of the country. The contractor system was also abolished in the majority of states.

Characteristics of NTFP

NTFPs can be classified as Common Pool Resources (CPR), which are neither purely private nor purely public. Management of CPRs is a perpetual challenge because these are difficult to protect, and limitation on uses of these resources is difficult. Table 8.2 below lists property rights and user behaviors regarding NTFPs.

Although NTFPs are open access resources, informal institutions and in some cases, formal institutions, regulate collection and trading of these. NTFPs with cultural significance have attracted more attention from users than other NTFPs. For example, tribal communities in central India do not harm *mahua* trees, and at many locations, trees have been traditionally distributed among families to maintain equity in collection of flowers. Table 8.3 lists roles of institutions in enforcing property rights.

Table 8.2: Property rights and user behavior regarding NTFPs

Consumption pattern	Exclusion easy	Exclusion difficult
Rivalrous in consumption	Private goods	Common Pool Resources (CPR)
Non-rivalrous in consumption	Club goods	Public goods

Table 8.3: Roles of institution in enforcing property rights

Ownership	Strong institutions for enforcement of property rights	Weak institutions for enforcement of property rights
Specified individual owners	Private property	Common property
Not specified individual owners	Public property	Open access

Challenges in NTFP Management

Because NTFPs are open access resources, management of these has always challenged resource managers. Although JFMCs located near forest areas claim ownership of NTFPs, most lack understanding of sustainable management, conservation, and value addition, which results in resource degradation and depletion. The Forest Department, which claims custodianship of the forest, typically does not prioritize NTFPs.

A few inherent characteristics that complicate NTFP resource assessment are:

Scattered Availability: In forest, availability of NTFPs does not follow a consistent pattern, and thus conventional inventory designs do not lead to generation of reliable data.

Lack of Standard Methods for Resource Assessment: Timber production is calculated via measurements of bole, while harvest of NTFPs (different parts) allows no standard formula to measure production and productivity. Designing a sampling technique for NTFP assessment is difficult. It is always choices are difficult to choose between strip plots and square plots, and random sampling and stratified sampling.

Irregular Production: Every year is not a fruiting year for many NTFPs – resulting in years when production is very high and other years of very poor production. Yield of certain species depends on rainfall pattern, temperature, and humidity, which need continuous monitoring and tracking. A few of the NTFPs, thus must be monitored and tracked continuously. For example, few high-altitude herbs, follow a 3-year maturity cycle, while in central India, some herbs mature in 6 months, rendering the resource assessment process cumbersome.

Determining sustainable harvesting limits for NTFP products becomes difficult when all these factors are considered. Even when limits are defined, implementation remains a challenge because of lack of trained manpower and difficulties in monitoring the process.

FACTORS INFLUENCING SUSTAINABLE HARVESTING OF NTFPS

Different scholars, researchers, and publications suggest that sustainable harvesting of NTFPs closely links to multiple factors: ecological (changes in rainfall pattern, temperature, harvesting practices, and regeneration); economic (wages paid to collectors, revenue generation by Forest Department, maximization

of profit by contractors, increase in demand by industries); social and institutional (NTFP as a CPR, elite capture, de-prioritization in favor of timber); and policy and regulatory frameworks (focus of management and working plans, fund allocation for research and development, capacity building of community and frontline staff of forest departments, overgrazing). Table 8.4 categorizes these issues.

To develop sustainable harvesting techniques that communities, the Forest Department, laborers, and contractors easily could adopt, consideration of the above-cited factors is essential.

Table 8.4: Categorization of factors that affect sustainability

Category	Issues
Ecological Factors	■ Natural rates of regeneration ■ Dispersal of seeds ■ Pollinator population ■ Rotation period of trees ■ Grazing by wildlife ■ Climate fluctuations ■ Disease and pest attack ■ Changes in population density of NTFP species
Economic Factors	■ Tendency to maximize short-term profit without regulation ■ Increase in demand by industries/exporters
Social and institutional factors	■ NTFPs considered as CPR ■ Premature harvest ■ Destructive harvesting methods used to collect bark, leaves, gum, and resin. ■ Collection rights claimed by all, conservation by none ■ Elite capture ■ Wage payments to collectors inconsistent ■ Level of indebtedness among collectors
Policy and Regulatory framework	■ Inadequate inventory of NTFP ■ Absence of mechanism to regularly monitor harvesting of high-value NTFPs by contractors ■ Over harvesting due to contractors hiring people with little stake in sustainable harvest ■ Focus of management (working) plan on timber ■ Lack of fund allocation for research and development, capacity building of community and frontline staff of Forest Department ■ Overgrazing by domestic cattle ■ No involvement of community in monitoring extraction of high-value NTFPs

Ecological Sustainability

One of the important steps is to define "sustainable harvesting," from an operational or management perspective, a sustainable system for harvesting non-timber forest resources is one of the ongoing harvest of fruits, nuts, latexes, and other products from a limited area of forest with negligible impacts on structure and dynamics of exploited plant populations (Peters 1995).

Alternatively, sustainable harvest means, "the level of harvest at which a species can maintain its population at natural or near-natural levels and the harvest will not change the species composition of the community" (Chauhan n.d.).

Economic Sustainability

Economic sustainability can be analyzed in two ways:

1. Determine household cash incomes from sale of NTFPs in local currency or in United States dollars (USD), and compare that income with the international poverty line.
2. Compare an alternative wage rate with income from collection of NTFPs in either of the following ways:
   - Compare daily returns Y for a single collector to the well-known international absolute poverty line of USD 2/per day/per person (Purchasing Power Parity [PPP]) (World Bank 2011).
   - Per person daily NTFP income USD PPP> USD 2 PPP day/per capita.
   - Conduct a national comparison: A "time opportunity cost" should be met (i.e., daily return Y to the household should match a possible alternative wage from other paid labor opportunities, converted to local currency at a current rate).
   - Per person daily NTFP income > Minimum wage paid by state government to skilled (or non-skilled) laborer.

As per government rules, the eligible age of a person for wage labor should be 18 years or above. Collection of NTFPs is often part of a diversified household strategy of labor use, and income flow is often regarded from the perspective of sustainability. Therefore, it is difficult to disaggregate income of children and aged persons who are key collectors of NTFPs. Calculation could occur by factoring either total household income or minimum resources required to earn minimum daily wage.

Social and Institutional Sustainability

An institution should be deemed sustainable if it has the strength to survive, develop, and fulfill its functions permanently with decreasing levels of external support (NORAD 2011). In NTFP management, if an institution can design and implement an NTFP management plan on its own and fund itself from its own revenues, it could be regarded as a sustainable institution.

Policy and Regulatory Framework

Multiple policies, regulations, and acts govern NTFPs, leading to ambiguity and lack of accountability and responsibility. For example, in Shivamogga landscape, NTFP harvesting rights are granted directly to private contractors, which is not consistent with the National Forest Policy, 1988. Similarly, in Hoshangabad landscape, JFMCs have been ignored in decision-making related to NTFP

harvesting, value addition, and marketing – in contradiction to JFM policy. In Himachal Pradesh, the Forest Department has failed to track harvesting and movement of NTFPs in the State because of frequent changes in policies and regulations. People engaged in unlawful trade of NTFPs generally exploit loopholes in the existing regulatory framework, and this negatively affects execution of sustainable practices.

It is necessary to develop an NTFP policy and regulatory framework consistent with the Indian constitution and existing laws and acts, and which fixes accountability. This policy and framework should be time-specific, and should advocate equitable distribution of costs and benefits among users. A provision for periodic review of managers through stakeholder consultation must be included. The framework should conform to internationally agreed treaties and protocols.

SUSTAINABLE HARVESTING OF NTFP

Because NTFPs contribute significantly to incomes of forest-dependent communities, serious concern has been raised regarding sustainability of harvesting practices (Marshall and Newton 2003; Stoian 2005; Belcher 2005; Fisher *et al.* 2008). Sustainable NTFP harvesting may offer only limited possibility of lifting forest dwellers out of poverty where (1) local rights to resources are weak or informal; (2) institutional, capital, and technological barriers to effective marketing are in place; (3) value chains are skewed; and (4) niche markets are uncertain (Belcher 2005; Belcher and Schreckenberg 2007).

These same factors can also contribute to NTFP overharvest in environments where harvesters do not enjoy a secure stake in ongoing management of resources (Belcher 2005). Sustainable harvesting of NTFPs therefore must be founded on understanding of NTFP value chains (Belcher and Schreckenberg 2007; Stoian 2005) and the place of NTFPs in livelihoods and landscape use (Laird *et al.* 2010).

Sustainability of NTFPs depends on products extracted, and characteristics of species and the forest. Developing sustainability criteria for flowers, fruits, seeds, and leaves is easier than for bark, resin, rhizomes, or the whole plant. NTFP species with fast growth rates and large populations are more able to withstand repeated harvest than those with smaller growth rates and populations. NTFP species that depend on generalist species or abiotic mechanisms for pollination and/dispersal are also more resilient to repeated harvest. NTFPs involving harvesting of whole plants or harvesting from restricted habitats, low adult population densities or growth rates, or specialist biotic relationships generally have low potential for sustainable harvest.

Harvesting Protocol Development Process

As per Lund (1997, 1998), four types of broad studies are required as bases for formulating protocols that would ensure sustainable development of NTFPs: biodiversity inventories (list of species), cultural studies, user markets, and resource inventories. In simple terms, the following steps should be followed to develop sustainable harvesting protocols:

- Selection of specific site
- Inventory of forest resources

- Selection of economically important NTFPs
- Experimentation for determination of sustainable limits
- Development of harvesting design, and determination of impact on species phenology and regeneration
- Determination of species-specific, sustainable harvest limits
- Development of model for sustainable management of NTFPs via community participation.

These steps are shown on Figure 8.1 below.

Each step is explained in detail as follows:

Inventory of NTFP Resource

Because of high diversity of product and life forms of NTFP species, assessment is complex and requires special considerations in designing site and product-specific methods. Only limited information is available at the species level for most commercial NTFPs, and even more limited knowledge at the ecosystem level. There is available. Therefore, knowledge regarding harvesting, assessment, and management of NTFPs fragmented across organizations and people must be accessed and applied.

The following information can be helpful in an NTFP inventory:

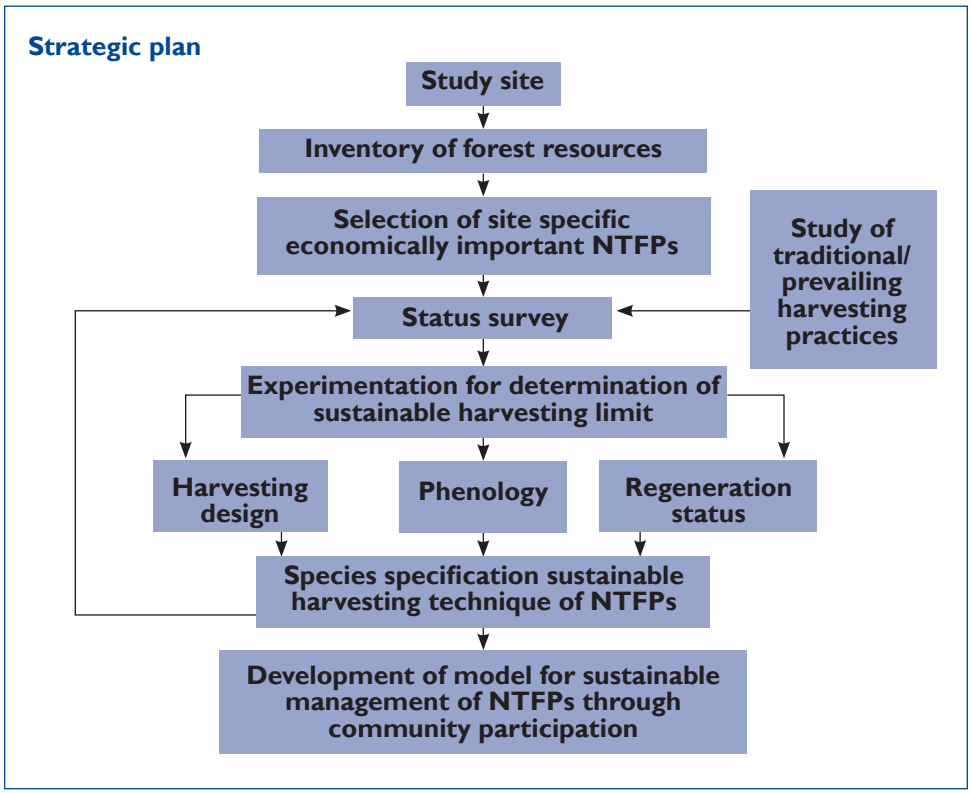


Figure 8.1: Process of Harvesting Protocol Development (State Forest Research Institute n.d.)

- Detailed list of NTFPs
- Botanical categorization of NTFPs
- Age class categorization of NTFPs
- Categorization of plants by productivity
- Commercial uses and viabilities of plants
- Products for household use
- Products collected for both commercial and household purposes
- Change in product availability over time
- Extinct, vulnerable, and threatened species
- Species that need special attention.

The service of a field botanists or taxonomists should serve in or aid these inventories.

Measuring Biophysical and Biodiversity Information for NTFP Species

To measure biophysical and biodiversity information, the quadrant method may be applied, as suggested by the Working Plan Code 2014 of the Ministry of Environment, Forest and Climate Change (MoEFCC)[4].

Yield and Regeneration Analysis

In this step, a community/planner is required to assess productivity of NTFP plants. Assessment of regeneration capacity of these plants also should occur. Some helpful questions are:

- How many trees of a species are in the forest patch? How many of them are small, medium, large, old, and in fruiting stage?
- How many young saplings (recruits) and established saplings?
- What is rate of replacement of mature plants by new saplings?

Are any plants producing seeds during rainy season, and if germination occurs during rains, what is the survival rate? Tools and methodology for yield and regeneration study:

Transect walks and the quadrat method are employed to determine regeneration status of species. During the transect walk, the NTFP collection area will be identified for layout of quadrats. Quadrats of 31.62 X 31.62 meters (m) (0.1 hectare [ha]) can be laid out as per the guidelines in Working Plan Code 2014. Nested quadrates of size 3m X 3m and 1m X 1m should be laid out in all four directions, at 30 meters from the center of the central plot, along diagonals, nested quadrats of size 3 X 3 m for enumeration of shrubs should be laid out within a non-hilly area, and nested quadrats of size 1 X 1 m for enumeration of herbs/grasses should be laid out along trails in a hilly area. Plot structure is shown on Figure 8.2.

Forest Patch and Economically Important NTFPs

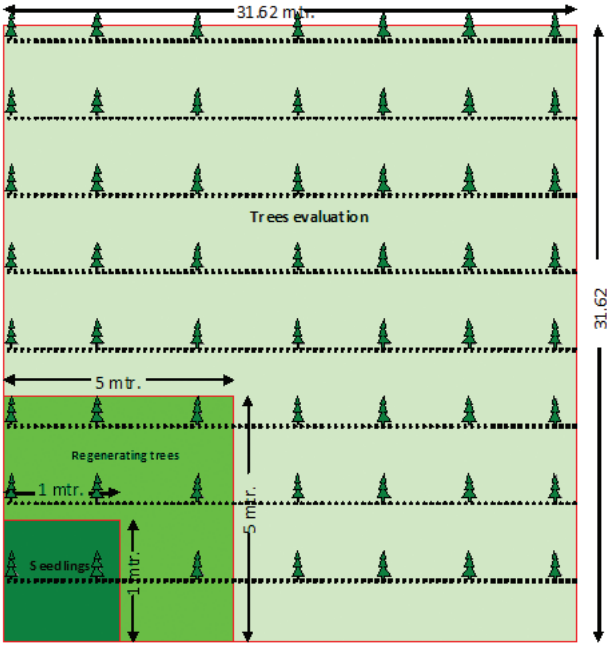


Figure 8.2: Plot structure

Selection of a forest patch requires assessment of the level of dependency of a village community on forest resources, especially NTFPs. A technique based on proximity, household involvement, market value, and volume collected can be applied to aggregate a score. Indicative weights are provided for illustration in Table 8.5 below.

The village ranking is calculated by use of the following equation:

Village Score = 0.2 * PROXIMITY + 0.15 * HOUSEHOLD_INVOVEMENT + 0.15 * NTFP_DEPENDENCE + 0.1 * MARKET_VALUE + 0.1 * LOCAL_SUPPORT + 0.1 * CONSENSUS + 0.1 * RESPONSIBILITIESRESPONSIBOLITIES + 0.1 * AVAILABILITY

Although preparing an inventory of all NTFPs available in the forest patch would be tedious and time-consuming, a practical approach is to conduct transect walks of distances that NTFP collectors generally cover. NTFP collectors

Table 8.5: Process for selecting a village

Indicator	% weightage	Scoring Criteria
Village proximity to large blocks of forest with high volumes of NTFPs (PROXIMITY)	20%	1, if forest is more than 5 kilometers (km) away from the village 2, if forest is less than 5 km away from the village
Involvement of a significantly large proportion of village households in NTFP collection (HOUSEHOLD_INVOLVEMENT)	15%	1, if less than 30% of households in the village are involved in NTFP collection 2, if more than 30% of households in the village are involved in NTFP collection
High dependence of the community on NTFP collection (high overall ratio of income from NTFP collection to total household income) (NTFP_DEPENDENCE)	15%	1, if NTFP contribution to household income is less than 30% 2, if NTFP contribution to household income is more than 30%
Estimated market value of NTFP traded from the village (MARKET_VALUE)	10%	1, if Market Value of NTFP from village is less than INR 50,000 2, if Market Value of NTFP from village is more than INR 50,000
Apparent local support for collaborative work by different sections of the village community on NTFP conservation and development (LOCAL_SUPPORT)	10%	1, if locals are interested 0, if locals are not interested

Indicator	% weightage	Scoring Criteria
Consensus among the village community, Forest Department and local institutions (Panchayati Raj Institution [PRI], JFMC, etc.) that planned activities serve the needs, interests, and preferences of local people and are welcome in the village (CONSENSUS)	10%	1, if there is a consensus 0, if there is no consensus
A willingness to accept responsibilities and contribute to project activities (RESPONSIBILITIES)	10%	1, if there is a willingness 0, if there is no willingness
Reasonable (throughout the year) with little or no recurrent migration of families (AVAILABILITY)	10%	2, if NTFP is available for more than 6 months of the year 1 if NTFP is available for less than 6 months of the year

define this boundary (locus of points at ends of transect walks) either as their access area or risk-free area (if wildlife is present), and have a fair idea of presence of species. The history of the forest compartment provides a historical overview of presence or availability of NTFP species.

Tools and Methodology for Identifying Economically Important NTFPs

- Resource mapping through Participatory Rural Appraisal (PRA) exercise
- Interview with key informants to determine general status of NTFPs in the forest
- Wealth ranking to determine relative economic status of collectors, vulnerable groups
- Household survey to determine total collection of NTFP, identification of commercially important NTFPs
- Demand in local market (volume)
- Prices offered by buyer.

An economically important NTFP is abundantly available in the forest patch, harvested by a number of community members, and extracted in large quantity during the season; it also generates income flowing into total incomes of households and takes up significant market share. Table 8.6 lists factors and provides weightage for the quantification that was developed for identifying applied quantitatively to identify commercially important NTFPs in the Hoshangabad landscape of Forest-PLUS.

ASSESSMENT OF HARVEST IMPACTS

Recognizing impacts of harvesting of NTFPs on the forest ecosystem, whether positive

Table 8.6: Identification of commercially important NTFPs

Indicator	Weightage
Volume of NTFP in the cluster	25%
Community dependency on NTFP (share of household income from NTFP)	25%
Market demand for the NTFP & availability of local/ regional markets	25%
Commercial value of the NTFP	15%
Value addition possibilities at the local level	5%

*NTFP Ranking = 0.25 *VOLUME +0.25* DEPENDENCE +0.25* MARKET_DEMAND +0.15* COMMERCIAL_VALUE +0.05* GROUP_INVOLVEMENT +0.05*VALUE_ADDITION*

or negative, is important. For example, bush cutting activity in *tendu* plant in central India is considered a positive action, because it helps in production and quality improvement of leaves. Moreover, collection of *tendu* leaves does not negatively affect the forest. Similarly, harvesting of leaves of cinnamon in Western Ghats exerts no negative impact. Regarding bamboo, if mature bamboo is not harvested within 3-4 years, quality of produce may deteriorate. Dried bamboo also spreads forest fire. Removing immature bamboo negatively affects growth of bamboo and forest quality.

Tapping of resin from trees is considered a harmless activity, if cambium of the tree is not disturbed and blazes undergo proper treatment. Trees should be mature and have adequate girth. However, if resin tapping proceeds by application of an unscientific technique, it will damage trees and decrease their vigor. For example, if selection of *Ailanthus malabarica* trees occurs improperly and blazes are not treated well, the tree will die within 2-3 years due to rotting or insect attack.

Similarly, collection of medicinal herbs requires knowledge about flowering, fruiting, seed maturity, seed shedding, and germination timings. Collectors must know which parts of the plant are required for medicinal purpose, and how to collect those one or more parts without damaging the entire plant or its habitat. For example, the usable part of *Picrorhiza kurroa* is its lateral rhizomes (which mature within a 3-year period), but ignorant collectors uproot the whole plant and disturb its habitat.

Key Questions:

- What is the impact of collection of a specific plant species?
- What is the impact on the forest and environment from collection of the species?
- Does any wild animal/bird use the plant?
- Has human-wildlife conflict increased in the region?
- Has incidence of crop raiding by wild animals increased?

EXAMPLE 1: Harvesting level experiment for resin of Ailanthus triphysa And Cinnamon in Shivamogga Forest-PLUS landscape

A harvest experiment involving the resin of *Ailanthus triphysa* occurred in samplings of 34 trees of different girths. Each tree was marked by paint and numbered. Of the 34 trees sampled, only 35 percent (12) were tapped for resin. Depth of debarking in tapped trees was found to be a more serious threat to the adult plant than other parameters such as height and width of debarking. Trees of average height exceeding 10 m and girth between 65 and > 100 centimeters (cm) were considered for tapping in the area. Depth of incision beyond 4 cm resulted in death of the tree or drying of the main bole in due course of time (See Figure 8.3 below). The practice of tapping with deep incision of more than 3.8 to 4 cm resulted in damage to the xylem and eventual death of the plant. Therefore, bark incision in the range of 1 to 3 cm is the best harvesting practice for tapping *Ailanthus triphysa* resin.

Similarly, sustainable harvesting protocols were developed for cinnamon leaves. The following guidelines were developed as a result of that study:

- Assess resources before collecting leaf: because leaves are collected from the tree, damage to tree can be significant. To avoid damage, it is essential to know resource availability, or quantity of leaves available from a tree.
- Select mature trees for collection (approximately 8-10 years old). Begin collection of leaves when tree attains height of at least 5 to 6 feet (ft) (4 to 5 years) by trimming the small twigs,

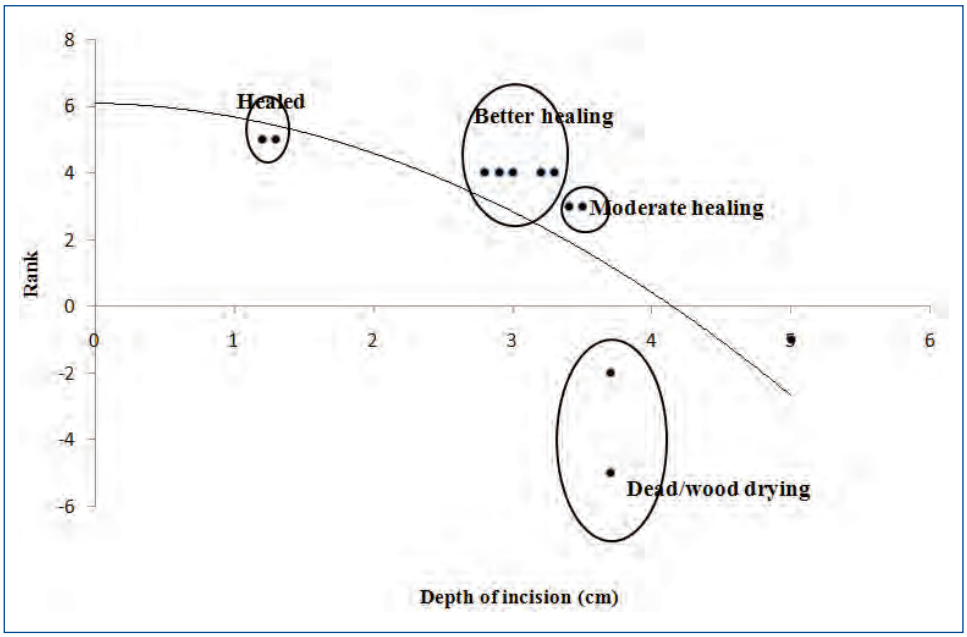


Figure 8.3: Association between intensity of tapping and damages caused to the plant

which will help maintain the height of the tree with more branches. More intense collection can begin by cutting the small branches after the tree is 8-10 years old.

- Collect every year from vigorous (healthy and growing) trees, and in alternate years from old and weak ones (Plate 8.1). Complete lopping of big branches every year damages the tree.
- Perform selective harvest by cutting small branches (twigs): Cut branches less than thickness of a thumb; 80 to 90 percent of leaves can be collected without cutting and damaging big branches. Do not allow branches to grow very tall.
- Mother trees should be maintained for reproduction at the ratio of 1:20: Trees subject to regular harvest do not produce seed. To overcome this problem, it is crucial not to collect leaves from some trees – leave one out of 20 trees uncollected for seed production (the mother tree).
- Collect leaves from February to March (before flowering /during budding): Timely collection of leaves is important because early or late collection may result in poor quality of leaves or essential oil.

The proposed scientific method should be compared with the indigenous approaches. Table 8.7 compares proposed "scientific methods" of collection with indigenous method.

Example 2: proposed technique for Sustainable Harvesting of Resin

Rill method (Fish bone) – Cut 2-inch-wide channels in fish bone shape of 1.5 to 2 ft length at height of 2.5 ft from ground level. Fix a small vessel to collect resin at the base of the channel (Plate 8.2 below). Collection season is from November to May.

Plate 8.1: *Young vigorous tree (at left) versus old Cinnamon tree (at right)*

Table 8.7: Comparison of proposed techniques with traditional method

Harvest/ collection method	Method 1 – Matured trees of Diameter at Breast Height (DBH) of 90 cm and above should be tapped. Tapping should start from 3 ft from ground level. During the first year 0.5 ft breadth by 1 foot length should be tapped by use of an axe to 1-inch depth. During next 2 years, only length should be increased (by 3 ft). After 3 years of tapping on the same side, next year tapping should occur on the opposite side of the tree, so that bark rejuvenates. (This method of extraction prescribed in Tender cum auction process.) Method 2 – Rill method (Fish bone): This simple and safe technique of tapping applies ethephon to enhance gum yield and wound healing. After 45 days of tapping, thick wound tissue develops at the injured region, and the wound heals completely within 60-70 days after tapping. Collection season is between November and May.	Collect resin by tapping from well matured tree (nearly 4 ft girth). Tapping occurs within < 0.5 ft width; length can be increased to 3 to 4 ft height from 2.5 ft above ground by use of an axe. Collection season is between November and May.

Plate 8.2: *Improved method of tapping and collection of resin*

DEVELOPMENT OF MODELS FOR SUSTAINABLE MANAGEMENT OF NTFP THROUGH COMMUNITY PARTICIPATION

Because NTFP management encompasses ecological, economic, socio-political, and legal aspects, all of these must be properly assessed before and while developing a management plan. The United Nations Convention of Biological Diversity (CBD) (CBD 2000) provides a framework to maximize output of some desirable products or services via consideration of different social, economic, and environmental contexts, termed the "Ecosystem Approach." The primary objective is to manage resources in a manner minimizing ecological destruction and maintaining economic stability in a forest-dependent community. A systematic framework is shown on Figure 8.4 below.

Ecological, Economic, Socio-Cultural, Situational Analysis

Situational analysis of all factors must occur – ecological, economic, social, cultural, and the legal and policy framework. Determination of ecological condition requires data on availability of NTFPs in the project area; regeneration status, yield, and productivity of those NTFPs; presence of associated species; and dependency level of wild animals and birds on those NTFPs. Economic analysis will indicate how many persons and families depend directly on NTFPs; who are engaged in collection, processing, and

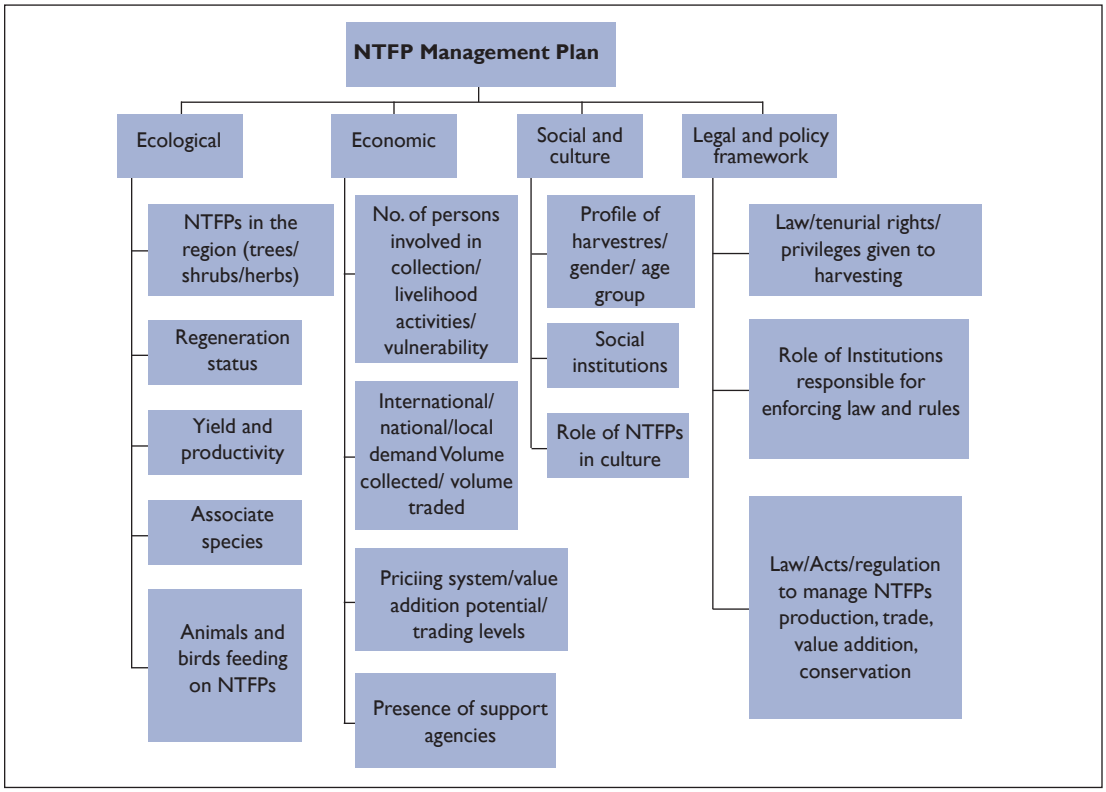


Figure 8.4: Designing model for sustainable management of NTFP

marketing; quantity removed for commercial and subsistence purposes; factors directly and indirectly responsible for pricing; and agencies that support different activities in the value chain. Social and cultural analysis covers the profile of harvesters, including genders and age groups of collectors, and social institutions that control usage, harvesting, and marketing of NTFPs.

Tools and Methodologies for Data Acquisition

Both qualitative and quantitative methodologies are needed to acquire information from the field. Because NTFPs are not evenly dispersed within forest areas, and all community members may not be involved in collection, it is difficult to identify sample plots, villages, and community members through random sampling. Various researches have revealed that community members generally collect commercially important NTFP within a radius of 2-5 km from their villages. High-value NTFPs, which include endangered or /threatened medicinal herbs, are generally collected by a few community members from core forest patches or inaccessible areas. Thus, before embarking on a full-fledged survey of NTFPs, the first step should be a discussion with the community to determine where people go to collect NTFPs, which areas host more NTFPs, and which are restricted areas. This step can occur by setting up a meeting of key informants of villages in a / group of villages. With the help of a forest map (sourced from Forest Department), villages can be identified where people undertake NTFP collection.

Participatory resource assessments often include:

- Transect walk to assess general presence of NTFPs
- Natural resource mapping
- Identification of forest patches hosting NTFPs.

For detailed explanation of the process, see Annexures 8.1, 8.2, 8.3, and 8.4.

Community Participation in Development of Sustainable Harvesting Techniques

Involvement of forest-dependent community is key to success of sustainable harvesting protocols. During socio-cultural and institutional analysis, a number of factors will emerge that exert both positive and negative impacts on harvesting of NTFPs. For example, if an NTFP is culturally important for a community, conservation of it is of great significance. On the other hand, in Shivamogga, soap-nut does not have much cultural importance, and the population thus is not concerned much with its conservation.

Again, community involvement is required for development and implementation of sustainable harvesting techniques. Community participation increases if NTFP potentially can generate a significant income either through trading or value addition – as demonstrated within the Forest-PLUS landscape in Hoshangabad in the case of the *mahua* flower. *Ex-situ* conservation is also an important factor in sustainability of interventions – as demonstrated in Rampur and Hoshangabad landscapes of Forest-PLUS. Motivating communities to adopt alternate, intensive livelihoods for which barriers to adoption are low is an alternative to searching for NTFPs in eco-fragile zones and wildlife areas – as demonstrated in Rampur landscape

by promotion of button mushroom cultivation. Additionally, technologies helpful in reducing a community's time for collection of fodder and fuelwood also provide an enabling environment for enterprise promotion. Solar water heaters and fuel saving driers have been accepted by communities in Forest-PLUS landscapes and adopted in practice. Cooperation with government departments in development of other livelihoods such as agriculture and horticulture production are helpful in reducing community dependency on forest resources.

CONCLUSION

NTFPs play an important role in the forest ecosystem and in the lives of forest-dependent communities. Development of techniques for sustainable harvesting of NTFPs is a perpetual challenge because of need to analyze all factors related to ecology, economy, socio-cultural structure, legal structure, and policy-making. Lack of resource inventories renders the task of developing sustainable harvesting techniques more time-consuming and expensive. This document has suggested simple processes and methodologies to develop sustainable harvest protocols for commercially important NTFPs. These techniques have been tested in the Forest-PLUS landscapes and are viable. Community involvement is necessary for development and implementation of these techniques. Based on experience, community participation increases if NTFP potentially can generate significant income either through trading or value addition. *Ex-situ* conservation is also an important factor in sustainability of interventions. Linkages of community members with alternate livelihoods and technologies that save fuelwood are required for both successful intervention and alteration in collection of NTFPs.

REFERENCES

Bahuguna, V. K. 2000. "Forests in the Economy of the Rural Poor: An Estimation of the Dependency Level." *AMBIO: A Journal of the Human Environment* 29 (3): 126-129.

Belcher, B. M. 2005. "Forest Product Markets, Forests and Poverty Reduction." *International Forestry Review* 7 (2): 82-89.

Belcher, B. and K. Schreckenberg. 2007. "Commercialisation of Non-Timber Forest Products: A Reality Check." *Development Policy Review* 25 (3): 355-377.

Cavendish, W. 2000. "Empirical Regularities in the Poverty-Environment Relationship of Rural Households: Evidence from Zimbabwe." *World Development* 28 (11): 1979-2003.

CBD. 2000. "Decision V/6 Ecosystem Approach." *Decision adopted by the Conference of Parties to the Convention on Biological Diversity at its fifth meeting*, Nairobi, Kenya. Montreal, Canada: Secretariat of the Convention on Biological Diversity.

Chauhan, B. S. n.d. *Environmental Studies*. New Delhi: Laxmi Publications.

Eliasch, J. 2008. *Climate Change: Financial Global Forests*, The Eliasch Review. UK: Office of Climate Change.

FAO. 2002. "Independent External Evaluation of the Special Programme for Food Security (SPFS)." In *Committee on Agriculture 87th* Session, May 2002. Rome, Italy: Food and Agricultural Organization of the United Nations.

FAO. 1999. *State of the World's Forests*. Rome, Italy: Food and Agricultural Organization of the United Nations.

Fisher, M. 2004. "Household Welfare and Forest Dependence in Southern Malawi." *Environment and Development Economics* 9 (2): 135-154.

Fisher, B., K. Turner, M. Zylstra, R. Brouwer, R. de Groot, S. Farber, P. Ferraro, R. Green, D. Hadley, J. Harlow, P. Jefferiss, C. Kirkby, P. Morling, R. Naidoo, J. Paavola, B. Strassburg, D. Yu, and A. Balmford. 2008. "Ecosystem services and economic theory: integration for policy-relevant research." *Ecological Applications (Ecological Society of America)* 18 (8): 2050-2067.

Gupta, B. N. 1991. "State of non-wood forest products in India." Paper presented at the *Regional Expert Consultation on Non-Wood Forest Products* at FAO Regional Office for Asia & Pacific, Bangkok, November 5-8, 1991. Bangkok: Food and Agricultural Organization of the United Nations.

Kamanga, Penjani, Pal Vedeld and Espen Sjaastad. 2009. "Forest Incomes and Rural Livelihoods in Chiradzulu District Malawi." *Ecological Economics* 68 (3): 613-624.

Laird, S. A., V. Ingram, A. Awono, T. C. H. Sunderland, O. Ndoye, E. L. Fotabong and R. Nkuinkeu. 2010. "Bringing Together Customary and Statutory Systems: The Struggle to Develop a Legal and Policy Framework for NTFPs in Cameroon." In *Wild Product Governance: finding policies that work for non-timber forest products*, edited by Laird, S.A., R. McLain, and R.P. Wynberg. London: Earthscan.

Lebedys, A. 2008. *Contribution of the Forestry Sector to the National Economies, 1990-2006*, Working Paper FSFM/ACC/08. Rome, Italy: Food and Agricultural Organization of the United Nations.

Levang, Patrice, E. Dounias, and S. Sitor. 2005. "Out of the forest, out of poverty." *Forest, Trees and Livelihood* 15: 211-235.

Lund, H. G. 1997. "My Gall Bladder, A Sow's Ears and My Tie: The Non-wood Forest Resources Inventory Connection Mystery." www.home.att.net/~gklund/lundpub.htm.

Lund, H. G. 1998. "The Non-wood Forest Resources Inventory Connection Mystery." In *Sustainable Development of Non-wood Goods and Benefits from Boreal and Cold Temperate Forests*, edited by Lund, H.G., B. Pajari, and M. Korhonen, 29-45. Joensuu, Finland: European Forest Institute.

Mamo, G., E. Sjaastad and P. Vedeld. 2007. "Economic dependence on forest resources: A case from Dendi District, Ethiopia." *Forest Policy and Economics* 9 (8): 916-927.

Marshall, E. and A. C. Newton. 2003. "Non-timber forest products in the community of El Terrero, Sierra de Manantlán Biosphere Reserve, Mexico: Is their use sustainable?" *Economic Botany* 57 (2): 262-278.

MEA. 2005. *Ecosystems and Human Well-being Synthesis*. Washigton DC: Island Press.

MoEF. 2010. *Report of the National Committee on Forest Rights Act*. Report submitted by N C Saxena to Shri Kantilal Bhuria, Union Minister of tribal affairs. Ministry of Environment and Forests, and Ministry of Tribal Affairs, Government of India, New Delhi.

NORAD. 2011. *Real-time Evaluation of Norway's International Climate and Forest Initiative, Contributions to a Global REDD+ Regime*. Oslo, Norway: Norwegian Agency for Development Cooperation.

Peter, C. M. 1995. "Observations on the Sustainable Exploitation of Non-Timber Tropical Forest Products, An Ecologist's Perspective." *Current Issues in Non Timber Forest Products Research*, Centre for International Forestry Research: 19-39.

Shaanker, U. R. and K. N. Ganeshaiah. 2004. "Livelihood Gains and Ecological Costs of Non-timber Forest Product Dependence: Assessing the Roles of Dependence, Ecological Knowledge and Market Structure in Three Contrasting Human and Ecological Settings in South India." *Environmental Conservation* 31 (3): 242-253.

Stoian, D. 2005. "Making the Best of Two Worlds: Rural and Peri-Urban Livelihood Options Sustained by Nontimber Forest Products from the Bolivian Amazon." *World Development* 33 (9): 1473-1490.

Strassburg, B., B. Vira, S. Mahanty, S. Mansourian, A. Martin, Adrian, N. M. Dawson, N. Gross-Camp, A. Latawiec and L. Swainson. 2012. "Social and economic considerations relevant to REDD+." In *Understanding relationships between biodiversity, carbon forests and people: The key to achieving REDD+ objectives*, edited by J. A. Parotta, C. Wildburger and S. Mansourian, 83-115. Vienna, Austria: International Union of Forest Research Organizations.

Viet Quang, D. and T. Anh. 2006. "Commercial Collection of NTFPs and Households Living in or near the Forests: Case study in Que, Con Cuong and Ma, Tuong Duong, Nghe An, Vietnam." *Ecological Economics* 60 (1): 65-74.

Vira, B. and A. Kontoleon. "Dependence of the poor on biodiversity: which poor, what biodiversity?" In *Linking Biodiversity Conservation and Poverty Reduction: A state of Knowledge Review*, Montreal Technical Series 55, edited by Dilys, R. Montreal, Canada: Secretariat of the Convention on Biological Diversity.

Wickens, G. E. 1991. "Management Issues for Development of Non-Timber Forest Products." *Unasylva* 42 (165): 3-8.

World Bank. 2006. *Where is the wealth of nations? Measuring Capital for the 21st Century*. Washington, DC: The World Bank.

World Bank. 2011. *The changing wealth of nations. Measuring sustainable development in the new millennium*. Washington, DC: The World Bank.

FURTHER READING

Belcher, B., M. Ruiz Perez, and R. Achdiawan. 2005. "Global patterns and trends in the use and management of commercial NTFPs: Implications for livelihoods and conservation." *World Development* 33 (9): 1435-1452.

Bharucha, E. 2005. *Textbook for Environmental Studies for Undergraduate Courses*, University Grants Commission. Hyderabad, India: Universities Press (Private) Limited.

FRI. 2014. *National Working Plan Code - 2014 (For Sustainable Management of Forests and Biodiversity in India).* Dehradun: Forest Research Institute, Ministry of Enviornment, Forest and Climate Change, Government of India.

Kuma, M. and S. Simon. 2015. "Floristic Composition, Vegetation Structure, and Regeneration Status of Woody Plant Species of Oda Forest of Humbo Carbon Project, Wolaita, Ethiopia." *Journal of Botany* 2015, Article ID 963816.

MoEF. n.d. *National Forest Policy, 1988*. New Delhi: Ministry of Environment and Forests (Department of Environment, Forests & Wildlife), Government of India. http://envfor.nic.in/legis/forest/forest1.html.

SECTION III
ECONOMIC PERSPECTIVE

The economic value of forests affects management goals. It is important to understand that value and how REDD+ may affect it. This section has two chapters. The first chapter in the section (Chapter 9) discusses basic concepts and principles of economic valuation and provides an overview of tools, techniques, and methods for valuation of forest ecosystem services, especially in the Indian context. The second chapter (Chapter 10) examines the experience with Clean Development Mechanism (CDM) in the Indian forestry sector through the example of one CDM project.

Chapter 9: Valuing Forest Ecosystem Services

Purnamita Dasgupta

From the Korku people: **"We plant trees for our children in the memory of our elders who planted for us"**[1]

Musings…

- The statement exhibits strong cultural ties with trees
- A high value cultural ecosystem service
- It is possible to compute some costs (losses) from a proposed intervention to cut a tree
- Monetization of the complete value of the cultural service is impossible

Question: Is there a need to capture the exact or complete monetized value in this case?

Answer: In almost all foreseeable instances, the answer would be - No.

Question: Should the benefits or avoided costs that can be monetized be calculated?

Answer: In almost all foreseeable instances the answer would be - Yes.

Question: Can valuation of the opportunity cost in terms of a trade-off where it exists, help design an incentive for preserving the tree?

Answer: Most probably, yes. A value is derivable for compensating those who face the trade-off arising from the choice to preserve the tree.

Decision: Would include consideration of the derived monetary value, while prioritizing several other concerns also such as context, scale of proposed intervention, time frame of intervention, and differential impacts on all stakeholders concerned.

Introduction to Economic Valuation: Key Concepts and Terms; Brief Historical Overview

An understanding of the nature of services provided by forest ecosystems has developed over the decades. Two developments were particularly significant. One is the recognition that most ecosystem services are not traded in the market and carry no price tags to make

the society vigilant to changes in their supply or in the condition of the ecosystems that generate them (MEA 2005). This can be true even when the concerned ecosystem service may have a significant economic value - markets can simply fail to capture the full or true values. Characteristics of public goods[2], externalities, information asymmetries, and inappropriate or insecure property rights structures are among the most common reasons that market prices fail to reflect the true value of forest ecosystem services. Another important development came from empirical studies which observed that the link between the regulating[3] services provided by a forest ecosystem and human well-being is not normally perceived by the users, unless specific awareness campaigns have been launched, or until specific groups of people or species are directly impacted by the loss of these services.

Both these realizations motivated research on the development of special methods to find the "value" of environmental goods and services not captured in markets. While much progress has been made, the efforts are ongoing, with new challenges being posed and new ecosystem services being added to the list. As these methods are under development, it is helpful to explore the fundamentals of economic valuation and understand what we know so far. At its heart, economic analysis seeks to determine the marginal (incremental) value of a change in the stock of the asset (forest in this case). The way in which this has been operationalized is to value changes in individual components of the forest. These components are typically divided into different classes of ecosystem services and aggregated to derive a sum total value. This total is deemed to reflect the value of the change in the forest stock. This has also been referred to in the literature as the "total economic value approach": to list the individual services from the forests, value these and aggregate them. In listing the values, various alternative classifications have been made in terms of direct and indirect values[4] and use and non-use values[5]. Also, there are different methods used to value individual services - whether stated preference or revealed preference. Given the complexities of a forest ecosystem, valuation of forest ecosystem services involves a mix of various types of values and methods, using both stated preference and revealed preference.

It is important to note that substantial advances have been made since the total economic value approach was initially adopted. Methodological developments have led to sophisticated approaches which explicitly include a time dimension, multi-metric, and non-probabilistic techniques. Although not used much to date, more complex valuation exercises are being taken up with innovative combinations of tools from other disciplines such as Geographical Information Systems (GIS), biophysical tools to capture spatial variations, and adoption of a landscape approach to economic valuation. For instance, addressing climate change in the context of the contributions that forests can make in mitigating it, as well as in terms of the adverse impacts it may have on certain sites and communities, requires new ways of strengthening time and uncertainty dimensions in economic valuation exercises. Multi-metric evaluations and non-probabilistic methodologies along with other tools are being increasingly focused on and debated. Non-market values, inequities, behavioral biases, and ancillary costs and benefits of response options have to now be increasingly considered in economic valuation exercises (Chambwera *et al.* 2014).

Economic valuation of changes occurring in the forestry sector is increasingly applied for policy purposes, particularly since the second half of the twentieth century. For instance, the Reducing Emissions from Deforestation and Forest Degradation (REDD+) framework is a climate mitigation activity with economic dimensions that deserve evaluation.

Keeping in mind that economic valuation of forests is a field in active development and growth, this chapter provides an overview of some relevant tools and techniques for forest ecosystem valuation and how they are used for REDD+. Following that, it explores how economic valuation has been applied in the Indian forestry sector, and the regulatory requirements and implications of its use in the National Working Plan Code (2014). The chapter concludes with some guidelines and further reading for practitioners interested in using these principles in their work. The reader is assumed to have some familiarity with economics and economic valuation.

TOOLS, TECHNIQUES AND METHODS: SOME RELEVANT ASPECTS

Economic valuation draws upon a range of methods which place a monetary value on forest ecosystem services, and lead to decision-making on interventions and programs which may affect the status of a forest. There are several good general reviews of alternative ways of classifying values and economic valuation methods in the context of natural resources[6], as well as reviews and valuation exercises specific to forestry in India[7]. In this section some specific aspects that merit attention are highlighted.

Valuation of non-marketed forest ecosystem services have challenged economists seeking to apply standard neoclassical approaches to valuing such services (Vardon *et al.* 2016): hypothetical bias, embedding effects in stated preference methods, the lack of robust approaches for validation, and discounting for socio-cultural values are important challenges. In fact, extra care should be taken to ensure that the valuation exercise includes the non-monetized or non-marketed forest ecosystem services that accrue primarily in less developed areas. Else, if the values of these services are not adequately captured, decisions based on the numbers generated can be biased against the poor whose values have been excluded or understated. The same issue can arise if there are uncertainties or unknowns about ecosystem services, which therefore tend to be ignored or undervalued. For both these reasons, most countries seek to design elaborate mechanisms for compensations and safeguards beyond market based values of forest lands. The need for including non-marketed and non-carbon benefits, and safeguards to protect such values as an integral part of REDD+ is well recognized (Visseren-Hamakers *et al.* 2012; McDermott *et al.* 2012; UNFCCC 2014).

A special word for the case of biodiversity is in order. In resource constrained economies, economic values can be a useful means of communicating the importance of non-marketed ecosystem services related to biodiversity, which otherwise may remain unnoticed and unaccounted for (Atkinson *et al.* 2012). Distinction is useful between biodiversity services that can be related to a limited extent to marketed products and those services which do not respond to market signals in any obvious way. Pollination

is an example of the former while examples of the latter include species that help in climate regulation, or control of pathogens and pests. The choice of technique for valuing biodiversity services must be done with care and must be sensitive to the context as it has major impact on establishing prioritization for optimizing investments and conservation of biodiversity (Arriagada and Perrings 2013; Kinzig *et al.* 2007). In some situations, for instance where regulatory services or life support functions are concerned, the derived economic values may be very high and call for risk-based management of forests irrespective of the exactness of the economic value. Economic valuation alone may fail to protect biodiversity in certain contexts (Carrasco *et al.* 2014) and require support from other policy mechanisms (Bryan *et al.* 2017). The valuation exercise helps in establishing the value and creating awareness about it, but the decision-making process on whether to preserve the service or not may not be left to the market. An example of this is biodiversity hotspots which are best taken care of through non-price based instruments such as legal instruments (adoption of precautionary principle, setting of safe minimum standards) and participatory natural resource management.

Values attributable to a particular forest ecosystem service can vary as per the technique applied to evaluate it. It is advisable therefore to use more than one method wherever there are uncertainties, or likelihood of distributional consequences that cannot be fully foreseen, such as with intangible services or non-marketed ones. Comparing values arrived at by different techniques in such cases is an important way to validate the derived economic value. It is also a way of ensuring that the full range of possible values is presented to the decision maker wherever uncertainties exist. For instance, Zhang and Xu (2017) compare values from a Total Economic Valuation method to that of using Equivalent Value Factors for the Sanjiang Plains in China, while Ghaley *et al.* (2014) demonstrate how differences between marketable and non-marketable shares of values impacts Beech forests in Denmark.

Many of the ecosystem services that are linked to biodiversity generate values that need to be recognized for their individual worth, as distinct from the value of the end-product. A case in point is that of insect pollinators, which contribute substantially to agricultural production, as shown by several studies (Goulder and Kennedy 2011; Gallai *et al.* 2009). In conventional economic terms these would constitute intermediate inputs towards the production of an end product (or service). It poses challenges in terms of the alternative ways in which it is conceptualized as an ecosystem service from being an intermediate one to a final product, as much as in the availability of methods to adequately capture the value (Atkinson *et al.* 2012). It is therefore important to be sensitive about the adequacy of a particular method in capturing the value of a specific service. In this as in several other contexts, such as socio-cultural aspects of forest ecosystems, it may be necessary to supplement economic valuation with methods that borrow from various other disciplines (Vihervaara *et al.* 2010; Martín-López *et al.* 2012; De Groot *et al.* 2010).

The urge to recognize a value placed by society over and above a simple aggregation of individual components of values has been an important aspect for many societies. The use of deliberative and shared values, and moving from the individual to participatory approaches

for eliciting values as well as systems modelling will create confidence in the process and in the inclusivity of the attributable economic value (Kenter *et al*. 2016a; Kenter *et al.* 2016b; Grima *et al.* 2016).

An economic valuation exercise must also be sensitive to the specific context in which it is being conducted. For instance, there may be a need to choose methods that take note of gender concerns in correctly valuing contributions. (Agarwal 2001). In the Indian context, an analysis of data from the National Sample Survey (Chopra and Dasgupta 2008) on non-timber forest products (NTFPs) for self-consumption and for sale, reveals that while a large percentage (48 percent) of rural households report collections for either self-consumption or sale, there is a clear distinction in the intrinsic significance of the value of collection by poor compared to non-poor households. The use of alternative participatory models, and qualitative approaches and interdisciplinary methods can contribute to improving the estimates from quantitative approaches.

For economic valuation to serve its purpose, the time frame over which the valuation exercise is to be conducted needs to be chosen with care. The temporal dimension is particularly important in conducting a valuation exercise for forest ecosystem services since forests are by nature dynamic entities, subjected to multiple stressors from within the natural world. There can be major shifts in values attributable to ecosystem services at specific time periods. Often these exercises are conducted for a period of a minimum of 20 years since there is an inherent problem in using standard approaches such as Net Present Value for time periods extending beyond 20-30 years. However, in many instances including climate change, it requires analysis over a much longer time period. In such cases, scenario building and integrated approaches should be used.

Finally, it is well recognized that in policy-making contexts, integrated approaches which are inclusive of cultural and social values and monetize ecological or economic values, work well (Mc Laughlin 2011; Balachandran *et al.* 2016). No doubt there can be major challenges in operationalizing such approaches (Villegos-Palacio *et al.* 2016), such as the difficulty of defining clear boundaries amongst such services, and the complexity of the overlaps between these services which make them often difficult to individually value in the conventional total economic value approach. However, one should seek to integrate these as much as possible, particularly by using multi-metric approaches to the valuation and using qualitative tools alongside the quantitative ones.

ECONOMIC VALUATION FOR FOREST ECOSYSTEM SERVICES

Opportunities and Challenges for Valuing REDD+

In general, society reaps higher economic values when legal and policy instruments are successfully implemented through well-functioning institutions. On one hand REDD+ can be viewed as a successful outcome of international negotiations which resulted in a concrete mechanism for transfer of funds for climate change mitigation activity, and on the other, most REDD+ initiatives have been slow in progressing beyond the pilot stage. It appears that more needs to be done in terms of both technological and institutional innovations, of which prioritizing the economic valuation of

forest ecosystem services (including carbon), and getting in place appropriate fund devolution and audit mechanisms at international and within country levels is critical. Transparency in distribution of funds by authorities vested with the responsibility to do so is paramount in building trust and confidence among stakeholders at all levels. Improved communication of compensation, value added interventions, and particularly disbursement mechanisms and delays in these have not been communicated for the most part to forest-dependent communities.

The economic benefits of the REDD+ program are not just carbon sequestration value, but a range of other values commonly clubbed together as 'co-benefits' in the literature. Co-benefits from reforestation programs have been considered as a key element in pushing for such programs, such as improved income opportunities, supply of raw materials for industries, soil conservation, slope stabilization, and poverty alleviation, as well as providing the necessary resources for investment where there are transfers to support the program itself (Singh 2008; Tubiello *et al.* 2009; Lamb 2011; Barr and Sayer 2012). Past experience has shown that such programs may also be accompanied by growing inequities amongst forest-dependent communities and between these communities and other actors such as the implementing agency (government), corporates and middlemen who constitute various parts of the value chain for forest products, and by the institutional and governance related arrangements in place (Barr and Sayer 2012; Corbera and Brown 2008; Skutsch *et al.* 2011; Smith *et al.* 2014).

REDD+ global costs were estimated to be between United States Dollar (USD) 17 to 33 billion per annum (Eliasch 2008). As such, estimations of costs are supposed to be inclusive of the opportunity costs (of land included), and transaction costs, although to what extent the costs are covered differs from context to context (Luttrell *et al.* 2012). A hybrid structure exists in terms of international support for REDD+ programs – country level initiatives, multilateral and bilateral activities co-exist. Though REDD+ projects are designed to take care of ecological, social and economic benefits within the forest ecosystem, the primary motivation being mitigation, the detailed mechanisms (such as for Measurement, Reporting and Verification [MRV], financial devolution, etc.) are specified in most projects only for carbon benefits. This could potentially lead to situations where certain ecosystem services are deprioritized in favor of carbon. For instance, afforestation (or reducing deforestation) using species that are high in carbon absorption capacity may lead to lower prioritization of biodiversity in resource constrained situations (Turnhout *et al.* 2017). A review of 60 REDD+ studies (Rakatama *et al.* 2017) found that on an average, the total REDD+ cost (USD 24.87/ tons of carbon di-oxide equivalents (tCO_2e) was 2.23 times higher than the opportunity cost and the opportunity cost was 3.28 times higher than the transaction and implementation cost. Implementation and transaction costs are likely to be higher where mechanisms are inefficient to reduce poverty, when there is lack of trust amongst stakeholders, or when there are concerns with and land tenure issues (Asquith *et al.* 2008; Balvanera *et al.* 2012; Peterson *et al.* 2010; Van Noordwijk *et al.* 2012; Magrin *et al.* 2014). Luttrell *et al.* (2017) found that often the costs of implementation are higher than estimated and fair compensation is not given to the stakeholders. Thus, it is of paramount

importance to have in advance accurate estimates of costs and benefits so that the project can budget for these adequately. Several studies have highlighted the importance of complete estimations of the costs and benefits in a REDD+ design (Rakatama *et al.* 2017; Araya and Hofstad 2016).

Learnings from 'Payments for Ecosystem Services' programmes[8]

The experience with Payments for Ecosystem Services (PES) programs has led to encouragement for carrying out reforestation projects in some instances, but also brought into prominence some apprehensions. Many of these apprehensions include socio-economic aspects such as the non-realization of expected targets for poverty and inequality reduction (Balvanera *et al.* 2012; Pinho *et al.* 2014). While conceptually PES is widely accepted (Gomez-Baggethun and Ruiz-Perez 2011; Arriagada and Perrings 2013), the experience with its implementation has varied. In the present context, what is of importance is its potential for feeding into a REDD+ program as part of its design. REDD+ has in fact also been described as the world's largest experiment in PES (Corbera 2012).

Experiences from other developing countries, including several in Latin America, have shown that local-and regional-level PES programmes tend to succeed with direct participation of communities in valuing benefits and costs, and in determining accrual and distribution of revenues to beneficiaries (Grima *et al.* 2016; Corbera *et al.* 2009; Robertson and Wunder 2005). The need for fair, transparent, and corruption-free accounting and disbursement of benefits and REDD+ incentives is an integral part of the understanding for a successful REDD+ project. (UNFCCC 2011).

It should also be noted that public funds are going to be the mainstay of REDD+ initiatives (Creed and Nakhooda 2011). Experience with ecosystems has shown that the types of actions involved are not undertaken by the private sector due to the nature of their costs, incentives, and resource requirements.

ECONOMIC VALUATION AND THE INDIAN FORESTRY SECTOR

The importance of the economic value of the services that forests provide has been well recognized in India. Illustrations of the policy context where economic valuation has been relevant are discussed in the last section of the chapter, while Box 9.1 highlights examples of the estimates of economic value of forests. These examples also serve to indicate that the conceptualization and operationalization of a specific valuation exercise will depend on the objective it seeks to fulfill.

At the macro level, for valuing forests at the level of the nation or state level two alternative approaches have been used. The first is to estimate the value of the forest in terms of the natural wealth that it embodies; this has been done in exercises to compute the (net) capital formation (genuine investment or savings) (Dasgupta 2011; World Bank Group 2014, WAVES 2015). The second is to derive estimates of green Gross Domestic Product (GDP) (Dasgupta Committee 2013). While the former seeks to examine the sustainability of the development path or wealth formation in the economy by including forest wealth, the latter aims to adjust the conventional output (GDP) of the economy to reflect the worth

of the forest based services (known as 'Green Accounting'). Within the national accounts at present, forestry as a sector finds mention primarily in terms of extractive values such as for timber and fuelwood. The forest sector is thus a part of the System of National Accounts (SNA) to that limited extent and attempts are ongoing to adjust these estimates to better capture changes in the forest services.

For instance, there have been indications that the stock of forest capital may have appreciated due to some policy-induced initiatives. However, the system of national accounts cannot accommodate these. Significant policy initiatives which impact natural capital formation include bans on green felling, a more permissive import policy for timber, increase in stocks, and complementary developments such as increased per unit productivity in agriculture which could also potentially lead to a decrease in conversion of forest land for agricultural use.

Approaches to Value Indian Forests

The marginal cost of avoiding depletion of forest stocks is the price of an environmental resource in the context of sustainable development. Economic valuation helps us arrive at this value. In general, though valuing all stocks and flows is a huge task, a pragmatic approach is to highlight those values of forests that are of obvious economic significance and are likely to remain so in the future. An adjusted set of national accounts can then be prepared every few years (Vincent 1999). Today, forest carbon stock accounting on a national level is a requirement under REDD+.

Apart from national estimates, attempts have also been made to derive the economic value of forestlands through various site-specific exercises in India, using various methodologies. These have ranged from pure financial returns computation and ecological impact profiling, to more holistic economic assessments which seek to internalize externalities and assign appropriate shadow prices. At the micro level, there has been a proliferation of studies on the valuation of goods and services from forest ecosystems, with values being attributable to specific contexts of valuation. Site-specific exercises become important since economic valuation requires an interdisciplinary approach, special methods and tools for assessing the net economic contribution in the specific area, and normally data and information requirements are substantial. Such data is not collected as part of any routine large scale surveys or even forestry sector-specific surveys and therefore these will for the most part be fairly resource intensive exercises. Hence, careful selection of scope, methods, and tools has to be done in site-specific exercises.

An economic valuation approach is also complementary with a risk management approach when forests are to be preserved for the future well-being of the population, in response to a threat (Chopra and Dasgupta 2017; Smith et al 2011). Economic valuation cannot adequately capture all forest ecosystem values, nor do all these values lend themselves to quantification. However, wherever possible, there is a need to evaluate the services from forests since these are critical inputs for decision-making alongside other complimentary processes (Chan *et al.* 2012a and 2012b).

Valuation that takes into consideration a range of forest services helps to better understand the interconnectedness between forests and other ecosystems, and helps prioritization of services from a landscape or ecological

corridors perspective. For instance, it is well acknowledged that forests and farming systems are intricately linked in India through supporting and regulating services such as micro-climatic stabilization and hydrological flows, and through provisioning services that directly impact agriculture such as pollination. Yet, these services are rarely prioritized in discussions of sustainable agriculture and their value remains mostly unrecognized in decision-making contexts.

Forest management practices are also seen to be better if supported by cost-benefit analysis that accounts for the entire array of ecosystem services forest provides (Marta-Pedroso *et al.* 2014). Tools and approaches are being developed to assess gains from afforestation, which incorporate costs and applicability of economic valuation in evaluating gains from such interventions (Baral *et al.* 2016; Christin *et al.* 2016) and real world applications of economic mechanisms to encourage conservation of forests (Srinivasan 2015).

Today, there are software based spatial methods and tools to help in computing both the physical flows and the monetary values of a wide range of ecosystem services, such as InVEST (http://www.naturalcapitalproject.org/invest/) and Human Ecology Mapping, Portland State university). Methods of appraisal range from the more conventional (cost-effectiveness analysis, multi-criteria analysis, cost benefit analysis) to less traditional ones such as non-probabilistic methodologies, risk – benefit analysis and decision analysis. It is important to note that there is enough expertise and rationale to start mainstreaming economic valuation of forests in India at the national, state and local or site specific level. Comprehensive economic valuation will feed into global and national policy processes.

ECONOMIC VALUATION AND THE NEW WORKING PLAN CODE

By law, all forest lands in India are managed under an approved working plan. The National Working Plan code (WPC) of 2014 is the regulation that gives the requirements for these plans. The WPC mentions the relevance of maintenance and enhancement of social, economic, cultural and spiritual benefits. There are multiple mentions of the economic benefits to local communities in the context of Non-Timber Forest Products (NTFP) and wildlife management, with suggested formats for data collection to assess economic and social benefits from forests. In the case of NTFPs, the economic aspects in terms of volume of extraction and price setting has a long history in India. In terms of REDD+, the plan specifically mentions:

> Implementation of REDD+, therefore requires efforts/mechanisms to measure forest carbon, interventions and payments to local people in addition to alternative activities such as fodder development to avoid lopping of tree branches, efficient cooking energy devices, etc.

The emphasis on carbon is as per expectations, but to attain congruence with the general thinking on REDD+ there should be more explicit recognition of the need to value carbon, as well as other ecosystem services. The working plan data collection architecture can be strengthened to provide the inputs for a meaningful REDD+ design, in terms of information on community benefits from the full range of ecosystem services, the details

of gainers and losers from activities proposed under the working plan, and to explicitly therefore develop formats to record such data[9]. Specifically, the working plans can contribute in terms of points 1, 2, 4, 5, 9 and 10 of the guidelines given in this chapter, provided of course adequate capacity is built and resources made available. This is feasible within the existing framework where there is provision for external expertise as required, as far as the actual valuation is concerned.

Protocols need to be developed within the country to ensure that all costs and benefits are covered, monetary and non-monetary benefits are mapped in comparable units across pilot projects, and the gainers and losers from any proposed interventions, along with the corresponding economic values wherever applicable are clearly presented in a standardized format. This will support robust decision making on which pilots are most likely to succeed. A very important aspect of this activity is to make it available in the public domain, and make all information freely accessible to all stakeholders in an interactive manner, coordinated by an autonomous regulatory body, if required. Whether the WPC can be strengthened to achieve this or whether this should be done specifically for REDD+ is a matter of further discussion. As a general principle, it would be an essential input for all decisions regarding alternative land use and land use change.

VALUING CARBON AND OTHER ECOSYSTEM SERVICES: IMPLICATIONS FOR REDD+ IN INDIA

Estimates suggest that over 1 billion tons of additional CO_2 could be captured by the REDD+ India program over the next 30 years and over USD 3 billion tons of carbon dioxide could be provided by it as carbon service incentives (MOEF 2010). This is to be read in conjunction with India's commitment to create an additional carbon sink of 2.5-3 Giga ton (Gt) CO_2e through additional forest and tree cover by 2030 (National Development Council 2015). To what extent a REDD+ project will be able to cover the costs of achieving its carbon capture targets depends on the specifics – costs of implementation, opportunity costs of land, transaction costs. Including those costs implicitly will facilitate putting in place the appropriate institutional structure and rules and regulations to facilitate the implementation.

The economic benefits that can be accrued from a REDD+ program can be broadly divided into monetary and non-monetary benefits (Luttrell *et al.* 2012), although strictly speaking there may be grey areas where the distinction is more difficult to make while evaluating the specific benefit. In contrast direct transfers (such as funding for specific activities within REDD+) or increased employment and income generation are direct gains. While one argument made is that payments via REDD+ for forest activities constitute a means of converting these areas into "revenue generating carbon sinks" (Barr and Sayer 2012), the critical concern in India - as in most developing countries - is the opportunity cost of the land irrespective of its current use category.

It is also too early to evaluate the efficiency of the financing mechanisms for the South Asian context since the mechanisms for financial devolution are still evolving, and the commitments for the funds are primarily (Smith *et al.* 2014) for activities related to REDD+ readiness and piloting at a local scale (Creed

and Nakhooda 2011; Minang and Noordwijk 2014).

India in its submissions to the UNFCCC has emphasized that forests will be managed for their carbon services and ecosystem services. To quote:

> Initiatives like Green India Mission (GIM) and National Afforestation Program (NAP), together with programs in sectors like agriculture and rural development would add or improve two mili hectare (mha) of forest and tree cover annually in our country. This will annually add two million tons of carbon incrementally, and post 2020, the forest and tree cover will be adding at least 20 million tons of carbon every year. This would require an investment of Indian National Rupee (INR) 90 billion (USD 2 billion) every year for 10 years (UNFCCC n.d.).

The important point to note is that this implies significant costs in terms of opportunity costs, transaction costs, and implementation costs. On the benefits side, the carbon values are also likely to change over time, although for project purposes these are calculated as per standard norms. The benefits in terms of ecosystem services will also require careful valuation, since these will also be dynamic in nature. The extended time periods over which the benefits are likely to be realized should be carefully considered.

In the case of ongoing pilot projects and demonstration activities for REDD+ initiatives, some estimates are usually available in terms of the aggregate worth of the existing carbon stock and potential for carbon sequestration. However, the distribution mechanisms and the attribution of this value to various stakeholders are unclear and unspecified except in terms of general principles. Critics of REDD+ have also pointed out that some of these projects have led to social exclusion and the perpetuation of prevailing inequities in their implementation (Corbera 2012; Dasgupta *et al.* 2014). While REDD+ may have secondary impacts, some of these will be positive (for instance increasing employment) while some could be negative for rural areas (such as landscape changes, or increasing conflicts over non-forest resources) (Dasgupta *et al.* 2014).

Among other considerations, two major points arise in terms of financial and distributional issues. This includes making sure that the benefits from REDD+ reach indigenous communities and that the desired flow of funds takes place in a timely manner from the center to the state and subsequently the district level. On both counts, experience from earlier reforestation programs and in particular the Joint Forest Management (JFM) program, suggests that performance varies substantially across states in India and it takes considerable time for states to learn from each other. The issue becomes relevant for economic valuation for REDD+ projects if distributional considerations are to be built into the formula for aggregation of net benefits (taking due note of costs). For instance, transaction costs may be higher if distribution or devolution concerns are not addressed adequately from the outset. If enhancement of agricultural productivity and livestock production is required for achieving food security with reduced deforestation and degradation practices, and it is to be accomplished with sustainable land use planning, technological investment and research in agriculture sector, funds will have to be provided for in order to meet these targets (UNFCCC 2011). Given that projects are

underway and that steps to measure carbon are initiated (MoEFCC 2015), it is also important to build capacity to measure and value ecological and environmental services, alongside carbon.

The draft REDD+ policy in India, as in the case of REDD+ projects elsewhere, makes it abundantly clear that national governments will be dependent on international support for proposed projects, though these could flow throw various channels. This implies in turn that a host of challenges that the reforestation programs have faced may recur in this case, although there is a good opportunity here to also gain from the lessons learnt from other programs such as PES. With regard to funding and financing concerns, these include leakage, impermanence, and rent seeking, and eventual inequity in distribution of carbon revenues across actors (Mcafee 2015; Lutrell 2017; Gilbertson 2011).

Where there is scope for improving ecosystem services, as in the opportunity provided by REDD+, implementation will require valuation exercises that have upheld values for decision makers that address equity and efficiency simultaneously (Leimona *et al.* 2015). The conventional approach has been to separate out the economic value from its distributional consequences. However, increasingly it has become apparent that distributional considerations can play a major role in influencing the way values are prioritized and used in decision making at various stages: from weights for a cost-benefit analysis for deciding upon a project or cost effectiveness for evaluating intervention options, to ensuring that all values have been accounted for and losers and gainers adequately identified, and REDD+ funds are properly managed to ensure that the intended devolution takes place. It is well established that people have aversion to risk, as well as inequality, and that equity matters (Dietz and Atkinson 2010). While multiple metrics from varied disciplines are important in measuring equity, it is equally important that the valuation exercise is conducted in an inclusive manner from its very inception. In interesting case study from Tanzania, Araya and Hofstad (2016) find that at a given REDD+ payment, normally a few families would still find it profitable to continue deforestation unless the compensation was higher than that based on pure carbon market values, given the limited availability of alternative employment for farmers in the region. The question of importance then is the kinds of weights that are attached to the values of different sub-groups in the population.

Tailoring the design to context is critical and valuation can contribute in identifying the economic contribution for local livelihoods. For instance, in the case of African countries the approach to base incentives or rewards on performance evaluation on deforestation was considered to be flawed as it failed to take into account the agricultural compulsions such as food security of affected households in the design (Karsenty 2012). Studies have shown that REDD+ payments might not be enough for the parties to stop deforestation and degradation practices. There is lack of clarity on the long term assurance of funding, as well as about the current sufficiency of availability of the payments which leads to a "wait and see" attitude (Turnhout *et al.* 2017).

The concern is mirrored in India where the forest dependent and forest dweller population is large and among the poorest in the country. Whether the pie is big enough to create incentives for all to preserve or afforest is

unclear. Opportunity costs differ in different areas. Thus, typically where alternative income generation opportunities are good such as in off-farm labor or employment, the incentive to engage in REDD+ will have to be sufficient to attract participation (Loaiza *et al.* 2015). Southgate et al. (2010) argue that uniformity of payment for beneficiaries can be inefficient if recipients accept less compensation in return for conservation measures, or if recipients that promote greater environmental gains receive only the prevailing payment.

Another concern with PES and REDD+ programs which may require some attention in the Indian context is that it can be costly to integrate smallholders and those with low awareness (Mcafee 2015). This means that adequate provision for transaction costs and capacity building must be made to ensure that the poor and vulnerable are not excluded. This is important to take note of since some studies elsewhere have found that the rural poor do tend to get excluded from participation (Hall 2012; Noordwijk *et al.* 2011; Sikor *et al.* 2010; Campbell 2009).

An understanding of which values accrue to which stakeholder is important for ensuring that project designs are inclusive. While this will not by itself ensure that social exclusion and distributional equity is achieved, it constitutes one important step towards ensuring that decision makers have access to complete information. It contributes in a multi-metric framework to evaluate the trade-offs and synergies amongst ecosystem services that a particular policy such as REDD+ promotes. No doubt, its ultimate acceptability and success in implementation will thereafter depend upon political economy considerations (Minang and Noordwijk 2014); including the extent to which global engagement with the process takes place (Grassi *et al.* 2013).

The Indian government's position in this context is in keeping with this approach, with its declared intent that the forest will not be managed for carbon services' alone, but for all the ecosystem services that are flowing to the local community. The emphasis is in fact on carbon as a co-benefit (UNFCCC n.d.). The intent as expressed in the submissions of the Government in India is to ensure that all REDD+ incentives available from international sources will flow fully and adequately to the local communities. The design for flow of funds from district to local levels to meet this laudable position is for the present quite flexible and left to each state government.

By its very objectives, the REDD+ approach in terms of distribution of benefits is meant to accommodate varying principles of compensation such as those with legal rights to land (forest dwellers and forest dependent communities in India), stakeholders involved in implementation (Government agencies) and all entities managing the forestland (which may overlap with the other categories), and those who are bearing any adverse consequences arising from the mitigation activity (which may not necessarily overlap with the first category). While laudable in terms of the scope of stakeholders, achieving a socially acceptable distribution with this varied group is a challenge. A well-intentioned and carefully conducted economic valuation exercise, which gives due weightage to perceived social priorities, is unlikely to provide an answer to satisfy all concerned. It can however provide key insights on what the cost-benefit matrix looks like, and how alternative priorities can be accommodated. Unfortunately, the perception

that there is one value from an economic valuation exercise, and that this acts as the single most important influence determining decision making of projects, has undermined the true importance of conducting a valuation exercise.

POLICY CONTEXT AND RECOMMENDED GUIDELINES

The public trust doctrine implies that the state holds in trust natural resources for the benefit of public use. In the case of countries like India, where the nation state owns most of the forested territory, the responsibility vested through this doctrine implies the need to have rules for use of resources and regulation of extraction in a manner that takes care of multiple interests, intergenerational concerns and commitments on the global front. This doctrine has seen applicability in the past in the context of forest lands in particular in India, from framing Net Present Value (NPV) for diversion of forestlands to non-forestry purposes to the creation of a special grant as an incentive to compensate states with forest cover in the XIII FC (FFC 2015); the latest being the Fourteenth Finance Commission's (FFC) recommendation to include area under forest cover of a state as a criteria for determining tax devolution (FFC 2015). The rationale is that given the opportunity costs of foregone developmental opportunities in preserving this global public good, the need for reforestation and afforestation, and the requirements of international obligations, states need to be helped through monetary incentives (as transfers on tax revenue).

To ensure that appropriate decisions regarding forest lands are made, and that these transfers are made based on a robust approach, it is important that valuation of potential benefits from such activities (or damages from lack of activities) are in place beforehand. Sustainability of flows from natural capital requires an understanding of preservation values, user cost and long term implications of determining choices. A systemic approach to valuation, including multi-metric approaches will provide a holistic view for decision-makers.

GUIDELINES FOR AN ECONOMIC VALUATION EXERCISE

There are several steps involved in conducting an economic valuation of forests. The major ones can be summarized as follows:

- Definition of the forest ecosystem and the desired scale for valuation.
- A complete listing of all the services or benefits that the forest provides, to the fullest extent possible given current levels of knowledge.
- Classify functions using alternative approaches to ensure full understanding of the linkages between ecosystem services and well-being, including those which can be:
  - Directly perceived and those which are indirect
  - Natural system functions as well as social system functions
  - Monetized services and those which cannot be monetized
  - Where there are trade-offs and synergies across stakeholder groups
- Identification and enumeration of stakeholders and attribution of services in determining economic values. These stakeholders can be at the global, national, state or community levels.

- A mapping of gainers and losers by the type of ecosystem service to be impacted due to a proposed intervention.
- Identifying available methodologies for evaluating the values attributable to the provisioning, regulating and cultural (whichever is the agreed classification) services of the forest concerned.
- Selecting the methodology which is most appropriate to the specific context from the available options for an identified ecosystem service.
- Expert judgment to determine wherever it is neither feasible nor desirable to impute a monetary value to a service. This may hold true even in situations where unique stakeholders can be identified to whom specific services accrue, since either the social or ecological context may make such valuation misleading due to empirical (data) constraints or lead to undesirable social outcomes; or there may be need to evoke other principles such as likelihood of ecological irreversibility.
  - Alternative methods to establish links between human and ecosystem well-being to be identified in the above instances. Examples are application of a precautionary principle, participatory decision-making, and co-operative working models.
- Data collection and computation of the value as per the applied methodology.
- Finalization of economic values with due consideration to sustainability concerns, accounting for:
  - Trends (depletion of resource base; preservation value)
  - Discounting of risks (allocation of risks, irreversibility, option values)
  - Ecological imperatives such as tipping points
  - Aggregation of values for contributing to socially optimal decisions (application of social welfare criteria, weighting of individual welfares - Pareto, Kaldor and Hicks compensation, efficiency criterion of new welfare economics, etc.) with focus on equity (inter-group, intergenerational) and inter-temporal dimensions.
  - Governance and institutional structures (property rights, awareness, communication) wherever preference elicitation is involved in arriving at monetary values.
- Communication and presentation of the values in terms of the relevant parameters that relate to:
  - The bio-physical characterization of the forest. For instance, two way tables and charts which present provisioning (or any other type of flows) by forest type and density which is easily comprehensible in the Indian context
  - A proposed accrual of values by stakeholder category and projected change in the service concerned

Box 9.1: Examples of Economic Value of Forests in India

National Level Estimates

- The quarterly *Gross Value Added* in 'agriculture, forestry and fishing' grew by 3.3 percent in 2016-2017 (Q2) as compared to 2.0 percent in 2015-16 (Q2) (MOSPI, 2016).
- *Total Economic Value* of forests lies between INR 18,284 and 3,97,197 /ha/year (Verma *et al.* 2014b)
- Value of the goods and services of forests as *Percentage of GDP* in India is approx. 6.86 percent. (Bahuguna and Bisht 2013).
- *Loss of forest ecological services* (i.e. soil erosion prevention, flood control and ground water augmentation) over three years (2001-03) due to declining dense forests was 1.1 percent of GDP; In some states loss of forest ecological services was significantly higher, ranging between 6-12% and more, as a percent of Net State Domestic Product (Green India States Trust; Sukhdev and Leigh 2012).

State Level Estimates

- *Forest service specific:* Tendu leaf collection leads to an annual income of about INR 145 Crore for the forest dwellers of Madhya Pradesh (*MP Madhyam*).
- *Contribution to state's income:* Himachal Pradesh's forestry sector officially contributes about 4.8 percent of total Gross State Domestic Product (GSDP) (WAVES, 2015).
- *Valuation of the forest:* Approximate worth of forests in Arunachal Pradesh forest INR 1,518billion/year (Kumar and Chaudhry 2015).
- *Forest service specific contribution to state income*: Recreational value of forests in Karnataka constituted 0.02 percent of GSDP at current prices for 2002-03 (Panchmukhi *et al.* 2008).

Specific Forest Ecosystem Estimates

- By *Forest Circles*: Net Present Value of seven ecosystem services for Himachal Pradesh including timber, carbon storage, fuel wood & fodder, NTPFs, ecotourism, watershed benefits and biodiversity varied between INR 5.8 and 9.2 lakhs per hectare (NPV Expert Committee 2006).
- *By Ecological class and Density:* Central Empowered Committee recommended NPV charges to be levied for diversion of forest land based on ecological class and density of forests varying from INR 4,38,000 to 10,43,000 /hectare (ha) (CEC 2008) (revised subsequently).
- *By Type of Service:* The carbon benefits from forests of Uttara Kannada (in terms of the avoided social costs) is estimated at INR 9673/ha/year (MOEFCC & GIZ 2014).
- By *Designated Area:* The value of benefits from Nagarhole National Park in Karnataka ranges from USD 13-148 million depending on the valuation method (Ninan and Kontoleon 2016).

REFERENCES

Agarwal, B. 2001. "Participatory exclusions, community forestry, and gender: an analysis for South Asia and a conceptual framework". *World Development* 29 (10): 1623-1648.

Araya, M. M. and O. Hofstad. 2016. "Monetary incentives to avoid deforestation under the Reducing emissions from deforestation and degradation (REDD) climate change mitigation scheme in Tanzania." *Mitigation and Adaptation Strategies for Global Change* 21 (3): 421-443.

Arriagada, R. and C. Perrings. 2013. "Making payments for ecosystem services work". In *Values, Payments and Institutions for Ecosystem Management* edited by P. Kumar, I. Thiaw and T. Barker, 16-57. Cheltenham: Edward Elgar.

Asquith, N. M., M. T. Vargas and S. Wunder. 2008. "Selling two environmental services: in-kind payments for bird habitat and watershed protection in Los Negros, Bolivia." *Ecological Economics* 65: 67-684.

Atkinson, G., I. Bateman, and S. Mourato. 2012. "Recent advances in the valuation of ecosystem services and biodiversity". *Oxford Review of Economic Policy* 28: 22–47. http://dx.doi.org/10. 1093/oxrep/grs007.

Bahuguna, V. K. and N. S. Bisht. 2013. "Valuation of Ecosystem Goods and Services from forests in India". *The Indian Forester* 139 (1). http://www.indianforester.co.in/index.php/indianforester/article/view/29126.

Balachandran, G., G. Mallard, O. Arewa, L. Baccaro, T. Büthe, A. Nightingale, P. Pénet, D. Pestre and A. Robert. 2016. "Governing Capital, Labor and Nature in a Changing World". In *International Panel on Social Progress*. Paris, France and New Jersey, USA. https://comment.ipsp.org/chapter/chapter-12-governing-capital-labor-and-nature-changing-world.

Balvanera, P., M. Uriarte, Almeida-Lenero, A. Altesor, F. DeClerck and T. Gardner. 2012. "Ecosystem services research in Latin America: The state of the art." *Ecosystem Services* 2: 56-70. http://dx.doi.org/10.1016/j.ecoser.2012.09.006.

Baral, H., M. R. Guariguata and R. J. Keenan. 2016. "A proposed framework for assessing ecosystem goods and services from planted forests." *Ecosystem Services* 22: 260-268. doi:10.1016/j.ecoser.2016.10.002.

Barr, C. M. and J. A. Sayer. 2012. "The political economy of reforestation and forest restoration in Asia-Pacific: Critical issues for REDD." *Biological Conservation* 154: 9-19. doi:10.1016/j.biocon.2012.03.020.

Bryan, B. A., R. K. Runting, T. Capon, M.P. Perring, S. C. Cunningham, M. E. Kragt, M. Nolan, E. A. Law, A. Renwick, S. Eber, R. Christian and K. Wilson. 2016. "Designer policy for carbon and biodiversity co-benefits under global change." *Nature Climate Change* 6: 301-305. doi: 10.1038/NCLIMATE2874.

Campbell, B. M. 2009. "Beyond Copenhagen: REDD, agriculture, adaptation strategies and poverty." *Global Environmental Change* 19(4): 397-399. doi:10.1016/j.gloenvcha.2009.07.010.

Carrasco, L., T. Nghiem, T. Sunderland and L. Koh. 2014. "Economic valuation of ecosystem services fails to capture biodiversity value of tropical forests." *Biological Conservation* 178: 163-170. doi:10.1016/j.biocon.2014.08.007.

Chambwera M., G. Heal, C. Dubeux, S. Hallegatte, L. Leclerc, A. Markandya, B. A. McCarl, R. Mechler and J. E. Neumann .2014. Economics of adaptation. In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects,* edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R.

Mastrandrea, and L. L. White, 945-977. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.

Chan, K. M. A., T. Satterfield and J. Goldstein. 2012a. "Rethinking ecosystem services to better address and navigate cultural values." *Ecological Economics* 74 (8): 18. doi:10.1016/j.ecolecon.2011.11.011.

Chan, K. M. A., A. D. Guerry, P. Balvanera, S. Klain, T. Satterfield, X. Basurto and A. Bostrom. 2012b. "Where are Cultural and Social in Ecosystem Services? A Framework for Constructive Engagement." *BioScience* 62 (8): 744-756. doi:10.1525/bio.2012.62.8.7.

Chopra, K. and P. Dasgupta. 2008. "Assessing the economic and ecosystem services contribution of forests: issues in modelling, and an illustration." *International Forestry Review* 10 (2): 376-386. doi:10.1505/ifor.10.2.376.

Chopra, K. and P. Dasgupta. 2017. "Economic Systems and Ecosystems: Interlinkages, Co-evolution or Disparate Movement?" *Ecosystem Functions and Management* 17:35. doi:10.1007/978-3-319-53967-6_2.

Christin, Z. L., K. J. Bagstad and M. A. Verdone. 2016. "A decision framework for identifying models to estimate forest ecosystem services gains from restoration." *Forest Ecosystems* 3 (1). doi:10.1186/s40663-016-0062-y.

Corbera, E., C. González Soberanisc and K. Brown. 2009. "Institutional dimensions of Payments for Ecosystem Services: An analysis of Mexico's carbon forestry programme." *Ecological Economics* 68: 743-761.

Corbera, E. 2012. "Problematizing REDD+ as an experimenting payments for ecosystem services." Current Opinion in *Environmental Sustainability* 4:612-619. http://dx.doi.org/10.1016/j.cosust.2012.09.010.

Corbera, E. and K. Brown. 2008. "Building Institutions to Trade Ecosystem Services: Marketing Forest Carbon in Mexico." *World Development* 36(10): 1956-1979. doi:10.1016/j.worlddev.2007.09.010.

Creed, A. and S. Nakhooda. 2011. *REDD Finance Delivery: Lessons from Early Experience*. Washington, DC, USA: Heinrich Boell Foundation.

Dasgupta P. 2009. Valuation of Ecosystem Services: Methodologies, Illustrations and Use. In *Handbook of environmental economics in India*, edited by K. R. Chopra and V. Dayal. New Delhi: Oxford University Press.

Dasgupta P. 2011. "Investment Data and Sustainability Measures for India." In *India's Economy and Growth: Essays in Honour of V. K. R. V. Rao*, edited by P. B. Nayak, B. Goldar, and P. Agarwal. New Delhi: Sage Publications.

Dasgupta, P., J. F. Morton, D. Dodman, B. Karapinar, F. Meza, M. G. Rivera-Ferre, A. ToureSarr and K. E. Vincent. 2014. "Rural areas." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects: Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change,* edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea and L. L. White, 613-657. Geneva, Switzerland: World Meteorological Organization.

De Groot, R. S., R. Alkemade, L. Braat, L. Hein and L. Willemen. 2010. "Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making." *Ecological Complexity* 7: 260–272. http://dx.doi.org/10.1016/j.ecocom.2009.10.006.

Dietz, S. and G. Atkinson. 2010. "The equity-efficiency trade-off in environmental policy: evidence from stated preferences." *Land Economics* 86 (3): 423-443.

Eliasch, J. 2008. "Climate Change: Financing Global Forests: The Eliasch Review". https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/228833/9780108507632.pdf.

Finance Commission. 2015. *14th Finance Commission Report 2015*. New Delhi: Ministry of Finance, Government of India.

Ferraro, P. J., K. Lawlor, K. Mullan and S. K. Pattanayak. 2012. "Forest Figures: A review of ecosystem services valuation and policy evaluation in developing countries." *Review of Environmental Economics and Policy* 6 (1): 20-44. http://dx.doi.org/10.1093/reep/rer019

Freeman III, A. M. 2003. "The Measurement of Environmental and Resource Values." *Resources for the Future*, Washington, DC, USA

Gallai, N., J. M. Salles, J. Settele and B. E. Vaissiere. 2009. "Economic valuation of the vulnerability of world agriculture confronted with pollinator decline." *Ecological Economics*. 68: 810–821. doi:10.1016/j.ecolecon.2008.06.014.

Ghaley, B. B., L. Vesterdal and J. R. Porter. 2014. "Quantification and valuation of ecosystem services in diverse production systems for informed decision-making." *Environmental Science and Policy* 39: 139-149. doi:10.1016/j.envsci.2013.08.004.

Gilbertson, T. 2011. "Fast forest cash: how REDD+ will be market based." In *No REDD Papers Volume 1: Indigenous women defending land and life since the beginning of time,* edited by H. Boas. Portland: Charles Overbeck and Eberhardt Press.

Gómez-Baggethun, E. and M. Ruiz-Pérez. 2011. "Economic valuation and the commodification of ecosystem services." *Progress in Physical Geography* 35: 613-628.

Goulder, L. H. and D. Kennedy. 2011. "Interpreting and estimating the value of ecosystem services." In*Natural Capital: Theory and Practice of Mapping Ecosystem Services*, edited by K. Peter, H. Tallis, T.H. Ricketts, G. C. Daily and S. Polasky. Oxford: Oxford University Press.

Grassi, G., S. Federici and F. Achard. 2013. "Implementing conservativeness in REDD is realistic and useful to address the most uncertain estimates." *Climatic Change* 119(2): 269-275. Doi: 10.1007/s10584-013-0780-x.

Grima, N., S. J. Singh, B. Smetschka and L. Ringhofer. 2016. "Payment for Ecosystem Services (PES) in Latin America: Analyzing the performance of 40 case studies." *Ecosystem Services* 17: 24-32. doi:10.1016/j.ecoser.2015.11.010.

Haines-Young R. and M. Potschin. 2010. "The links between biodiversity, ecosystem services and human well-being." In *Ecosystem Ecology: A New Synthesis*, edited by D. G. Raffaelli and C. L. J. Frid, 110-139. Cambridge: Cambridge University Press.

Hall, A. L. 2012. *Forests and climate change: the social dimensions of REDD in Latin America*. Cheltenham: Edward Elgar.

Karsenty, A. 2012. *Financing options to support REDD+ activities*. Report for the European Commission DG Climate Action.

Kenter, J. O., N. Jobstvogt, V. Watson, K. Irvine, M. Christie and R. Bryce. 2016a. "The impact of information, value-deliberation and group-based decision-making on values for ecosystem services: integrating deliberative monetary valuation and storytelling." *Ecosystem Services* 21: 270-290. http://dx.doi.org/10.1016/j.ecoser.2016.06.006.

Kenter, J. O., M. S. Reed, K. N. Irvine, E. O'Brien, R. Bryce, M. Christie, N. Cooper, N. Hockley, I. Fazey, J. Orchard-Webb, N. Ravenscroft, C. M. Raymond, P. Tett and V. Watson. 2016b. "Shared values and deliberative valuation: Future directions." *Services* 21: 358-371. http://dx.doi.org/10.1016/j.ecoser.2016.10.006

Kinzig, A., C. Perrings and B. Scholes. 2007. "Ecosystem services and the economics of biodiversity conservation." Working Paper. School of Life Sciences, Arizona State University: 21. http://www.public.asu.edu/~cperring/Kinzig%20Perrings%20Scholes%20(2007).pdf.

Kumar, P., ed. 2010. *The Economics of Ecosystems and Diversity: Ecological and Economic Foundations*. London and Washington: Earthscan.

Kumar, S. and P. Chaudhry. 2015. "Ecosystem services valuation of the forests of Arunachal Pradesh State, India, Brazilian." *Journal of Biological Sciences* 2 (4): 369-375.

Lamb, D. 2011. "Regreening the Bare Hills; Tropical Forest Restoration in the Asia Pacific Region." *Springer*, New York: 547.

Leimona, B., M.V. Noordwijk, R.D. Groot and R. Leemans. 2015. "Fairly efficient, efficiently fair: Lessons from designing and testing payment schemes for ecosystem services in Asia." *Ecosystem Services* 12: 16-28. doi:10.1016/j.ecoser.2014.12.012.

Loaiza, T., U. Nehren and G. Gerold. 2015. "REDD+ and incentives: An analysis of income generation in forest-dependent communities of the Yasuní Biosphere Reserve, Ecuador." *Applied Geography* 62: 225-236.

Luttrell, C., L. Loft, M.F. Gebara and D. Kweka. 2012. "Who should benefit and why? Discourses on REDD+ benefit sharing." *In* Analyzing *REDD+: Challenges and Choices*, edited by A. Angelsen *et al*., 129-152. Bogor, Indonesia: Center for International Forestry Research. http://www.cifor.org/publications/pdf_files/Books/BAngelsen1201.pdf.

Luttrell, C., E. Sills, R. Aryani, A. D. Ekaputri and M. F. Evinke. 2017. "Beyond opportunity costs: who bears the implementation costs of reducing emissions from deforestation and degradation?" *Mitigation and Adaptation Strategies for Global Change*. doi:10.1007/s11027-016-9736-6.

Magrin, G. O., J. A. Marengo, J. P. Boulanger, M. S. Buckeridge, E. Castellanos, G. Poveda, F. R. Scarano and S. Vicuña . 2014. "Central and South America." In *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by V. R. Barros, C. B. Field, D. J. Dokken, M. D. Mastrandrea, K. J. Mach, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y.O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea and L. L. White, 1499-1599. Geneva, Switzerland: World Meteorological Organization.

Marta-Pedroso, C., L. Laporta, V. Proença, J. C. Azevedo and T. Domingos. 2014. "Changes in the ecosystem services provided by forests and their economic valuation: a review." *Forest Landscapes and Global Change*: 107-137. doi:10.1007/978-1-4939-0953-7_5.

Martin-Lopez, B., I. Iniesta-Arandia, M. Garcia-Llorente, I. Palomo, I. CasadoArzuaga, D. G. D. Amo, E. Gomez-Baggethun, E. Oteros-Rozas, I. Palacios-Agundez, B. Willaarts, J. A. Gonzalez, F. Santos-Martin, M. Onaindia, C. LopezSantiago and C. Montes. 2012. "Uncovering ecosystem service bundles through social preferences." *PLoS ONE* 7 (6): e38970. https://doi.org/10.1371/journal.pone.0038970.

McAfee, K. 2015. "Green economy and carbon markets for conservation and development: a critical view."

International Environmental Agreements: Politics, Law and Economics 16 (3): 333-353. doi:10.1007/s10784-015-9295-4.

McDermott, C. L., L. Coad, A. Helfgott and H. Schroeder. 2012. "Operationalizing social safeguards in REDD+: actors, interests and ideas." *Environmental Science and Policy* 21: 63-72. http://dx.doi.org/10.1016/j.envsci.2012.02.007.

McLaughlin, P. 2011. "Climate change, adaptation, and vulnerability re-conceptualizing societal–environment interaction within a socially constructed adaptive landscape." *Organization & Environment* 24 (3): 269-291.

Millennium Ecosystem Assessment [MEA]. 2005. *Ecosystems and human well-being: Synthesis*. Washington, DC: Island Press.

Minang, P.A. and M.V. Noordwijk. 2014. "The political economy of Readiness for REDD." *Climate Policy* 14 (6): 677-684. doi:10.1080/14693062.2014.912979.

MoEF. 1999. *Committee Report: Methodology for Quantifying Intangible Benefits of Forests*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2010. *India's Forests and REDD+*. New Delhi: Ministry of Environment and Forests, Government of India. http://www.moef.nic.in/downloads/public-information/REDD-report.pdf

MoEFCC. 2015. India: First Biennial Update Report to the United Nations Framework Convention on Climate Change. New Delhi: Ministry of Environment, Forest and Climate Change. Government of India.

MOEFCC and GIZ. 2014. "The Economics of Ecosystems and Biodiversity TEEB India Initiative". *Interim Report - Working Document*. https://www.giz.de/en/downloads/giz2015-en-ecosystems-biodiversity-interim-report-india.pdf.

MOSPI. 2016. "Press Note on Estimates of Gross Domestic Product for the Second Quarter (July-September) Of 2016-17". Central Statistics Office Ministry of Statistics and Programme Implementation Government of India. http://www.mospi.gov.in/sites/default/files/press_release/nad_PR_30nov16.pdf.

Government of Madhya Pradesh. n.d. *Forests*. Bhopal: Madhyam. Accessed August 28, 2017. http://www.mp.gov.in/en/web/guest/forest;jsessionid=3C537F198EF6AAAC6581ED28B52AD428.worker2

NDC. 2015. India's Intended Nationally Determined Contribution, UNFCCC. http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf.

Ninan, K. N. and A. Kontoloen. 2016. "Valuing forest ecosystem services and disservices – Case study of a protected area in India." *Ecosystem Services* 20 (8).

Noordwijk, Meine van, Leah Onyango, Antoine Kalinganire, Laxman Joshi, Minh Ha Hoang, Nestry Ndichu, and Ramni Jamnadass. 2011. "Rural livelihoods in changing,multifunctional landscapes." In *How trees and people can co-adapt to climate change*: 37-61. https://www.worldagroforestry.org/region/sea/publications/download?dl=/bookchapter/BC0319-11.pdf&pubID=2648.

NPV Expert Committee. 2006. Report of the Expert committee on Net Present Value (Professor Kanchan Chopra Committee), Submitted to the Honourable Supreme Court of India, May.

Panchmukhi, P. R., Pushpa Trivedi, Sailbala Debi, Arun Kumar Kulkarni and Preeti Sharma. 2008. "Natural Resource Accounting in Karnataka: A Study of the Land and Forestry Sector." *Final report submitted to the Central Statistical Organization, Government of India, Centre for Multi-disciplinary Development Research, Dharwad-580004, Karnataka,*

India. http://mospiold.nic.in/Mospi_New/upload/nad10_2008_karnataka_final.pdf.

Peterson, M. J., D. M. Hall, A. M. Feldpausch-Parker and T. R. Peterson. 2010. "Obscuring ecosystem function with application of the ecosystem services concept." *Conservation Biology* 24: 113–119.

Pinho, P. F., G. Patenaude, J. P. Ometto, P. Meir, P. M. Toledo, A. Coelho and C. E. Young. 2014. "Ecosystem protection and poverty alleviation in the tropics: Perspective from a historical evolution of policy-making in the Brazilian Amazon." *Ecosystem Services* 8: 97-109. doi:10.1016/j.ecoser.2014.03.002.

Rakatama, A., R. Pandit, C. Ma and S. Iftekhar. 2017. "The costs and benefits of REDD: A review of the literature." *Forest Policy and Economics* 75: 103-111. doi:10.1016/j.forpol.2016.08.006.

Robertson, N. and S. Wunder. 2005. "Fresh Tracks in the Forest: Assessing Incipient Payments for Environmental Services Initiatives in Bolivia." Jakarta, Indonesia: CIFOR.

Sikor, T., J. Stahl, T. Enters, J. C. Ribot, N. Singh, W. D. Sunderlin and L. Wollenberg. 2010. "REDD-plus, forest people's rights and nested climate governance." *Global Environmental Change* 20 (3): 423-425. http://dx.doi.org/10.1016/j.gloenvcha.2010.04.007.

Singh, P. P. 2008. "Exploring biodiversity and climate change benefits of community-based forest management." *Global Environmental Change* 18: 468–478. doi: 10.1016/j.gloenvcha.2008.04.006, ISSN: 0959-3780.

Skutsch, M., B. Vickers, Y. Georgiadou and M. McCall. 2011. "Alternative models for carbon payments to communities under REDD+: A comparison using the Polis model of actor inducements." *Environmental Science & Policy* 14: 140–151.doi: 10.1016/j.envsci.2010.12.005, ISSN: 1462-9011.

Smith, N., R. Deal, J. Kline, D. Blahna, T. Patterson, T. Spiesand K.Bennett.2011. Ecosystem Services as a Framework for Forest Stewardship: Deschutes National Forest Overview. US Department of Agriculture, Forest Service, Pacific Northwest Research Station. General Technical Report no. PNW-GTR-852, Portland. https://www.pdx.edu/sustainability/sites/www.pdx.edu.sustainability/files/Ecosystem_Services_Forest_Stewardship.pdf.

Smith, P., M. Bustamante, H. Ahammad, H. Clark, H. Dong, E. A. Elsiddig, H. Haberl, R. Harper, J. House, M. Jafari, O. Masera, C. Mbow, N. H. Ravindranath, C. W. Rice, C. Robledo Abad, A. Romanovskaya, F. Sperling and F. Tubiello. 2014. "Agriculture, Forestry and Other Land Use (AFOLU)." In *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, edited by C. B. Field, V. R. Barros, D. J. Dokken, K. J. Mach, M. D. Mastrandrea, T. E. Bilir, M. Chatterjee, K. L. Ebi, Y. O. Estrada, R. C. Genova, B. Girma, E. S. Kissel, A. N. Levy, S. MacCracken, P. R. Mastrandrea, and L. L. White. Geneva, Switzerland: World Meteorological Organization.

Southgate, D., T. Haab, J. Lundine and F. Rodríguez. 2010. "Payments for environmental services and rural livelihood strategies in Ecuador and Guatemala." *Environment and Development Economics* 15:21-37. http://dx.doi.org/10.1017/ S1355770X09005361.

Srinivasan, S. 2015. "Economic valuation and option-based payments for ecosystem services." *Mitigation and Adaptation Strategies for Global Change* 20 (7), 1055-1077. doi:10.1007/s11027-013-9516-5.

Sukhdev, P. and J. Leigh Bell. 2012. The importance of Green Accounting. The Hindu Business Line. http://www.thehindubusinessline.com/opinion/importance-of-green-accounting/article3559301.ece.

Tubiello, F. N., A. Rahman, W. Mann, J. Schmidhuber, M. Koleva and A. Müller. 2009. "Carbon financial mechanisms

for agriculture and rural development: challenges and opportunities along the Bali roadmap." An editorial essay. *Climatic Change* 97: 3-21

Turnhout, E., A. Gupta, J. Weatherley-Singh, M. J. Vijge, J. D. Koning, I. J. Visseren-Hamakers and M. Lederer. 2017. "Envisioning REDD in a post-Paris era: between evolving expectations and current practice." Wiley Interdisciplinary Reviews: *Climate Change* 8 (1). doi:10.1002/wcc.425.

UNFCCC. 2011. Submission by India to SBSTA. United Nations Framework Convention on Climate Change. https://unfccc.int/files/land_use_and_climate_change/redd/submissions/application/pdf/india_driversdeforestationdegrdn_sbsta.pdf.

UNFCCC. 2014. Addressing methodological issues of non-carbon benefits and non-market-based approaches in REDD+. WWF's Submission to UNFCCC 40. http://unfccc.int/resource/docs/2014/smsn/ngo/411.pdf.

UNFCCC. n.d. *Views on implementing COP decisions on 'Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries'* (REDD-plus). United Nations Framework Convention on Climate Change. https://unfccc.int/files/documentation/submissions_from_parties/application/pdf/india_submission_reddplus-strategy.pdf.

Van Noordwijk M., H. L. Tata, J. Xu, S. Dewiand and P. A. Minang. 2012. "Segregate or integrate for multi-functionality and sustained change through rubber-based agroforestry in Indonesia and China." In *Agroforestry: The Future of Global Land Use,* edited by P. K. R. Nair and D. P. Garrity, 69-104. *Springer.* The Netherlands

Vardon, M., P. Burnett and S. Dovers. 2016. The accounting push and the policy pull: balancing environment and economic decisions." *Ecological Economics* 124: 145-152. doi:10.1016/j.ecolecon.2016.01.021.

Verma, M., D Negandhi, S. Mehra, R Singh, A. Kumar and R. Kumar. 2014a. *High Conservation Value Forests: An Instrument for Effective Forest Fiscal Federalism in India.* Bhopal: Indian Institute of Forest Management. June 2014. http://fincomindia.nic.in/writereaddata%5Chtml_en_files%5Cfincom14/others/28.pdf

Verma, M., D. Negandhi, A. K. Wahal, R. Kumar, G. A. Kinhal and A. Kumar. 2014b. *Revision of rates of NPV applicable for different class/category of forests.* Bhopal: Indian Institute of Forest Management. November 2014.

Vihervaara, P., M. Rönkä and M. Walls. 2010. "Trends in Ecosystem Service Research: Early Steps and Current Drivers." *Ambio* 39 (4):314-324. doi:10.1007/s13280-010-0048-x.

Villegas Palacio, C., L Berrouet, C. Lopez, A. Ruiz and A. Upegui. 2016. "Lessons from integrated valuation of ecosystem services in a developing country: three case studies of ecological, socio-cultural and economic valuation." *Ecosystem Services* 22: 297-308,doi:10.1016/j.ecoser.2016.10.017.

Vincent, J. R. 1999. "Net Accumulation of Timber Resources." *Review of Income and Wealth* 45 (2): 251-262. doi:10.1111/j.1475-4991.1999.tb00331.x.

Visseren-Hamakers, I. J., C. Mcdermott, M. J. Vijge and B. Cashore. 2012. "Trade-offs, co-benefits and safeguards: current debates on the breadth of REDD." Current Opinion in *Environmental Sustainability* 4(6): 646-653. doi:10.1016/j.cosust.2012.10.005.

WAVES. 2015. *Accounting for Forests in Himachal Pradesh Feasibility and Planning Study.* WAVES Technical report, India

World Bank Group. 2014. *Waves Annual Report 2014, Wealth Accounting and the Valuation of Ecosystem Services* (WAVES). Washington, DC: The World Bank.

Zhang, H. and E. Xu. 2017. "An evaluation of the ecological and environmental security on China's terrestrial ecosystems." *Scientific Reports*, 7 (1). doi:10.1038/s41598-017-00899-x.

FURTHER READING

CEC. 2008. Writ Petition (CIVIL) No. 202/95 & 171/96) http://mpforest.gov.in/img/files/LM2_12-25S.pdf.

CEC, IMF, OECD, UN and World Bank. 1993. System of National Accounts (SNA). Brussels/Luxembourg, New York, Paris, Washington: Commission of the European Communities-Eurostat, International Monetary Fund, Organization for Economic Co-operation and Development, United Nations and World Bank. https://unstats.un.org/unsd/nationalaccount/docs/1993sna.pdf.

Bateman, I. J., R. Brouwer, S. Ferrini, M. Schaafsma, D. N. Barton, A. Dubgaard, B. Hasler, S. Hime, I. Liekens, S. Navrud, L. De Nocker, R. Ščeponaviči□t□ and D. Sem□nien□. 2011. "Making benefit transfers work: deriving and testing principles for value transfers for similar and dissimilar sites using a case study of the non-market benefits of water quality improvements across Europe." *Environmental and Resource Economics* 50: 365-387.

Dasgupta P., J. M. Morton and *et al*. 2014. "Rural Areas." In *Impacts, Adaptation and Vulnerability, Report of the Working Group II*, *Intergorvernmental Panel on Climate Change*, edited by C. B., Barrros V. R. *et al*. Cambridge: Cambridge University Press.

Expert Committee. 2006. *Report of the Expert Committee on NPV*. Submitted to the Supreme Court of India, April, 2006.

GOI. 2015. *Report of the Fourteenth Finance Commission*. New Delhi: Ministry of Finance, Government of India. http://fincomindia.nic.in/ShowContentOne.aspx?id=9&Section=1.

Green National Accounts in India: A Framework (Report of an Expert Group convened by the Prime Minister of India. (Issued by the Government of India, April 2013). Dasgupta, P. (Chair), T. C. A. Anant, K. Basu, K. Chopra, N. Desai, H. Gundimeda, V. Kelkar, R. Kolli, K. Parikh, P. Sen, P. Shyamsundar, E. Somanathan, and K. Sundaram.http://mospi.nic.in/Mospi_New/upload/Green_Accounts_in-India-1may13.pdf.

Lu, H., E. Campbell, D. E. Campbell, C. Wang and H. Ren. 2017. "Dynamics of ecosystem services provided by subtropical forests in Southeast China during succession as measured by donor and receiver value." *Ecosystem Services* 23: 248-258. doi:10.1016/j.ecoser.2016.11.012.

Hein, L., K. Bagstad, B. Edens, C. Obst, R. de Jong and J.P. Lesschen.2016. "Defining Ecosystem Assets for Natural Capital Accounting." *PLoS ONE* 11 (11): e0164460. doi:10.1371/journal. pone.0164460.

MoEFCC. 2014. *National Working Plan Code – 2014*. New Delhi: Ministry of Environment and Forests, Government of India.

Pallavi, A. 2012. Protectors dubbed criminals. http://www.downtoearth.org.in/coverage/protectors-dubbed-criminals-38993.

UK National Ecosystem Assessment (NEA). 2011. T*he UK National Ecosystem Assessment: Synthesis of the Key Findings*. Cambridge: UNEP-WCMC.

Van Noordwijk, M., M. H. Hoang, H. Neufeldt, I. Öborn and T. Yatich. 2011. *How trees and people can co-adapt to climate change: reducing vulnerability through multi-functional agroforestry landscapes*. Nairobi: World Agroforestry Centre (ICRAF).

Chapter 10: CLEAN DEVELOPMENT MECHANISM: THE INDIAN FORESTRY EXPERIENCE

Manoj Sharma

CLEAN DEVELOPMENT MECHANISM (CDM): AN OVERVIEW

Clean Development Mechanism (CDM) was proposed in 1997 as a means to reduce greenhouse gas (GHG) emissions, but was not institutionalized until 2007 under the United Nations Framework Convention on Climate Change (UNFCCC). Essentially, developed countries pay for projects to cut or avoid emissions in developing countries, and are awarded credits (Certified Emission Reductions [CERs]) to apply to their own emission reduction targets. Emission reduction projects are defined as those that use technology development or transfers, or development, protection, and conservation of carbon sinks

Table 10.1: Types of CDM Projects and their respective CERs issued (as of February 2016)

CDM Project theme	No. of Projects	Percent (%)	CER issued (x000)
HFC, PFC, SF, & N_2O reduction	144	1.7	837,511
Renewable energy	6,065	71.3	457,374
CH4 reduction, and cement, and coal mine bed	1,291	15.2	193,711
Supply-side energy efficiency	510	6.0	81,608
Fuel switch	133	1.6	56,610
Demand side energy efficiency	267	3.1	4,447
A/R	70	0.8	11,328
Transport	32	0.4	2,401
Total	**8,512**		**1,644,990**

(forests and plantations). Emission reduction projects are more popular in comparison to the Afforestation/Reforestation (A/R) projects because of the ease in adopting as well as documenting them, and trading their CERs.

CDM is meant to work from the bottom-up. Developing countries (non-Annex-1 countries) propose emission reduction projects, which are then sent up the approval chain to the national governments.

The Kyoto Protocol defined emission reduction targets for the Annex-1 countries during the first commitment period (2008 to 2012).[1] Annex-1 countries could either reduce their inland emissions (change technology or consumption pattern) or develop opportunities of emission reduction (promote carbon sinks [e.g., plantations] or technology change), as noted above, in the Non-Annex-1 countries, as emission reduction options were cheaper in these countries. The Kyoto Protocol allows trading of carbon as a commodity. By this, developing countries could reduce their GHG emission and earn CERs, which could be traded with the developed countries (see Figure 10.1).

CERs are allocated, and each CER is equivalent to one metric ton (MT) of CO_2 with multiples assigned for converting each gas to its CO_2 equivalent, e.g., 1 MT of Methane = 21 MT

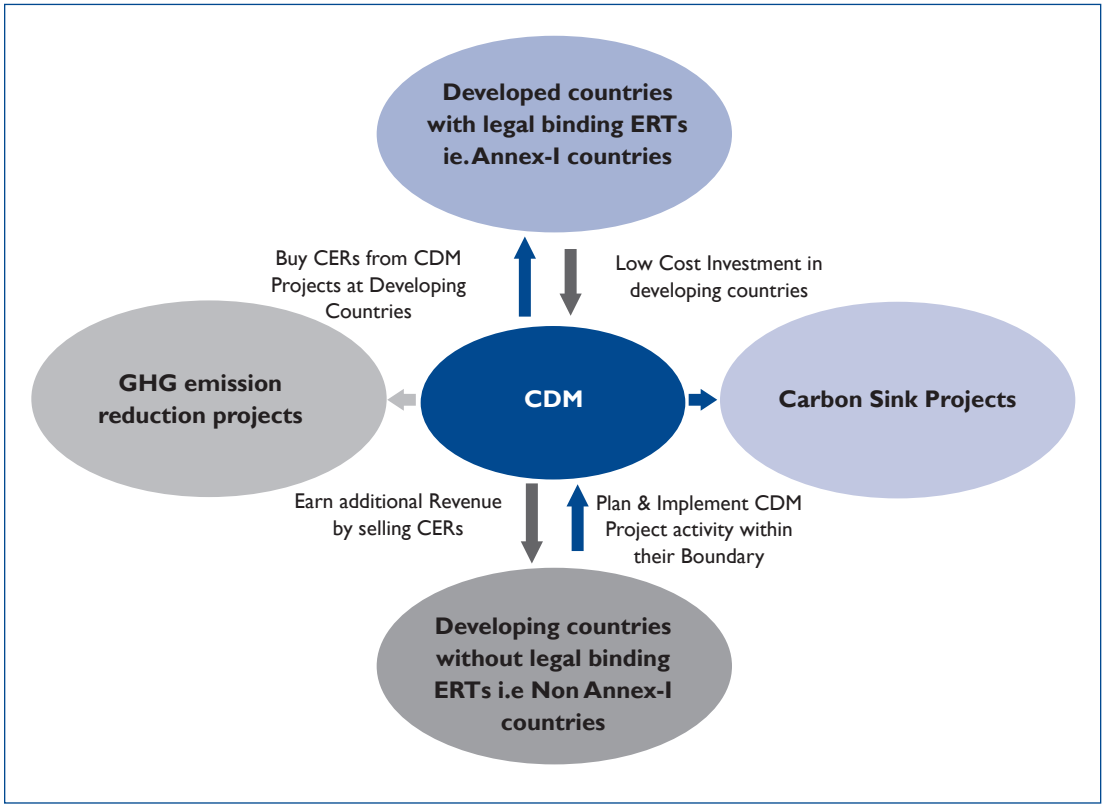


Figure 10.1: Mechanism of CDM

of CO_2, and 1 MT of SF_6 = 23,900 MT CO_2 (see Table 10.2). The mechanism stimulates sustainable development and emission reduction, while giving industrialized countries flexibility in how they meet their emission reduction limitation targets.

UNFCCC and third-party validators are involved in this process as facilitators to ensure fair carbon trading.

Prior to CDM, the original proposal was to create a Green Development Fund with financial support from Annex-1 countries to support mitigation projects in developing countries. This fund was endorsed by the G77[2] and China, but was strongly opposed by developed countries, who viewed it as a penalty. Developing countries also opposed the possibility of any mechanism that would assist developed countries to offset their commitments through emission reduction projects in developing countries, instead of creating carbon sinks.

Although CDM was essential, and a well-planned program for GHG abatement, it has had mixed responses in different phases. Initially, efforts were slow to convert CDM ideas into practice. As the momentum increased, the potential for reduction of emissions through CDM-type activities became apparent across the globe. Globally, Joint Implementation Projects between industrialized countries generated Emission Reduction Units (ERUs) that became more popular than CDM. In the last leg of the first commitment period, the third of the "Kyoto flexibility mechanisms" (Intergovernmental Emissions Trading) started as the Green Investment Scheme. This is by far the simplest mechanism; however, its growth is below expected levels.

Table 10.2: Global Warming Potential of GHG

GHG	Sources	Global Warming Potential (In MT CO_2)
Carbon dioxide (CO_2)	Fossil fuel combustion, deforestation, agriculture	1
Methane (CH_4)	Agriculture, land use change, biomass burning & land fills	21
Nitrous oxide (N_2O)	Fossil fuel combustion, agriculture, industrial	310
Hydrofluorocarbons (HFCs)	Industrial / manufacturing	1300
Perfluorocarbons (PFCs)	Industrial / manufacturing	3260
Sulfur hexafluoride (SF_6)	Electricity transmission, manufacturing	23900

Source: Global warming potential https://www.ec.gc.ca/ges-ghg/default.asp?lang=En&n=cad07259-1

BRIEF OVERVIEW OF THE PROGRESS OF CDM ACROSS DIFFERENT SECTORS (INTERNATIONAL)

The Kyoto Protocol was an important initiative towards global emissions reduction. However, this initiative was hindered by the United States' refusal to participate, and strong arguments raised by India and China on behalf of the developing countries. These hurdles significantly reduced the impact of the protocol on global warming.

India and China hosted 29 percent and 56 percent of all the CDM projects respectively, but most CERs were generated from China due to a greater number of CDM projects registered from the country (72.7 percent). Similarly, Brazil and Mexico were the most active leaders – raising 34 percent and 18 percent of the CDM projects, respectively. Brazil and Mexico received 45 percent and 17 percent of the CERs in Latin America for their efforts, respectively. The maximum number of CDM projects were registered from the Asia-Pacific and Latin American regions, comprising 95 percent of the total number of the projects. The Asia-Pacific region had 6,972 (82 percent) and Latin America had 1,101 (13 percent) of the total 8,512 CDM projects in 2016. Further, economic impact of the Protocol on industries was another key issue surrounding its adoption (Shailesh 2011a and 2011b).

The Kyoto Protocol provided the flexibility to deal with possible short-term economic impacts. Regions and countries that may be impacted by weather change and sea-level rise might have room in their emission targets "portfolios," and may benefit financially from being able to sell emissions credits to other nations.

During the first commitment period (2008-2012), 1,645 million CERs (mCERs) were issued, with the total issuance in the period 2013-2020 expected to be 4,080 mCERs.

The Paris Climate Change Agreement (December 12, 2015) concentrated on public-private partnerships to encourage the green economy; focusing implementation on new game-changing technologies to reduce costs on sustainable practices for a low-carbon and resource-efficient world.

Initially, most of the technology-related emission reduction projects were being automatically registered for CERs. Due to uncertainty in the CDM methodologies, however, the number of registered projects for CERs declined from 92 percent in 2005 to 31 percent in 2008. The system improved and in 2012, 94 percent were again registered automatically, showing a similar trend to that observed following the Kyoto Protocol. The current status of automatic registration of projects for CERs is 98 percent. (see Figure 10.2).

Article 11a of Directive 2003/87/EC provides for operators to exchange CERs against allowances. Use restrictions on CERs from industrial gas projects and projects registered after 2012 from non-Least Developed Countries as well as the legal possibility for similar restrictions, have reduced CER rates.

Qualitative restrictions by EU's Emissions Trading System on CERs' use (apart from visible oversupply of CERs) resulted in a drastic fall in the number of new CDM projects in 2013, and the sharp decline in CER prices from €20 in 2008 to €0.40 in 2013.[3]

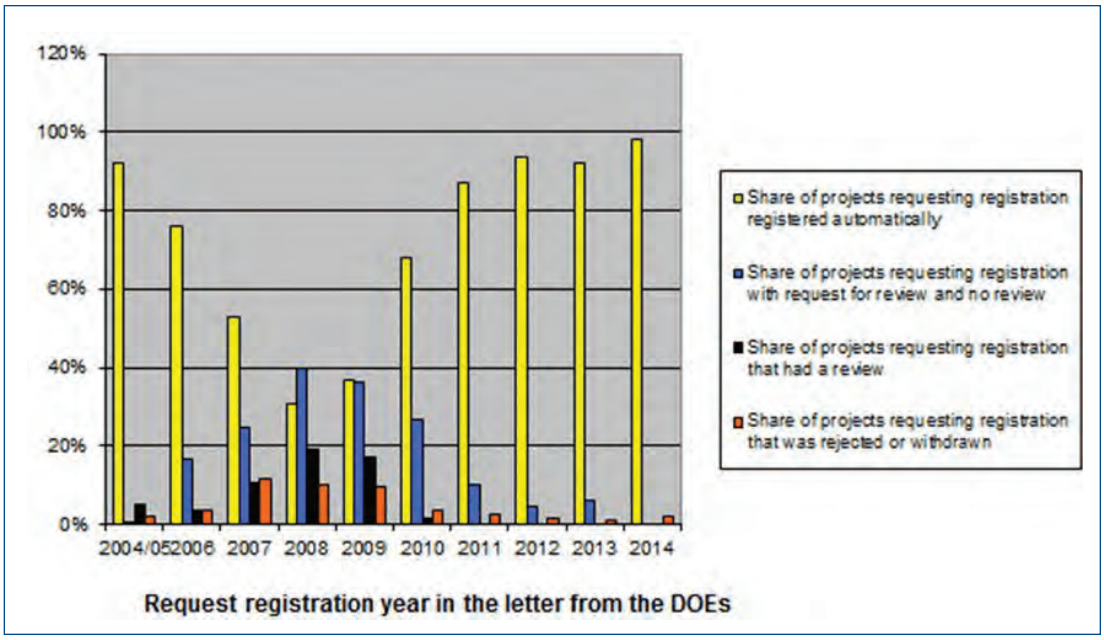


Figure 10.2: Status of CDM Project requests over time

Positive signals in CDM market (the Durban decision to extend the Kyoto Protocol), as well as negative signals and new initiatives such as the Sectoral Crediting Mechanism have further intensified confusion over the future of CDM market.

BRIEF OVERVIEW OF THE PROGRESS OF CDM ACROSS DIFFERENT SECTORS (INDIA)

India has been proactive in CDM since it signed the Kyoto Protocol on August 26, 2002. However, India's approach to CDM has been a *laissez faire* system that neither actively promoted nor discouraged CDM projects (Benecke 2009; Sirohi 2007). On the other hand, China´s national policy prioritized investment in CDM projects such as in the renewable energy sector (Schroeder 2009).

India, like Brazil and China, used CDM to help reduce their carbon emissions, as well as to host a variety of CDM projects. India registered a total of 2,295 projects – around a quarter of the global total – from 2003 to 2011, second only to China. India could have benefitted from this opportunity more fully if a national policy had been made to that effect. The primary sectors eligible for CDM are renewable energy, fuel switching, energy efficiency improvements, reduction of CH_4 emissions in agriculture, heat waste recovery in industrial processes, and carbon sink projects (afforestation and reforestation).

Sustainable development is the ultimate objective of the CDM agenda in developing countries, but achievement is uncertain. CDM projects were restricted in India due to the following:

- Baseline establishment was difficult
- CDM consideration denied
- Weak arguments for proving technical and financial additionality[4]
- Weak evidence for establishing technical innovativeness of the project;
- Validation report statements not conforming the additionality and CDM consideration in depth
- Lack of information available in public domain:
  - Data availability to demonstrate additionality, or
  - Data availability to demonstrate first-of-its-kind (common practice analysis)
- Lack of control on the processes of GHG emission reduction:
  - Quality assurance & quality control procedures, or
  - Monitoring methods
- Scarcity of competent project developers and validators
- Continuous evolving process of CDM registration
- Extended and unexplained time gaps between various stages of CDM projects.

Eight projects in the energy and manufacturing sectors were rejected for one or more of the following reasons:

- Their additionality barriers were not adequately substantiated,
- the methodology was not correctly applied,
- a valid methodology was not applied, or
- modification in methodology was not requested as a deviation.

Thus, a technical expert became essential for documentation.

Apart from these, the lack of mechanisms for monitoring and evaluating the proposed benefits, as well as addressing grievances, averted people's support to CDM projects (e.g., the Sasan coal power project in Singrauli, Madhya Pradesh faced disagreements from the local community).

Brief overview of the progress of CDM projects in the forestry sector (International)

A significant amount of deforestation occurs in many non-Annex I countries. Some of these countries started massive afforestation and reforestation programs that were put in place well before the UNFCCC and Kyoto Protocol came into being. These A/R activities were undertaken by both public and private bodies, with public and private funding, for economic, energy, and environmental reasons. These policies offset carbon losses from deforestation to varying degrees; and include establishing new forest plantations (as well as other activities such as forest regeneration, establishing non-forest plantations, etc.). A/R CDM projects had a similar framework, financial arrangements, additionality, and leakages, globally.

The first transaction for CO_2 emission mitigation took place in the early 1990s, in anticipation of changes to environmental legislation. These were voluntary in nature. Similarly, in 1995, the Joint Implementation Program were conducted with the objective of establishing protocols and experiences, but without allowing carbon crediting between developed and developing countries. However, the Kyoto Protocol (1997) introduced binding commitments to emission reduction as well as the use of "flexibility mechanisms" for

facilitating the achievement of these GHG emission reduction targets. Early in 2000, the World Bank launched two additional carbon funds that included land-use-based activities: The Bio Carbon Fund (BCF) and the Community Development Carbon Fund. At the seventh session of the Conference of the Parties (COP 7), held from October 29 to November 10, 2001 in Marrakech, Morocco, it was decided that only A/R activities would be allowed under CDM. However, no other rules were established for projects in the forestry sector. As of October 2006, the BCF signed Emissions Reduction Purchase Agreements with seven CDM reforestation projects, totaling to 2.5 mCERs. Kyoto Protocol and the Marrakech Accords, apart from including the implementation of land use, land use change, and forestry (LULUCF) activities, had also contributed to the conservation of biodiversity and sustainable use of natural resources.

Restricted global scenario of CDM

Withering Additionality

- Globally, the CDM projects had wide variations in almost all aspects of the projects.
- The scale of GHG benefits from different projects varied from single large-scale project activities (e.g., Plantar, Peugeot projects), to small-scale projects that were "bundled" together under a single umbrella (e.g., Guaraqueçaba, Scolel Té).
- The biodiversity aspects of various project activities also differed markedly. Many activities examined were dominated by A/R activities in plantations of one or two species (e.g., Romania, SaskPower, Plantar) that were not always native (e.g., Plantar).
- The commercial nature of project activities also differed. In some projects, commercial activities were initiated because of the availability of carbon credits (e.g., SaskPower, V&M, Kilombero). Some project activities aimed at promoting carbon sequestration and sustainable LULUCF practices by local, small-scale farmers (e.g., Guaraque çaba, Scolel Té). Still, some projects were purely environmental projects, not seeking either financial or GHG-credit returns (e.g., Peugeot).
- In some of the early projects, particularly those undertaken as part of the U.S. initiative on joint implementation, not all costs were reported, which means costs per ton of CO_2 were underestimated.
- Globally, the potential carbon sequestration costs varied from USD 5.8/t CO_2 for reforestation in the Scolel Té project to USD 68/t C (USD 249/t CO_2) in the Sumitomo reforestation and forest regeneration project in Indonesia.

CDM Markets after 2012

Globally, the CDM market is down. Uncertainties in locating fresh markets post-2012 curbed the enthusiasm for investment in CDM projects in developing countries.

Financial Health of CDM projects

The forestry business (regardless of CDM) has the following characteristics that pose limitations to investors:

- High upfront investment in land, manpower, site development, and planting
- Delayed returns on investment depending on species, weather, and ecology during project duration

- Low rates of return for low investment, poor markets, and restrictive harvest regime
- High perceived risks due to local ecology, biotic pressure, and social pressures
- Investment decisions for reasons beyond business, such as local livelihood development, ecological restoration, and infrastructure development

The A/R CDM projects usually had a long gestation period, and a marginal Internal Rate

Table 10.3: IRR from selected draft Project Design Document (PDDs) submitted along with new proposed methodologies

Project name	Country	IRR w/o CERs	IRR w/o CERs	Considered CER price	Considered time frame
Moldova soil conservation project https://cdm.unfccc.int/Projects/DB/SGS-UKL1216031019.22/view	Republic of Moldova	4.2%	5.8%	USD 3.5	100 years
Facilitating reforestation for Guangxi watershed management in Pearl River Basin, China https://cdm.unfccc.int/Projects/DB/TUEV-SUED1154534875.41/view	China	8.4%	15.8%	USD 3	20 years
The Mountain Pine Ridge reforestation project https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0013	Belize	< 15%	> 15%	NA	NA
"Treinta y Tres' afforestation combined with livestock intensification" http://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0004	Uruguay	10.8%	NA	NA	30 years
Rio Adquidaban Reforestation Project (RA) http://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0009	Paraguay	8%	11.5%	USD 15	24 years
Kikonda forest reserve reforestation project https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0008	Uganda	7.6%	14%	USD 5	24 years

Project name	Country	IRR w/o CERs	IRR w/o CERs	Considered CER price	Considered time frame
"Los Eucaliptus" afforestation project https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0016	Uruguay	8.4%	10.%	USD 3.5	52 years
Mexico Seawater forestry project https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0017	Mexico	11.9%	12.9%	USD 3	20 years
Afforestation for combating desertification in Aohan County, Northern China https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0020	China	4.1%	13.8%	USD 3	20 years
Carbon sequestration in small and medium farms in the Brunca Region, Costa Rica (COOPEAGRI Project) https://cdm.unfccc.int/Projects/DB/AENOR1349188271.57/view	Costa Rica	14.4%	21%	USD 3.8	20 years
'Treinta y Tres' afforestation on grassland https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0027	Uruguay	10.3%	12.5%	NA	20 years
Reforestation on degraded land for sustainable wood production of woodchips in the eastern coast of the Democratic Republic of Madagascar https://cdm.unfccc.int/methodologies/ARmethodologies/pnm/byref/ARNM0028	Madagascar	5.1%	10%	USD 10	30 years

Source: Neeff and Henders 2007

of Return (IRR) in the absence of income from CERs (see Table 10.3). Thus, this led all CDM projects to make adjustments by aligning themselves with national priorities, business interests, and ecological opportunities.

Views of Corporates for making fresh investment in CDM projects

Corporations have a cynical approach toward CDM projects. CER prices are no longer a decisive factor in investment decisions. CDM projects mandate an enormous amount of compliance documentation primed through accredited consultants, and need a minimum of two years for an investment and gestation period. As a result, the project developer requires support for investment. It can be concluded that corporations also require a less cumbersome CDM registration process and seek clarity on the 2nd commitment period of Kyoto Protocol.

DETAILS OF FORESTRY CDM PROJECTS IN INDIA – COMPLIANCE / MANDATORY MARKET

Sequestration Capacity of Indian Forests

Development Alternatives, an Indian non-governmental organization (NGO), assessed the CO_2 sequestration capacity of Indian forests up to the year 2000, and recorded that the annual production of stem wood in the country varied from 26 million m^3 to 32 million m^3, with a 30 million m^3 annual production of stem. The unrecorded annual fuel wood production was 22 million m^3, making the average annual wood production 52 million m^3. The same study also mentioned that 1 m^3 of stem wood was equivalent to 2.3 m^3 of total biomass (stem, roots, branches, etc.) that absorbs 0.26 tons of carbon (tc). Thus, annual biomass production in Indian forests (52 million m^3) sequesters approximately 31 million tc (mtc) CO_2. Another estimate reveals 6.24 tc/ha/yr carbon sequestration (Sedjo1989). The total annual sequestration capacity of Indian forests works out to be 399 mtc (1,479 million tons of CO_2 emissions) which is practically 10 times more than the sequestration capacity computed by taking the total volume of biomass (31 mtc). The total CO_2 emissions from fossil fuels recorded in 1989-1990 was 152.9 mtc. Indian forests present opportunities not only for carbon sinks, but also for biological diversity and CDM forestry projects.

CDM in Indian Forestry sector

India registered a significant number of CDM projects, primarily due to diversity in projects, availability of skilled people, and ease of permissions from national authorities. However, the forestry based A/R projects were dismal. In spite of the large potential for forestry projects in India, only a few could be registered, and could hardly yield any ecological or commercial benefits. A review of the forestry-based CDM projects in India yields several lessons:

- A/R type projects that included small-scale agroforestry projects, social forestry projects, and commercial monoculture plantation projects, started falling out soon because of technical, social and management reasons.
- It was difficult to assure buyers from the Annex-I Countries due to the problem of permanence of forestry projects.

- Several project developers in developing countries found the language of the CDM protocol confusing.
- The baseline determination was site-specific.

The Ministry of Environment, Forest and Climate Change (MoEFCC) is the nodal agency for CDM projects in India. However, the MoEFCC approved most projects, including some which did not comply with the CDM protocols, probably due to the paucity of resources.

Overall, the forestry-based A/R options suffered in India due to the lack of transparency (among government, project proponent, and international bodies), as well as cheaper options available for developed countries to buy carbon credits. Poor performance by government authorities in the regulating the sector or in protecting stakeholder benefits contributed to the projects' failures.

Carbon Trading in India

India is one of the largest beneficiaries of the world carbon trade through CDM, making it a preferred location for carbon credit buyers. Carbon credits are traded on the Multi Commodity Exchange of India Ltd, but it still does not have a proper carbon trading policy. A Forward Contracts (Regulation) Amendment Bill has been introduced in the Indian Parliament to promote National Commodity and Derivatives Exchange as a platform for the trade of carbon credits. However, an additional statute may be needed as the Indian Contracts Act may be insufficient to govern contractual issues related to carbon credits.

In the CDM forestry scenario, India has 7 out of 39 registered projects worldwide constituting 18 percent of the total projects (see Annexure 10.4). Majority of these projects failed validation because of the high opportunity costs of land as well as labor, and delayed and low benefits. Indeed, a significant number of farmers have withdrawn their private lands from the respective projects in Haryana and Tamil Nadu. The land consolidation scenario was different in the CDM projects of Himachal Pradesh, where a few farmers actually developed plantations on their private lands.

These experiences raised doubt over people's participation in further ambitious forestry programs such as Green India Mission, and Reducing Emissions from Deforestation and Forest Degradation (REDD+) under the National Action Plan on Climate Change (NAPCC). Strategies and governance of A/R CDM projects need to be addressed if forest management is to be financed through markets in the form of carbon forestry programs. More importantly, forestry CDM projects need to assure the security of farmer's livelihoods.

DETAILS OF FORESTRY CDM PROJECTS IN INDIA – VOLUNTARY MARKET

The voluntary carbon market is a commodity market dealing in "reduced emissions," measured by verification standards and sustainable development guarantees. The voluntary market facilitates transactions as small as offsetting emissions from an individual's air travel. Parties have similar incentives as that of the CDM market but avoid lengthy procedures and higher costs of CDM projects. Both seller and buyer maximize their credits

from a Verified Carbon Standard (VCS) project. However, the Voluntary Reduction Market is minimally regulated and thus called a "buyer-beware" market, criticized for the quality and "additionality" of the offsets traded.

VCS projects cover all sectors and sizes including A/R, energy efficiency, transport, and waste management. VCS is among the most widely used agriculture, forestry, and other land use sector (AFOLU) standard. Voluntary Carbon Unit (VCU) credits represent GHG emission reductions that are real (already happened), measurable (have a known methodology), additional (exceed business as usual scenarios), permanent (crop lasts until rotation), independently verified (by VCS), conservatively estimated (lower side estimates), uniquely numbered, and transparently listed (registered with designated body).

The Climate, Community and Biodiversity Standards (CCB Standards)

The Climate, Community & Biodiversity Alliance (CCBA) is a unique partnership of leading international NGOs that was founded in 2003 with a mission to stimulate and promote land management activities that credibly mitigate global climate change, improve the well-being and reduce the poverty of local communities, and conserve biodiversity. The CCB Standards were developed by CCBA. Apart from evaluating land management projects, the CCB Standards identify projects that simultaneously address climate change, support local communities and smallholders, and conserve biodiversity; promote excellence and innovation in project design and implementation; and mitigate risk for investors, offset buyers and increase funding opportunities for project developers. The six Indian projects out of 119 VCS (forestry) projects worldwide are presented in Table 10.4, and described below.

Project 1: India Sunderbans Mangrove Restoration, 2015
http://www.vcsprojectdatabase.org/#/project_details/1463
This reforestation project was a community initiative aiming to provide a new financing mechanism to overcome the current barriers to contribute positively to wetland restoration through mangrove reforestation in a multi-species environment and to allow communities to benefit from the carbon market. An important insight through all of these dimensions is that no single concept of "community" can be universally applied: the connections among stakeholders and others are never as clear as one assumes them to be (https://factsreports.revues.org/2134)

Project 2: Araku Valley Livelihood Project, 2014
http://www.vcsprojectdatabase.org/#/project_details/1328
Various horticultural tree species and shrubs were to be planted on 6,024 ha in this VCS A/R project activity over a three-year project rollout period. The different species' groups of the proposed A/R activity comprise horticulture trees, teak, bamboo, and various indigenous trees. After a tree establishment phase (approximately three years), coffee will be planted under shade on 3,000 ha.

The planting area is located on degraded land with very low plant cover (around 60 percent of the land is classified as barren). The horticultural tree planting will sequester carbon and generate additional income by turning this

Table 10.4: Six Indian VCS Projects

Project ID	Project Name	Project Proponent	Country	Sectoral Scope	Estimated Annual Emission Reductions	Additional Certifications
1463	India Sunderbans Mangrove Restoration	Livelihoods Fund	India	AFOLU	51,249	
1328	Araku Valley Livelihood Project	Livelihoods Fund	India	AFOLU	80,660	
1015	Community-based reforestation project on degraded lands in Uttar Pradesh, India by Indian Farm Forestry Development Co-operative Limited	Indian Farm Forestry Development Co-operative LTD	India	AFOLU	5,651	
994	TIST Program in India, VCS 001	Clean Air Action Corporation	India	AFOLU	11,047	CCB Standards Second Edition - Verified
922	Plantation Project on wastelands by Sun Plant Agro Limited	Sun Plant Agro Limited	India	AFOLU	1,708	
689	Reforestation of degraded land in Chhattisgarh, India	Prakash Industries Limited	India	AFOLU	5,007	CCB Standards First Edition - Verified

degraded, low carbon land into a high carbon site.

Project 3: Community-based reforestation project on degraded lands in Uttar Pradesh, India by Indian Farm Forestry Development Co-operative Limited, 2013

http://www.vcsprojectdatabase.org/#/project_details/1015

Wastelands in India are a significant resource on which many rural people depend for food, fodder, and fuel wood. This project provides an opportunity for the rural poor to restore

degraded lands and improve their living conditions. Indian Farm Forestry Cooperative Limited has implemented the project in the districts of Allahabad, Sultanpur, Pratapgarh, Unnao, and Lucknow of Uttar Pradesh since July 15, 2008, covering an area of about 222 ha. The project has assisted farmers, especially women, to promote plantations on wasteland and marginally productive lands by organizing primary farm forestry cooperatives – thus, making it a participatory program. Project activities help in improving soil and water conservation and bringing about ecological balance, and generate consistent employment for the rural poor, and thus, help them in their socio-economic development.

Project 4: The International Small Group and Tree Planting Program (TIST) in India, 2013
http://www.vcsprojectdatabase.org/#/project_details/994
This is a VCS grouped project and a subset of the TIST reforestation project in India, comprising 452 small groups, 2,599 members, 924 project areas, and 671.8 ha. The groups are registered in the TIST program and are working to break their local cycle of deforestation, drought, and famine. The trees planted in land parcels are beginning to reduce erosion, stabilize and enrich the soil, and will soon be providing shade.

Project 5: Plantation project on wastelands by Sun Plant Agro Limited, 2012
http://www.vcsprojectdatabase.org/#/project_details/922
Sun Plant Agro Limited, a pioneer in commercial plantation activities in the north-eastern region of the state of Bihar, has initiated a project for rehabilitation of 384 hectares of degraded, fallow land by adopting a commercial plantation model with trees like *Gmelina arborea*, *Anthocephalus cadamba*, *Dalbergia sisoo*, *Bombax ceiba*, *Albizzia lebbeck*, *Eucalyptus*, *Jatropha* etc. The plantation sites are located in the districts of Kishanganj, Araria, Supaul and Purnea in the state of Bihar and Madhupur district in the state of Jharkhand. The plantation sites in Bihar are located within the geographical confines of the Mahanadi and Kosi river basins, on barren privately owned lands. The project sites are located in districts which are in some of the most backward regions in India with respect to various human development indicators, thus amplifying the importance of the plantation activities as a source of employment and economic progress in the project areas.

Project 6: Reforestation of degraded land in Chhattisgarh, India, 2011
http://www.vcsprojectdatabase.org/#/project_details/689
The land to be reforested under the project activity was degraded. Land conditions did not permit the arrival and establishment of forest propagules. The project area is a revenue area, obtained from the villagers and secluded from forest lands. The lands under the project activity are locally known as Bhata lands, with poor water-holding capacity and no vegetation, prone to wind and water erosion. Major purposes of the project activity are to:

- Enhance carbon sink through reforestation
- Reclaim the degraded land in a sustainable manner
- Reduce pressure on natural forests of the region
- Uplift the socio-economic status of the native rural population

Common peculiarities among all VCS (A/R) projects

- All projects are intensive wasteland and land-use-based A/R projects.
- They are community centric (i.e., strongly people-oriented projects).
- Livelihood management is the core objective.
- They are governed by commercial organization(s).
- They are long-term projects.
- They are process / technology driven.
- They employ unique project modeling.
- The projects are small and marginal stakeholder-centric.

ANALYSIS OF THE CDM EXPERIENCE IN INDIAN FORESTRY SECTOR & LESSONS FOR REDD+

Reducing emissions from deforestation and forest degradation, as well as promoting conservation, sustainable management of forests, and enhanced forest carbon stocks (REDD+) is a voluntary initiative established under the UNFCCC. Its goal is to create financial incentives for developing countries to reduce forest-related GHG emissions, provided the rights of local communities are respected with a gender-sensitive approach that protects the environment. The UNFCCC's Cancun Agreement explicitly named five activities comprising REDD+, that:

- Reduce emissions from deforestation
- Reduce emissions from forest degradation
- Conserve forest carbon stocks
- Sustainably manage forests
- Enhance forest carbon stocks

Forests are important carbon sinks that absorb 2.6 billion tons of CO_2 each year – about one-third of the CO_2 released from the burning of fossil fuels. The current rate of deforestation accounts for nearly 20 percent of all GHG emissions – more than the world's entire transport sector. Forests, besides being carbon sinks, regulate water ways, protect soil, and cool the Earth's surface. Indian forests have a vast carbon sequestration potential (see Section 10.4.1, Sequestration Capacity of Indian Forests).

Deforestation and forest degradation in India – Implications for REDD+

Contrary to the general perception, analysis shows that India is currently experiencing deforestation as well as forest degradation. According to the latest assessment by the Forest Survey of India (FSI), the net annual loss of forests is estimated to be 99,850 ha during the period 2007-2009, even though the total area under forests has increased. The specific elements of REDD+ readiness activities that India needs to work on are:

- The national REDD+ strategy;
- a Monitoring, Reporting, and Verification (MRV) system;
- a strong Reference Emission Level; and
- a system for monitoring safeguards.

However, much work needs to be done on some key aspects, such as scale, sourcing financing, RELs, safeguards, and MRV systems as shown in Table 10.5.

Table 10.5: Unresolved aspects of REDD+ Program

Issues	Unresolved (Post-Cancun Agreement)
Scope and scale of REDD+	Exact definition of activities remains unclear.
Drivers of deforestation	Exact scope of drivers in terms of proximate and underlying drivers of deforestation and degradation have not been specified. The Cancun Agreement does not clearly specify the nature of activities linked to drivers of deforestation and degradation.
MRV for safeguards	Timing and frequency of submission of the first and subsequent summary of information on safeguards is yet to be decided. Subsidiary Body for Scientific and Technological Advice (SBSTA) also has to be considered if more guidance about information on safeguards is needed to ensure transparency, consistency, comprehensiveness and effectiveness.
Financing REDD+	There is a lack of clarity on the use of market or non-market approaches for funding REDD+ actions.
Methodological issues	MRV modalities remain largely unclear.

CDM experience in the Indian forestry sector

A/R is a complex category of CDM projects, with only 28 registered projects across the globe. Out of these 28, five projects are from India. The number of registered A/R projects are low primarily due to confusion over methodologies and extensive additionalities. There are seven small-scale methodologies, 11 large-scale methodologies, and two consolidated methodologies for developing carbon credit projects in the A/R scope. Even the forests, in the CDM context, are areas covered with wooden species for a minimum of 10-30 percent crown cover, having a minimum height 2-5 m, and minimum area 0.05 ha to 1.00 ha. All national governments have to opt for a specific CDM forest definition within these margins. India has decided to accept any single tree canopy with 15 percent tree cover standing over 0.05 ha with trees having a minimum 2 m height as suitable for a CDM project.

A/R CDM projects are unique because they cannot be developed on land that is already covered with forests (or it can be said that the land area which comes under the definition of forest opted by the host country). Agroforestry only qualifies if the proposed project activity results in conversion of long-term non-forest land to forests. Enrichment plantations / agroforestry cash crops / forest conservation measures do not qualify under the modalities and procedures for CDM. (see Annexure 10.5).

Although India has traditionally been characterized as a Low Forest/Low Deforestation country, the analysis suggests that there is significant deforestation and forest degradation occurring in the country. Consequently, there is significant potential for REDD+ activities in India.

RECOMMENDED SET OF GUIDELINES FOR FIELD PRACTITIONERS OF REDD+ / ECOSYSTEM APPROACH TO FOREST MANAGEMENT

Environmentalists, A/R project developers, and Designated National Authority (DNA), and all other concerned parties should reinitiate efforts for real mitigation of climate change via increased carbon sinks. Urgent efforts are needed to raise funds for CDM A/R projects for which all authorities and corporations should:

- Think globally and act locally to pool in funds
- Work together honestly as a team to win
- Appreciate each other's honest field efforts
- Identify projects/capable project implementers
- Restrict paperwork and reporting, instead act in the field

The following may help facilitate use of CDM projects:

- Create country-specific "Carbon Fund" and Carbon Credit information cell.
- Simplify coordination and procedures.
- Intensify local capacity building and increase availability of national experts.
- Develop country/state/sector-specific methodologies involving research organizations.
- Rationalize complex timber felling regimes and timber transit rules.
- Create a CDM policy cell with the federal government.
- Support biomass energy planting projects/ fuel structure projects.
- Initiate model pilot CDM projects by the DNA, and support different stakeholders.
- Make data available regarding eligible land for CDM A/R project in a spatial domain.

All of the DNA functions pertinent to CDM activities should take a more proactive role by adopting the following tasks:

- Re-evaluate requirements for CDM applicability before accepting and establishing a CDM project. Provide policy guidance on development of CDM A/R projects.
- Initiate model pilot projects in collaboration with different stakeholders.
- Develop a capacity-building initiative at federal/state level.
- Ensure that all information required for demonstrating the existence of a CDM project is available and transparent.
- Simplify the process, so that project developers can complete the process of CDM validation in minimum time.
- Reply to the enquiries by project proponents in a timely manner.
- Stay updated on the latest developments and develop an understanding of the basic intent of the Kyoto Protocol.
- Facilitate market survey and guidelines for negotiation/trading.
- Keep evidence of relevant communications, demonstrate consistency in approach.
- Continue to learn and improve.
- Select consultants and Designated Operational Entities (DOE) based on their competence.

Key Recommendations for REDD+: The following seven recommendations consolidate key CDM issues raised in the previous sections.

They are covered broadly in two phases to assess national legal frameworks:

Phase I: Information integration

In this phase, gather information/inputs on laws, regulations, policies, institutions, and data related to forests and forest governance

- Recommendation 1: Identify relevant components of the international legal and policy framework for national-level REDD+ implementation.
- Recommendation 2: Identify relevant stakeholders using a transparent, gender-sensitive and participatory process, and pay particular attention to indigenous people, forest-dependent communities, and local communities.
- Recommendation 3: Gather baseline data and mapping information.
- Recommendation 4: Identify relevant components of the national legal framework.

Phase II: Assessment

This phase aims to assess whether the existing national legal framework is consistent with international law and best practices related to REDD+. It is essential to have a good understanding of the international instruments a country is seeking consistency with the existing national legal framework as it relates to forests; and baseline information on forests, forest users, and land use plans.

By using the information collected, practitioners should assess the extent to which the existing legal framework can be used to support REDD+ implementation. It will be for practitioners (or respective DNA) to determine the changes needed, and mechanisms to achieve them.

- Recommendation 5: Assess existing legal framework to identify any overlaps in definitions, land use plans, law enforcement, and jurisdictions.
- Recommendation 6: Assess whether the legal framework is consistent with international obligations regarding REDD+ implementation. (Note that there is a broad range of relevant international instruments, and that this assessment will vary depending on those instruments. Use the instruments identified as part of Recommendation 1.)
- Recommendation 7: Assess whether the legal framework supports delivery of multiple benefits and equitable benefit sharing.

No universal legislative formula fits the requirements of all developing countries. Combinations of the legal approaches that may be suitable include implementing REDD+ through established legal frameworks; building on existing law and engaging in specific legislative reforms (both short and long-term) as necessary; enacting new legislation for REDD+; and/or where there are gaps in enforcement of existing laws, strengthening institutional mandates and capacities. Eventually, it will be for each country to determine which aspects of their national legal frameworks require changes and how best to effect those changes.

It may be undoubtedly concluded that the positives of forestry CDM projects outweigh the negatives. A developing country like India could benefit immensely from this market-based mechanism, provided it can negotiate more effectively in international carbon markets.

REFERENCES

Benecke, G. 2009. "Varieties of Carbon Governance: Taking Stock of the Local Carbon Market in India." *Journal of Environment and Development* 18 (4): 346-370.

Neeff, T., and S. Henders. 2007. *Guidebook to markets and commercialization of forestry CDM projects*, Serie técnica. Manual técnico no. 65, 42. Turrialba, Costa Rica: Centro Agronómico Tropical de Investigación y Enseñanza.

Sirohi, S. 2007. "CDM: Is It a 'Win-Win' Strategy for Rural Poverty Alleviation in India?" *Climatic Change* 84 (1): 91-110.

Schroeder, M. 2009. "Varieties of Carbon Governance: Utilizing the Clean Development Mechanism for Chinese Priorities." *Journal of Environment and Development* 18 (4): 371-394.

Sedjo, R.A. 1989. "Forest to offset the Greenhouse Effect." *Journal of Forestry* 87 (7): 12-15.

FURTHER READING

Ghosh, S. and S.K. Sahu. 2011. *The Indian Clean Development Mechanism: Subsidizing and Legitimizing Corporate Pollution, An Overview of CDM in India with Case Studies from various sectors*. National Forum for Forest people and Forest Workers with Siliguri, West Bengal: North Eastern Society for the Preservation of Nature and Wildlife and Kolkata, West Bengal: Society for Direct Initiative for Social and Health Action.

Gillenwater, M. and S Seres. 2011. "The clean development mechanism: a review of the first international offset program." Prepared for the Pew Center on Global Climate Change.

Lecocq, F. 2007. "The Clean Development Mechanism: History, Status, and Prospects." *Review of Environmental Economics and Policy* 1 (1): 134–151.

Grubb, M. 2003. "The Economics of the Kyoto Protocol." *World Economics* 4 (3):143-189.

OECD and IEA. 2003. *Forestry projects: lessons learned and implications for CDM modalities*. Paris: Organization for Economic Co-operation and Development Environment Directorate and International Energy Agency.

Ravindranath, N. H., N. Srivastava, I.K. Murthy, S. Malaviya, M. Munsi and N. Sharma. 2012. "Deforestation and forest degradation in India - implications for REDD+ General Article." *Current Science* 102 (8): 1117-1125.

ANNEXURE 10.1

List of prominent Asian Offset suppliers

Name	Website
Agricultural Training and Development Society (ADATS)	www.adats.com
Asia Network for Sustainable Agriculture and Bioresources (ANSAB)	www.ansab.org
BioCarbon Group	www.biocarbongroup.com
Carbonyatra	www.carbonyatra.com
China Alliance for Clean Stoves	cacs.chinaluju.com
China Green Carbon Foundation	www.thjj.org
CLP Wind Farms (India) Private Limited	www.clpindia.in
Conservation Carbon Company	conservecompany.com
DTZ Facilities & Engineering (S) Limited	www.dtz.com
East India Commercial Co. Ltd.	www.eiccltd.com
FFC Energy Limited	www.ffcel.com.pk
Forest Carbon Partners Ltd.	www.forestcarbon.com
Hydrologic Social Enterprise	www.hydrologichealth.com
InfiniteEARTH Ltd	www.infinite-earth.com
Korea Energy Mangement Coporation (KEMCO)	www.kemco.or.kr
MicroEnergy Credits	www.microenergycredits.com
National Biodogester Programme	www.nbp.org.kh
NeoEthical Sustainable Solutions	www.nessk.org
Nexus Carbon for Development Ltd.	www.nexus-c4d.org
Shan Shui Conservation Center	www.shanshui.org
Sindicatum Sustainable Resources	www.sindicatum.com
Socio-eCO2nomix-Global	www.vccslindia.org
Swire Pacific Offshore operations Pte. Ltd.	www.swire.com.sg
The Energy and Resources Institute	www.teriin.org
Vert Conservation Pte. Ltd.	www.vertconservation.com

ANNEXURE 10.2

A case study: Reforestation of degraded land in Chhattisgarh, India (Prakash Industries Limited)

Prakash Industries Limited initiated an AFOLU project to reforest degraded land in Chhattisgarh, India (degraded revenue lands obtained from the villagers, which were secluded from the forest lands). The land would have continued to degrade in the absence of the project activity. The project was mainly designed on the Bhata lands. Bhata soil comprises the yellow and red alluvial soil of Madhya Pradesh (MP), which are found in the Basin of Mahanadi River covering Balaghat, Durgapur, Raipur, and Bilaspur districts. These soils are grouped as Bhata, Matasi, Dorsa, and Kanhar – as they are found at different altitudes. Bhata lands have poor water-holding capacity and no vegetation, and are heavily prone to wind and water erosion. Thus, the major determinations of the project activity were to:

- Enhance carbon sink through reforestation.
- Reclaim the degraded land in a sustainable manner.
- Reduce pressure on natural forests of the region.
- Uplift the socioeconomic status of the native rural population.

This project (ID# 689) aimed at producing 5,007 Voluntary Emissions Reduction annually (http://www.climate-standards.org/2008/12/06/reforestation-of-degraded-land-in-chhattisgarh-india/). The project was eligible for CDM registration but was not registered because the international consultant hired for this purpose was not registered with the UNFCCC at that time and could not initiate the project for CDM. In addition, the project documentation was aligned with the ARM 001 methodology that was changed in COP-2 (Copenhagen Summit). Thus, the project had to be registered with the VCS market. Having extraordinary features, this project qualified for the Gold Category.

The CCB (Gold) category validation for a CDM project adds to the improved project area ecosystem. As such, the project earns a better reputation against its VCUs for greater visibility and price offered. The CDM projects mandate enormous amounts of compliance documents primed through accredited consultants. CDM managers may view documentation of Southeast Asia's first Gold-rated Indian CDM project (in its own category), registered under VCS and CCB streams using the links provided in Annexure 10.2.

Besides these CCB and VCS documents, project proponent and their field staff, and consultants filled their set of issuance certificates (verifications and monitoring) that are available (see Annexure 10.3).

Project minutiae: "Reforestation of Degraded Lands in Chhattisgarh (India)" implemented by PIL

- M/s. Prakash Industries Limited (PIL) initiated for the registration of the project "*Reforestation of Degraded Lands in Chhattisgarh (India)*" implemented by Prakash Industries Limited under the CDM of UNFCCC using CDM approved methodology AR-AM 0001, covering about 280 ha.
- The project was being facilitated by the Emergent Ventures India Pvt. Ltd., validated by TUV-NORD (Germany), an international certification agency. Rainforest Alliance (New York) verified the project as per the CCB Standard.
- The project would have earned 60,000 carbon credits over 10 years for combating the ill-effects of climate change by sequestration of GHG through planting trees.
- The project received a set back because of strategic changes in the proposed methodology at Copenhagen Climate Change Conference in December 2009.
- The severity of the situation worsened with the fact that TUV-NORD was not accredited with UNFCCC at that time for this purpose, but later received accreditation on the basis and merits of this project.
- All efforts since 2001 went in vain, and the project was registered through a VCS stream using methodology AR-ACM0002 version1.0.
- See http://www.vcsprojectdatabase.org/#/project_details/689.

The following adjustments were made in the project activities to address different concerns:

Environment concerns	Mitigations
Biodiversity concerns	■ Private lands used in the project were lying barren & eroding due to a few decades having no significant bio-productivity. ■ No use of genetically modified (GM) plants. ■ Only the local fast-growing tree species were used to reforest the project area(s).
Lack of opportunity for stakeholder involvement	■ All stakeholders were allowed to participate in project planning and implementation. ■ The inhabitants were in harmony with the project as they were not only part of the consultations but also benefitted from the project activities from the sale of their lands.
Availability of fuel wood for cooking	■ As per a state government report – "Agroforestry for Poverty Alleviation" of Chhattisgarh Planning Commission, the concerned project's inhabitants were distributed 586 MT of fuel wood and 429 MT fodder free of cost, over a span of 6 years (2002-2007) against the earlier non-significant land productivity.

Additional project experiences

- The project proponent was disappointed to find that none of the UNFCCC accredited Indian consultants were eligible for CDM documentation. The overseas consultant was found to be misleading. The project proponent wanted to remove the misleading consultant but no other consultant would take up the half-finished job of another consultant.
- The protocol for CDM documentation and CER issuance is too complex to be followed independently

by a corporate manager or farmers. The language of CDM documents is too technical. Thus, a specialized consultant is essential. These consultants are expensive for a project proponent from a developing country. This expenditure is made up front, which is a risky preposition.

- Plantations in private lands are developed for economic returns, whereas CDM A/R projects are developed for community benefit, preferably managed under the silvicultural rotation. In developing countries, commercial gains are an important objective of A/R projects, which is hard to exchange for a social benefit objective.
- Modifications in CDM methodology or mandate or documentation came up a few times during the first phase of the commitment period, in the name of additionality that completely changed the procedure as well as returns from CERs / VERs. This A/R project was growing well and could have generated 60,000 CERs. However, one additionality dictated that total earnings from CERs could not exceed the total project cost, and restricted the returns from the project. Similar additionalities could erode the returns from plantation projects, and render them unattractive to investment.
- Project assessment, monitoring, evaluation, and validation methodologies had been too complex for the project proponent to follow. Several project proponents were not aware of the methodologies. These complex methodologies proved a hindrance in adopting the proposed CDM methodologies.
- The project proponent is always at the receiving end of the process, as the CDM regulator influences the trade intensively and frequently. Unlike common markets, the instruments of benefits (e.g., bonds) are designed by regulators and not market participants. Thus, uncertainity prevails with respect to the price of CERs / VERs. Additionality, new supplies getting approval (Russia Hot air), changes in oil prices, or sudden increases in supply from China, or bad weather / biological attack may end the project altogether.
- These A/R activities and projects have unusually longer gestation periods from project registration to carbon trade-off. This is due to excessive papers and validations, social behavior of stakeholders, communities involved, and changes in earnings (income scenario).
- The CDM market is evolving while operating, but the financial restriction curbs additional income even if the market rises. Moreover, the price of CERs / VCSs from different sources (streams) are different. The project proponent gets different levels of income, for the same level of investment and efforts.
- There is a risk of unforseen changes in the value of CERs, possibility of failure of CDM application, or new additionality cropping up are the major hinderances restricting investment in the CDM projects.
- The VCS project activities (post-non registration of the same in CDM stream) started its paperwork in 2008, as per the revised methodology, but registration was recieved in 2014 and for VERs that too had restricted income. During this long period (2000–2014), the CDM methodology changed, as did the market demand; new CER sources emerged, and CER prices crashed. Thus, the CER market emerged as a highly volatile market that supports investment for long-term social cause and minimum returns.
- All A/R projects bear delivery risks. These biological projects are threatened by climate, biological pests, diseases, human activites, fires, and natural calamities. Thus, the delivery of commercial,

as well as CDM benefits all are at risk throughout the life-cycle of the project. All possible precautions should be taken to safegaurd against under-performance and late delivery.

- Even the CDM deals are not risk free. The project proponent depends on consultants that act as a middleman. Often the details of buyers, including paying capacity, are best known to the consultant only. Sellers should review buyers' balance sheets and make informed decisions.
- The National Designated Authority (NDA) does nothing to protect proponents. It never promoted local / national consultants. Thus, CDM process appears troublesome to resourceful corporations. An indifferent DNA was incapable of either bargaining in favor of project proponents nor could he protect the interests of farmers / tribes / stakeholders in A/R projects
- Projects that bear the risk of underperformance or non-delivery of CER attract penalty clauses and credit wraps or may have to evoke clauses of convertible preference shares.

Papers of India's first Gold-rated CDM project registered under VCS and CCB streams

Project Design Document

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/Prakash_Industries_Ltd_AR_CCB_PDD_07_04_09.pdf (CCB stream; 23/6/2008)

http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/7533 (VCS; 4/10/2011)

Validation Statement (Gold level approval)

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/prakash_industries_ccb_valid_statement_09.pdf (CCB; 23/6/2009)

http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/7531 (VCS; 4/10/2011)

Validation Report

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/prakash_industries_ccb_assess_09.pdf (CCB; 23/6/2009)

http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/7530 (VCS; 4/10/2011)

Project Design Document

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/PIL_CCB_PDD_v1.0+(1).pdf (CCB; 10/10/2012)

http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/7532 (VCS; 4/10/2011)

Monitoring Plan

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/PIL_CCBA_MR_v1.0.pdf (CCB; 10/10/2012)

Project Implementation Report

https://s3.amazonaws.com/CCBA/Projects/Reforestation_of_Degraded_Land_in_Chhattisgarh_India/PIL_CCBA_+Project+Implementation+report_V1.0.pdf (CCB; 10/10/2012)

Annexure 10.3

Certificates filled by project proponent, their field staff, and Consultants for verifications and monitoring

Verification Report by Consultant (TUV NORD) submitted on 29 February 2012
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/8923

Verification Deed of Representation submitted by Consultant on 29 February 2012
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/8924

Monitoring Report submitted by Indian Consultant on 29 February 2012
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/8925

Issuance Deed for Representation filled by Project Proponent on 1 March 2012
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/8940

Verification Deed for Representation submitted by second overseas Consultant on 3 May 2013
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/12415

Issuance Deed for Representation filled by Project Proponent on 3 May 2013
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/12416

Monitoring Report submitted by Indian Consultant and Project Proponent on 29 December 2014
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/16940

Verification Report submitted by overseas CCB Consultant on 29 December 2014
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/16941

Additional documents submitted

AFOLU Project Element by TUV NORD (counter to VCS non-permanence report) filled on 29 February 2012
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/8926

Validation Statement by The Rainforest Alliance (Second overseas Consultant)
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/12294

KML File (Google Earth file showing project sites)
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/12469

Project Review Report by VCS received on 30 December 2014
http://www.vcsprojectdatabase.org/services/publicViewServices/downloadDocumentById/16942

ANNEXURE 10.4

An overview of registered forestry CDM projects in India

S. No.	Title	Project start date	Registration Date	Project Location (State/s)	Proponent b	External Stakeholders	Area (ha)	Type of land	Avg. Land holding Under project / farmer (ha)	No. of Farmers Involved	Project Period (year)	Avg. Reduction (tCO_2 e/annum)
1	Small Scale Cooperative Afforestation CDM Activity in Sirsa, Haryana	Jul-08	Mar-09	Haryana	HFD (Govt.)	Nil	369.87	Private	1.63	227	60	11596
2	Reforestation in Khammam District of Andhra Pradesh, India under ITC, Social Forestry Project	Jul-01	Jun-09	Andhra Pradesh	ITC ltd (Pvt.)	Nil	3070.19	Private	0.90	3398	32	57792
3	The International Small Group and Tree Planting Program (TIST), Tamil Nadu, India	Jan-04	Jan-10	Tamil Nadu	TIST ltd (Pvt.)	UK, Northern Ireland, climate change capital carbon fund II s.à r.l'	106	Private	0.09	1200	30	3594
4	India: Himachal Pradesh Reforestation Project – Improving Livelihoods and Watersheds a	Jul-06	Mar-11	Himachal	MHWDP (Govt.)	Spain, Biocarbon Fund	4003.07	Public, common and private	NA	NA	60	41979

S. No.	Title	Project start date	Registration Date	Project Location (State/s)	Proponent b	External Stakeholders	Area (ha)	Type of land	Avg. Land holding Under project / farmer (ha)	No. of Farmers Involved	Project Period (year)	Avg. Reduction (tCO_2 e/annum)
5	Bagepalli CDM Reforestation Programme	Jan-08	May-11	Kar., A.P	ADATS (NGO)	Nil	8933.34	Private	1.10	8,107	100	92103
6	Reforestation of degraded land by MTPL in India.	Jun-01	Aug-11	Orissa, A.P, C.G	MTPL (Pvt.)	Nil	14969.46	Private	1.25	12002	50	146998
7	Improving Rural Livelihoods Through Carbon Sequestration By Adopting Environment Friendly Technology based Agroforestry Practices	Oct-04	Feb-11	Orissa, Andhra Pradesh	JKPL and VCCSL (Pvt.)	Canada, BioCarbon Fund	3502.7	Private	1.75	1994	30	356696

NA = Not applicable; INA = Information not available; ab = Revised values for Himachal project, have been taken from (MHWDP, undated)
b = Text in parentheses represents the type of project proponent. Govt., Pvt. and NGO stand for government, private and nongovernment organizations respectively

ANNEXURE 10.5

Key Highlights

The A/R projects constitute a small fraction of the of CDM projects. The majority of A/R project proponents are resistant to invest in forestry projects due to the long project duration, high upfront costs, complex CDM methodologies, required technical skills, labor, and large areas of land, in addition to coordination among a range of stakeholders. In spite of these odds, India registered nine A/R projects under CDM (January 2001– July 2016) and six AFOLU projects (October 2011– July 2016) under VCS. AFOLU projects relate to projects such as afforestation and reforestation, improved farming techniques, reduced chemical use, and improved livestock management that avoids or captures methane. Paradoxically, all of these projects were farmer-centric but promoted by corporations or government agencies. Varied CDM projects gradually realized resistance from their respective project registration to sell their carbon credits against the initial perceptions.

On the whole, A/R projects were promoted in existing plantation programs from the paper or plyboard industries. All of the projects promoted by ITC, JK Paper Mills (JKPM), and MTPL were oriented with farmer associations, plantations, and massive social forestry programs for more than two decades prior to application. These plantation programs attracted several competitor companies and increased the price of pulpwood. The companies that invested in raising plantations also had to buy costly pulpwood once prices increased. Thus, the sense of investing in plantations eroded. The opportunity of CDM funds came as a respite for those visionary organizations who took the initiative to secure CDM funds. Several other companies were watching the outcome of those initial applications. Slow processing and eventual failure of these CDM applications curbed the multiplication possibilities of forestry CDM projects in India. These projects had problems at registration due to their "retroactive" existence. Moreover, the additionality of "duration of plantation" was never resolved. Although, the project proponent companies opted for 30–50 year project duration, it was difficult to ensure "consistent plantation cover" of a crop which was being harvested every third year. Although for a justified cause, organizing additional funds via CDM always had issues with additionality. This debacle prohibited wood-based industries from entering into forestry CDM projects, in spite of the supply chain linkages, logistics, and wood demand.

The CDM projects in Haryana and Himachal Pradesh were part of the big bilaterally funded projects by the European Commission and World Bank, respectively. Since public funding of A/R projects is forbidden, these projects also had additionality issues. All these farmer-oriented projects were negatively impacted when land prices increased from 2006 to 2010. Wage rates have also significantly increased because of National Rural Employment Guarantee Scheme (NREGS) that gives assured employment of 100 days per year to one member of a family at 190 INR/day. Hence, the opportunity cost of labor for plantation and other activities under CDM projects have substantially increased, making them economically unattractive. Many farmers defected from the associations and diverted their land to estate purposes. Moreover, these projects underrated transaction and internal management costs needed to manage 3000–12,000 members. The CDM projects from the states of

Haryana, Himachal, and Andhra Pradesh in addition to the ITC project spent INR 2.28, 10 and 7.80 million respectively just on project preparation (paperwork). Project preparation, monitoring and validation costs constitute 6 to 8 percent of the total costs that are often paid to external consultants who are the clear beneficiaries in these projects.

Implementation of A/R projects was slow in Haryana and Himachal Pradesh. Moreover, the species planted were non-timber. Thus the financial returns from the forestry CDM projects were delayed and smaller than farmer's expectation. Along with the technical as well as management hitches, these farmer-oriented A/R projects had poor economic sustainability. The low participation of local communities, weak or nonexistent community institutions, inflexible design, and rigid CDM rules adversely affected sustainability of these projects.

Most A/R projects made block plantations of fast-growing species such as Eucalyptus (*Eucalyptus* hybrid), Casuarina (*Casuarina equisetifolia*) and Ailanthus (*Ailanthus excelsa*) that had adverse social and ecological impacts over the long term. Community participation was low, weak, or nonexistent in absence of clear and compelling CDM rules. The rationale and significance of these CDM projects need to be objectively reexamined for better performance of CDM projects in the future.

ANNEXURE 10.6

Challenges and opportunities rated by project developers (A/R CDM projects)

The experience from Indian A/R projects, related global discussions, and observations on CDM procedures, as well as different sets of suggestions have emerged from project proponents, which may be useful for future projects developers, DNA, and CDM management. Challenges have been ranked on a scale of 1-10, 1 being the highest and 10 being the lowest.

Challenges ranked by CDM project proponents

A/R project proponents rated extensive methodology and high transaction costs as the most challenging hurdles for CDM projects. Lack of community participation and non-availability of indigenous DOE were least challenging hurdles.

Challenges	Rank
High transaction cost of CDM A/R projects	1
Long project cycle of CDM A/R projects	6
Non-availability of information of eligible land under CDM A/R	6
Non-availability of indigenous DOEs in A/R sector	10
Non-participation of Insurance companies in financial allocation in CDM	7
Lesser participation of developed Annex I countries in financial allocation in CDM	2
Complex CDM A/R procedures / methodologies towards Project development	2
Lack of indigenous CDM A/R methodologies	1
Lack of expertise of state forest department / tree growers / farmers/ NGOs in CDM A/R projects preparation	3
Lack of opportunities for community participation in CDM A/R projects	9
Lack of institutional management viz. climate change cells (CDM cells) in the federal government / state Forest Department / research institutions	8
Lack of awareness about carbon credit market	5
Lower price of forestry CERs	4

Ranking of options for CDM projects

Project proponents rated agroforestry on private land as the most preferred option. Project proponents were not adverse to using community land and involving community but rated using degraded forest as most difficult option for a CDM project.

Options identified	Rank
Agroforestry at own farmland: productive / wasteland	1
A/R in private land involving civil societies: village land / community land	2
Rehabilitation of degraded forest land	5
Long rotation commercial timber plantation without community involvement	4
Bio-fuel plantation	3

Ranking of barrier towards implementation of CDM A/R projects

Among different barriers towards poor implementation of CDM A/R Projects (in term of 1 for biggest and 3 for smallest), project proponents ranked economic viability of investors, technology transfer, marketing of CERs, and project preparation guidelines as the major barriers.

Particulars	Barriers	Rank
Economic viability	Investors	1
	Output	2
	Permanent asset	3
Physical viability	Quality seedling	2
	Technology	1
Lack of awareness	About CDM A/R	2
	Plantation	3
	Marketing	1
Stringent Guidelines	Project preparation	1
	Monitoring	2
	Evaluation	3

Ranking administrative and economical barriers of CDM A/R projects

Project proponents ranked the poor fund availability for long-term projects, lack of capacity building for CDM projects, availability of eligible land as per CDM definition, and lack of data on eligible land as the most restricting factors.

Rank	Financial Barrier	Institutional Barrier	Policy Barrier	Physical Barrier
1	Funds for long-term projects	Lack of capacity building for CDM	Land eligibility and land availability as per CDM	Lack of land data on eligible land for CDM
2	Economic viability of project	Poor support by federal Government	Lack of local CDM A/R methodologies	Poor involvement of local community
3	Low pricing of A/R CER	Lack of expertise toward development of Project Concept Note/PDD	Addressing additionality	Poor quality planting material
4	Profitability of project	Lack of support for post PDD activities - dealing with buyer	Addressing Baseline/ Leakage	Lack of data on growing stock and carbon stocks
5	Poor finance by developed countries	Lack of indigenous DOE to validate and verify	Definition of forests under CDM	Felling Regimes / Timber Transit Rules

Criticism by Environmentalists: CDM in the Forestry Sector in India

The UNFCCC's Cancun Agreement explicitly named five activities comprising REDD+ that:

- Reduce emissions from deforestation;
- Reduce emissions from forest degradation;
- Conserve forest carbon stocks;
- Sustainably manage forests; and
- Enhance forest carbon stocks.

Many consider enhancement to include A/R, and the latter three activities together as the "plus" in REDD+. Conservation activities are generally considered emissions neutral as they preserve a status quo; in some existing standards, conservation activities would only qualify if the forest within the boundaries of the activity were under threat, in which case a projected or business-as-usual baseline would be constructed and the conservation project would fall under avoided deforestation or degradation.

At COP 9 of the Climate Change Convention (Milan, Italy), many of the LULUCF issues of the protocol were finally settled, and a decision was made to allow A/R projects to be carried out under CDM. This favors the developing countries interested in earning carbon credits from their forestry

activities. However, parts of the CDM LULUCF were still criticized by environmentalists:

- As it allows monoculture plantations (biodiversity concerns), and genetically modified (GM) plants.
- CDM projects are developed largely by corporations. If communities are not involved and benefits are not transferred to them, then sustainable development is doubtful (stakeholder issue).
- Concern is that women may be either deprived of treated as free fuel as well as fodder, or their drudgery may increase (gender implications).
- Buyers would bargain to get maximum carbon credits at minimum possible price. Their tactics and pressures may disrupt the ecology conservation efforts in developing countries.
- There was objection to the logic that forest management activities are not eligible for LULUCF projects. This biased funding may increase afforestation and reforestation in one area while some other area is neglected or left for the budget-crunched national governments to take care of them.

The anomaly about REDD+ causes following concerns about performance of REDD+ program:

- The availability of a large supply of potentially cheap carbon credits could provide an avenue for companies in the developed world to simply purchase REDD+ credits without providing meaningful emission reductions at home.
- A large number of carbon credits could swamp developing carbon markets. However, they could also facilitate ambitious emissions targets in a post-Kyoto agreement.
- Putting a commercial value on forests neglects the emotional value of forests among indigenous peoples and local communities.
- There is no consensus on a definition for forest degradation. Thus, all calculations may be misleading.
- The risk is that baselines are set unrealistically by developing country authorities and are not actually accurate around the forest's carbon stocks.
- There are risks that the local inhabitants, and communities that live in the forests may be overlooked from planning, implementation, and benefit sharing related to CDM projects.
- Some projects may be baffling, and unethical companies may take advantage of the low governance.
- Fair distribution of REDD+ benefits will not be achieved without a prior reform in forest governance and more secure tenure systems.

SECTION IV
COMMUNITIES AND INSTITUTIONS

The role of communities and community institutions is critical in the Indian forestry context. There is also an emphasis on decentralized governance of forest resources. This section contains two chapters. The first chapter (Chapter 11) examines the opportunities and challenges related to involvement of democratically-elected Panchayati Raj Institutions in the forestry sector. India has considerable experience of involvement of local communities in forest management, as well as of benefit sharing through the Joint Forest Management (JFM) program. The second (Chapter 12) discusses the issue of benefit sharing under REDD+, and presents one possible benefit sharing mechanism.

Chapter 11: PANCHAYATI RAJ INSTITUTIONS AND FORESTRY

Sirisha Indukuri, Saumya Mathur and Shailesh Nagar

INTRODUCTION

Decentralization in its essence refers to transfer of power from central government to lower levels in a political, administrative and territorial hierarchy (Crook and Manor 1998; Agarwal and Ribot 1999). Decentralization could be administrative decentralization or deconcentration, in which transfer of power is to lower-level central government authorities or to other local authorities who are upwardly accountable to the central government (Ribot 2002). Decentralization could also involve creation of new political entities and bodies at a sub-national level and an increase in their powers, which is referred to as devolution (Rodríguez-Pose and Gill 2003).

There is a worldwide trend towards regionalism resulting in widespread transfer of power downwards to regions and communities since the 1990s (Keating 1998). By 2004, an estimated 60 countries were engaged in processes towards decentralization of their forestry sector and this trend has been increasing (Governments of Indonesia and Switzerland 2004). Decentralization in the forestry sector is often not an end in itself, but is seen as a tool to accomplish broader objectives pertaining to the conservation, poverty reduction, grassroots democracy, equity, and sustainable development.

The deliberations during the Interlaken workshop[1] indicated that successful decentralization involves a number of prerequisites, including formulation of clear enabling legal and policy frameworks and timely and wide distribution of this information; integration of the decentralization process into national forest programs; achievable objectives; clear allocation of roles, responsibilities, resources and accountability; and mechanisms for conflict resolution. Successful decentralization outcomes have been linked to secure tenure as well as secure fiscal, revenue and taxation powers; equitable access to forest resources; control over decision-making, commercial rights and market access; sensitivity to cultural traditions and local knowledge and, wherever appropriate, recognition of ancestral rights of local communities.

At the same time, it also needs to be ensured that decentralization does not lead to fragmented and dysfunctional landscapes.

Improper decentralization could also result in a plethora of conflicts at the local level. Therefore, as mentioned above, appropriate conflict resolution mechanisms need be put in place in advance.

In India, both central and state governments share the responsibilities of preparing policies and managing forests[2]. The community-oriented decentralization process started in late 1980s with the revised National Forest Policy of 1988 and was further consolidated with the issuance of the Joint Forest Management (JFM) circular by the Government of India in 1990. The enactment of the The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act in 2006 (popularly known as Forest Rights Act or FRA) gave further impetus to devolution of powers to local communities, especially in the tribal-majority areas.

PANCHAYATI RAJ INSTITUTIONS

Historical perspective

While the concept of decentralization and local *Panchayats* has been a part of India's tradition and administrative system for as long as the civilization existed in Indian sub-continent, the first large-scale organized effort to tackle the problem of local governance in rural India was made through the Community Development Programme in 1952. The program was based on an integrated approach to rural development. However, due to an absence of effective people's participation, and extensive bureaucratic structure, the program was a failure. The Balwant Rai Mehta Committee appointed by the Government of India to review the program strongly recommended establishment of a three-tiered Panchayati Raj Institution (PRI) system and promotion of rural development work through people's participation. These recommendations laid the foundation of the PRI system in the country. However, the PRI system got the constitutional mandate much later through The Constitution (Seventy-Third Amendment) Act, 1992 (hereinafter 73rd amendment) that came into force in 1993.

The preamble to the 73rd amendment identified PRIs as self-governing institutions and giving them a constitutional status, mandating all the states to implement the PRI system. The increasing importance of the PRIs led to the formation of the Ministry of Panchayati Raj (MoPR) in 2004 for inclusive development and efficient delivery of services at the local level.

Institutional structure

The PRIs have a three-tier institutional structure consisting of village, block and district levels.

The *Gram Sabha* (the village assembly) consists of all the registered voters in the hamlets/villages comprising a *Panchayat*. The *Gram Panchayat* – the basic administrative unit of the PRI system – consists of elected representatives of the *Gram Sabha* and operates at the village/cluster level. The members elected by the *Gram Sabha* are referred to as *Gram Panchayat* members or ward members and the head of the elected members is known as the *Sarpanch*. These elected members look after issues like infrastructural development, tax collection, public health and implementation of different schemes mandated for the *Panchayat*. Members of the *Gram Panchayat* are elected every five years by the *Gram Sabha*.

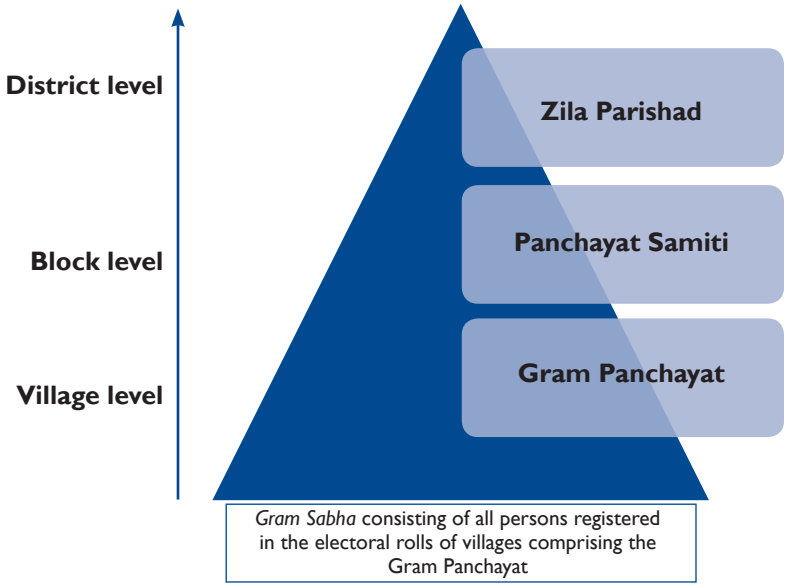


Figure 11.1: The three-tiered structure of PRIs

Panchayat Samiti or Block *Panchayat* formed at the block level is the intermediate level *Panchayat* under the PRI system and consists of elected members (*Sarpanch* and one elected member from each *Gram Panchayat*), associate members (all the Members of Parliament and State Assembly from the area of the Block *Panchayat*), co-opted members (one woman, Scheduled Caste and Scheduled Tribe members in case they are not represented in the Block *Panchayat*) and *ex-officio* members (Sub-Divisional Magistrate and the Block Development Officer). Block *Panchayat* takes care of departments such as finance, public works, health, education, and information technology, with an officer for each department.[3]

Zilla Parishad or the district-level Panchayat has a supervisory function and acts as a coordinating unit. All the presidents of the Block *Panchayats* within a particular district are the members of the *Zilla Parishad*. All the Members of Parliament and State Assembly from the area of the district are also members of the *Zilla Parishad*. The *Zilla Parishad* looks after departments related to health, agriculture, veterinary issues, engineering, education, backward classes welfare, public works and other development departments.[45]

The 73rd amendment added the XIth Schedule to the Constitution of India, which specifies 29 subjects on which PRIs have jurisdiction and state governments can enact legislations to devolve these subjects to the PRIs. Out of these 29 subjects, 11 are related to natural resources (see Figure 11.2).

- Agriculture, including agricultural extension
- Land improvement, implementation of land reforms, land consolidation and soil conservation
- Minor irrigation, water management and watershed development
- Animal husbandry, dairying and poultry
- Fisheries
- Social forestry and farm forestry
- Minor forest produce
- Drinking water
- Fuel and fodder
- Non-conventional energy sources
- Maintenance of community assets

Figure 11.2: Subjects related to Natural Resources Management that have been devolved to PRIs

PRIS IN THE SCHEDULED AREAS[6]

Schedule V Areas

The Schedule V areas are important for decentralized forest management, as these areas not only have a high forest cover, but also have a high proportion of forest-dependent people. However, the 73rd amendment was not automatically made applicable to Schedule V areas. The PRI system was subsequently extended to these areas through the Panchayats (Extension to Scheduled Areas) Act (PESA), 1996. PESA empowered the tribal communities residing in Schedule V areas to gain greater control over natural resources such as land, water, minerals, forests, and Non-Timber Forest Products (NTFPs).

PESA mandates the primacy of *Gram Sabha* in the governance of Schedule V areas and recognizes it as the core institution, with government departments and other institutions complementing it. It introduced a new form of local and participative self-governance ethos. The powers bestowed upon the *Gram Sabhas* include: (i) control over land acquisition, (ii) management of village markets, (iii) regulatory bodies in respect of regulating any type of intoxicants, (iv) ownership of minor forest produce (i.e. equivalent to NTFPs), (v) control over money lending, (vi) control over institutions and functionaries in all social sectors, and (vii) power to approve all development plans and identify beneficiaries of each program[7] (Biswas 2015).

PESA changed the definition of a village to include a habitation or a group of habitations comprising a community and managing its affairs in accordance with traditions and customs. PESA is applicable in a total of nine States (which have Schedule V areas), which

amended their State Panchayat Acts to comply with the provisions of PESA. These States are (i) Andhra Pradesh, (ii) Chhattisgarh, (iii) Gujarat, (iv) Himachal Pradesh, (v) Jharkhand, (vi) Madhya Pradesh, (vii) Maharashtra, (viii) Odisha and (ix) Rajasthan (MoPR 2011).

PESA is a major milestone in the journey towards decentralization of power in the Scheduled V areas. However, there are critical gaps in its implementation. The Act is not in harmony with the various state subject laws and legislations, including those related to forests. Several states continue to follow the sector-specific laws even after the enactment of PESA. Further, ambiguities in the Act have left open scope for misinterpretation.
Due to above challenges and limitations, PESA has not yet achieved its full potential for promoting devolution of powers over forest and other resources in the Schedule V areas (Bijoy 2012).

Schedule VI Areas

The Schedule VI was added to the Constitution to provide for administration of tribal areas in the North East region of India. Under Schedule VI, rights of the tribal communities residing in these areas are protected by constitutionally-mandated district or regional local self-government institutions. The following states in the North East region have areas specified in Schedule VI: Assam, Meghalaya, and Mizoram with three Autonomous District Councils (ADCs) in each state, and Tripura with all its districts covered.

The nature of the ADCs, however, differs from state to state. For instance, the councils in Assam and Meghalaya have been constituted at the district level whereas; in Mizoram the councils have been created at both the district and sub-divisional levels. Schedule VI confers wide powers to these institutions, which includes preservation of tribal customs, matters related to village or town administration, management of any forest other than reserved forests, land acquisition, execution of development activities and also certain judicial powers. (ActionAid 2016)

While ADCs have more powers than District Panchayats (their counterpart elsewhere), the actual ground situation varies from state to state (GoI 2006a). These institutions also face a number of challenges, as listed below.

Inadequate devolution of powers:
Several state governments been slow in transferring agreed functions to the councils and have continued with or established parallel development and administrative machinery in the council areas.

Conflict with traditional institutions: There are several traditional institutions in Schedule VI areas, such as the *Syieships* and *Dorbars* of the Khasi hills of Meghalaya and the *Kuki-Impi* of the Kukis in Manipur. There is potential of conflict between the traditional institutions and those mandated under the Schedule VI (Choudhary 2014).

Concentration of power: There is a general feeling that there is elite capture of these institutions and that these institutions are cut-off from the common people. With decision-making concentrated in few hands, there are issues of corruption and nepotism as well (Sharma 2016).

Development role: The councils are completely dependent on the provision of

funds from the higher levels of the government, thereby reducing their flexibility and hindering their emergence as vibrant institutions for local development.

Poor quality of governance: In many councils, the customary laws have not been codified. There are either no courts or these are managed by poorly trained persons. Several Councils have not been able to codify customary system of land tenure and have not been able to protect the common lands. The general lack of cadastral surveys in the area has also complicated the situation (see Thyniang 2015).

PRIS AND THE FORESTRY SECTOR

Current Status

There are two key avenues through which PRIs' role in forest management can be assessed. One is the direct devolution of subjects related to forests (Schedule XI of the Constitution) under 73rd amendment and second is role of PRIs in different existing institutions for management of forests.

Following the 73rd amendment, while most states and Union Territories have devolved some of the functions related to forestry to the different tiers of PRIs, the PRIs are yet to demonstrate effective control over forest resources in areas under their jurisdiction. While various Panchayat Raj Acts include sections pertaining to devolution of aspects related to forest resources, the central and state forest laws have a larger bearing on the way forest resource is governed and managed. Existing laws on forests, land resources, irrigation, drinking water supply, soil and water conservation, and fisheries have constituted "line agencies" with monopolistic powers of control and management of natural resources (Vani 2002). Moreover, the power to collect and utilize revenue from land, water, and forest resources under the existing sectoral laws has deprived the local bodies of the important power of taxation. The required changes in the relevant sectoral laws are missing in the states which are required for affecting the devolution that is promised in the state Panchayati Raj Acts.

States like Bihar, Chhattisgarh, Gujarat, Himachal Pradesh, Jharkhand, Kerala, Maharashtra, Odisha, and West Bengal have sub-committees under the PRIs that have functions related to forestry. However, there is very little information on the actual functioning of these sub-committees and their impact on the ground.

As regards the role of PRIs in different existing institutions for management of forests, the key institutions at present covering large number of villages and forest area have been established under the JFM program or FRA. The Biodiversity Management Committees (BMCs) under the Biological Diversity Act, 2002 are another, although nascent, set of relevant institution.

Although community forest management has been in existence in specific parts of India for a long time (for example the *Van Panchayats* in Uttarakhand, sacred groves in different parts of the country, and the village councils in the states of North East India), it was through the JFM program initiated by the central government in 1990 that there was a country-wide effort to decentralize forest management. Therefore, the JFM program is a milestone for state recognition of the role of local communities as partners in managing forest resources.

The JFM program envisaged creation of village institutions – often referred to as Joint Forest Management Committees or JFMCs[8] – that would support the State Forest Departments in protection and regeneration of forest areas and, in return, would benefit from enhanced legal access to fuelwood, fodder and NTFPs from the protected forest patches. This initiative was mainly in response to the growing realization that it is not possible to conserve and regenerate the degraded forestlands without active and willing participation of local communities.

The central government's JFM circular was followed by state-specific enabling resolutions and guidelines for JFM being issued by several states. By the late 1990s, JFM program was being implemented in most states. An estimate in 2011 indicated that were a total of 118,213 JFMCs in the country, covering a total of area of 22,938,814 hectares of forests (ENVIS 2011).

In the year 2000, a second set of guidelines were issued by the central government that promoted participation of women in JFMCs, proposed legal back up for JFMCs, and shared guidance for preparation of micro plans. It was, however, the third set of guidelines that came out in 2002, which suggested a relationship between the JFMCs and PRIs. It was perceived that the JFMCs would benefit from the administrative and financial position and organizational capacity of PRIs. However, the 'separate non-political' identity of the JFMCs as 'guardian of forests' was maintained (MoPR 2011).

A JFM handbook issued by the Ministry of Environment and Forests (MoEF)[9] also emphasized the important role of PRIs in the formation and functioning of JFMCs (MoEF n.d.a). Although there is involvement of PRIs in the JFM program of some states (for example, West Bengal), the JFMCs by and large function independently of PRIs. A clear articulation of the central government's vision for the PRI involvement in the forestry sector through a revamped JFM program has been made in the National Mission for a Green India (popularly known as Green India Mission or GIM) (MoEF n.d.b). However, this has not translated into concrete actions on the ground so far.

Although the JFM program has led to several positive outcomes across a range of sites, it has several limitations as well. A major limitation is that barring a few exceptions, it is based on executive orders that could be changed or withdrawn at any time. The program is also excessively dependent on the local forest officials, who are *ex-officio* secretaries of JFMCs in many states. Therefore, there have been calls to involve PRIs rather than creating parallel bodies such as JFMCs. This could help the forestry sector in moving from deconcentration towards devolution.

As mentioned earlier, FRA was enacted in 2006. The Act provides a legal framework to (i) vest forest rights with forest-dwelling Scheduled Tribes and other traditional forest dwellers[10]; (ii) define types of forest rights; and (iii) define the procedure for vesting such rights. The holders of forest rights, the *Gram Sabha* or village assembly as defined by the act, and the village level institutions are empowered to:

- protect wildlife, forests and biodiversity;
- ensure that adjoining catchment areas and other ecologically sensitive areas are adequately protected;
- ensure that habitat of right-holders is protected from destructive practices; and

- ensure that decisions taken in the *Gram Sabha* to regulate access to community forest resources and stop any activity which adversely affects forests, wildlife and biodiversity, are complied with (Krishnan *et al.* 2012).

The Act recognizes and vests 13 claimable rights providing individual or community tenure, and protects all existing customary rights and also the rights recognized by state laws or the Councils in Schedule VI areas (Sarin 2014). According to Ministry of Tribal Affairs, till March 31, 2016, 1.74 million titles (16,97,327 individual and 42,488 community claims) had been distributed, covering an area of around 3.6 million hectares.

Under FRA, *Gram Sabhas* are the authority to initiate the process for determining the nature and extent of individual and community forest rights, which may be given to the forest dwelling Scheduled Tribes and other traditional forest dwellers within the local jurisdiction under the Act.

The *Gram Sabhas* elect a Forest Rights Committee from among its members to support it in various functions under the Act. The *Gram Sabhas* submit verified and approved claims to a Sub-Divisional Level Committee which, in turn, forwards the claims to the District Level Committee for a final decision. A State Level Monitoring Committee is also formed to monitor the process of recognition and vesting of forest rights. The Sub-Divisional Level Committee, the District Level Committee and the State Level Monitoring Committee consist of officers of the departments of Revenue, Forest and Tribal Affairs of the state government and three members of PRIs at the appropriate level. Among the PRI members in respective committees, the Act specifies that two shall be from Scheduled Tribes and at least one shall be a woman.

The Rules under FRA were amended in 2012 to provide more powers to *Gram Sabha*. Although FRA has been a major step in devolving several powers to *Gram Sabha*, several challenges remain, which are briefly discussed below:

Difficulty in recognizing rights of pastoralists: Migrant pastoralists have been dependent on forest and other common lands for generations and being migrants, the *Gram Sabha*-based claims procedure is unsuitable for these communities.

Lack of clarity on level of *Gram Sabha* **constitution**: There is lack of clarity regarding the level of *Gram Sabha* (at hamlet level or higher level) that is empowered under FRA (Sarin 2014). Some critics view this as undermining the role of *Gram Sabha*.[11]

Under the provisions of the Biological Diversity Act, all local bodies, including *Gram Panchayats*, have to constitute a BMC for promoting conservation, sustainable use and documentation of biological diversity. It is estimated that as of July 2017, there were 62,502 BMCs across 26 states (NBA 2011). The number of BMCs is still low considering that around 15 years have elapsed since the enactment of the Biological Diversity Act. Nonetheless, this Act along with FRA represents a serious attempt to devolve powers over forests and other natural resources to PRIs.

Devolution of powers over NTFPs: The Odisha Experience

The NTFP sector is India's largest unorganized sector with over 275 million people dependent on it for their livelihood and sustenance. NTFP contributes about 20 percent to 40 percent of the annual income of forest dwellers who are mostly landless tribals (Planning Commission 2011), while 50 percent of forest revenues and 70 percent of forest-based export income also comes from NTFP (Mahapatra and Shackleton 2011).

Several commercially-important NTFPs are collected and traded by the state government owned corporations. The state government of Odisha, however, devolved considerable powers over 68 NTFPs to PRIs in the year 2000 (RCDC 2011)[12]. This devolution gave the authority to the *Gram Panchayat*s to regulate the procurement and trade of the specified NTFPs. The traders who wished to procure NTFPs from the collectors had to register themselves with the local *Gram Panchayat* before they could start trading, thus giving power to the local *Gram Panchayats* to monitor functioning of the traders, especially with regard to the procurement price they paid to the NTFP collectors.

It is noteworthy that the devolution was done at the level of the *Gram Panchayat* and not *Gram Sabha* as specified under PESA for Schedule V areas. Besides this, the rights of *Gram Panchayat*s were restricted to their revenue jurisdiction, and not extended to reserve forests. However, the biggest challenge was lack of capacity and resources (human and financial) at the *Gram Panchayat* level to control and regulate local-level trade. Due to the very short transition period from state control to complete de-regulation of NTFPs, there was no proper orientation provided to the *Gram Panchayat*s with regards to various processes, such as the registration process of the traders and the monitoring of payments made by the traders. The *Gram Panchayat*s faced further challenges due to poor information on abundance, ecological requirements, and sustainable harvest levels of different NTFP species (Mahapatra and Shackleton 2011). In many cases, the *Gram Sabha, Palli Sabha* (hamlet-level council) and ward members were not fully aware of the policy changes, which further affected field implementation of the devolution policy (RCDC 2011).

It is clear from the above account that the experience of devolution of powers over NTFPs to PRIs in Odisha has been rather mixed. Thus, there is a strong need to not only build capacity of PRIs to undertake management of natural resources such as NTFPs, but also to bring clarity regarding the various ambiguous and sometimes even seemingly contradictory provisions in different extant laws and rules. Successful devolution cannot take place unless a well though through alternate system is in place.

Green India Mission

GIM is one of the eight Missions announced in 2008 under the National Action Plan on Climate Change. GIM aims to address climate change by enhancing carbon sinks in sustainably managed forests and ecosystems, enhancing the resilience and ability of vulnerable species/ecosystems to adapt to the changing climate and enabling adaptation of forest-dependent communities in the face of climatic variability.

There are three main objectives of the GIM: 1) doubling the area under afforestation/eco-restoration in India in the next 10 years (total area to be afforested/eco-restored is 20 million hectares); 2) increasing the Greenhouse Gas (GHG) removal by India's forests to 6.35 percent of India's total annual GHG emissions by the year 2020; and 3) enhancing the resilience of forests/ecosystems (MoEF 2012).

The GIM envisages a pivotal role for the *Gram Sabhas*. The *Gram Sabha* will be the overarching institution to oversee the implementation of the GIM at the village level. All other committees, namely, JFMCs (revamped), Community Forest Management groups, *Van Panchayats*, Committees set up under FRA, BMC and likewise, will be committees set up by the *Gram Sabha*.

In giving a pivotal role to the *Gram Sabha*, the aim of the mission is to strengthen them. Strengthened and informed *Gram Sabhas* would mean better coordination and linkages across different institutions at the local level, and improved accountability of such institutions. The move avoids the creation of new institutions that may result in a multiplicity of institutions at the village level and rather ensures coordination and inter-linkages between the existing institutions.

Although the GIM sets the broad directive, it does not delve into factors that may be important to ensure effective functioning of the *Gram Sabhas*. Legal empowerment of the bodies of the *Gram Sabha*, including the revamped JFMCs and other committees could be done under the Indian Forest Act. Provisions to acknowledge the *Gram Sabha* and its committees would also need to be made in the state Panchayat Acts.

The GIM further states that a federation of the committees of the *Gram Sabha* along with a federation of self-help groups/user groups at the cluster level will be represented in the revamped Forest Development Agency at the district level. The vision to set up federations is to strengthen grassroots institutional base for livelihood activities and enterprises at the cluster/landscape level (MoEF n.d.b).

While the GIM has envisaged a key role for PRIs, its implementation started only recently and it is yet to be seen if the PRIs will actually play a central role in planning and implementation.

CONCLUSION

Forest governance is a complex issue in India, with a plethora of acts and rules involving participation of multiple institutions at different levels and their diverse interests. While there has been an effort to decentralize governance of forests in India through JFM, the 73rd amendment has provided a legal space and a true possibility of bringing a decentralized form of governance for management of forests. As far as the forestry sector is concerned, though, the role of PRIs in delivering the directed mandate has had mixed experience.

This is mainly due to confusion over different provisions in sectoral laws. However, there are a few sectoral laws, such as the Biological Diversity Act and FRA that support devolution of powers to PRIs. In addition to amending or clarifying sectoral laws, another major area that needs attention is awareness generation and capacity building of PRIs. They can deliver only when they have adequate capacity and resources (funds and functionaries) to manage the forests sustainably.

For effective involvement in future REDD+ programs, PRIs need to be made aware about issues related to climate change, drivers of forest degradation and deforestation, and sustainable forest management. As REDD+ is premised on a landscape-based approach and requires convergence, PRIs could play an important role in REDD+ at the grassroots level.

REFERENCES

ActionAid. 2016. *Functioning of Autonomous Councils in Sixth Schedule Areas of North Eastern States*. Bhubaneswar, Odisha: Natural Resource Hub and Democratisation Hub, ActionAid India.

Agrawal, A. and J. Ribot. 1999. "Accountability in Decentralization: A Framework with South Asian and West African Environmental Cases." *Journal of Developing Areas* 33: 473-502.

Bijoy, C.R. 2012. *Panchayat Raj (Extension to Scheduled Areas) Act of 1996: Policy Brief*. Delhi, India: United National Development Programme.

Biswas, S. 2015. "Implementation of PESA: Issues, challenges and way forward." *International Research Journal of Social Sciences* 4 (12): 49-54.

Choudhury, D. 2014. "The Forest Rights Act, Northeast India, and Shifting Cultivators – A Commentary." In *Democratizing Forest Governance in India*, edited by S. Lele and A. Menon. New Delhi: Oxford University Press.

Crook, R. C. and J. Manor. 1998. *Democracy and Decentralisation in South Asia and West Africa: Participation, accountability and performance*. Cambridge, UK: Cambridge University Press.

ENVIS Center on Forestry. 2011. "JFM Committees and Forest Area." *Proceedings of National Workshop on Joint Forest Management*, June 27-28, 2011. Dehradun, India: Forest Research Institute. Accessed June 20, 2016. http://frienvis.nic.in/Database/JFM-Committees-and-Forest-Area-Under-JFM_1994.aspx.

GoI. 2006a. *Planning for the sixth schedule areas and those areas not covered by Parts IX and IX-A of the Constitution*, Report of the Expert Committee. New Delhi: Ministry of Panchayati Raj, Government of India.

GoI. 2006b. *The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006*. New Delhi: Ministry of Law and Justice, Government of India.

Governments of Indonesia and Switzerland. 2004. "Decentralization, Federal Systems in Forestry and National Forest Program". In *Report of The Interlaken Workshop*, co-organized by the Governments of Indonesia and Switzerland, April 27-30, 2014, Interlaken, Switzerland.

Keating, M. 1998. *The new regionalism in Western Europe*. Northampton, UK: Edward Elgar Publishing.

Krishnan, P., R. Ramakrishnan, S. Saigal, S. Nagar, S. Faizi, H. S. Panwar, S. Singh, and N. Ved. 2012. *Conservation across landscapes: India's approaches to biodiversity governance,* edited by P. Krishnan and R. Ramakrishnan. New Delhi, India: United Nations Development Programme.

Mahapatra, A. K. and C.M. Shackleton. 2011. "Has de-regulation of non-timber forest products control and marketing in Odisha state affected local patterns of use and marketing?" *Forest Policy and Economics* 13 (8): 622-629.

MoEF. 2012. *India's Second National Communication to United Nations Framework Convention on Climate Change*. New Delhi, India: Ministry of Environment and Forests, Government of India.

MoEF. n.d.a. *Joint Forest Management - A Handbook: Capacity Development for Forest Management & Training of Personnel*, ID-P199. New Delhi: Ministry of Environment and Forests, Government of India

MoEF. n.d.b. *National Mission for a Green India*. New Delhi: Ministry of Environment, Forest and Climate Change,

Government of India. Accessed June 5, 2016. http://www.envfor.nic.in/major-initiatives/national-mission-green-india-gim.

MoPR. 2011. *State of Panchayati Raj 2010-11: A Report*. New Delhi: Ministry of Panchayati Raj, Government of India.

NBA. 2011. *Biodiversity...Future Secured*. Chennai, India: National Biodiversity Authority.

Planning Commission. 2011. "Report of the sub-group II on NTFP and their sustainable management in the 12th five year plan." In *A Report submitted under Planning Commission's working group on forests and natural resource management*. New Delhi: Planning Commission, Government of India.

RCDC. 2011. "NTFP Laws Policies and Management." *Banajata* website. Accessed June 3, 2016. http://www.banajata.org/pdf/state-level/orissa.pdf.

Ribot, J. 2002. *Democratic Decentralization of Natural Resources: Institutionalizing Popular Participation*. Washington, DC: World Resources Institute.

Rodríguez-Pose, Andrés, and N. Gill. 2003. "The Global Trend towards Devolution and its Implications." *Environment and Planning C: Government and Policy* 21 (3): 333-351.

Sarin, M. 2014. "Undoing Historical Injustice: Reclaiming Citizenship Rights and Democratic Forest Governance through the Forest Rights Act." In *Democratizing Forest Governance in India*, edited by S. Lele and A. Menon. New Delhi: Oxford University Press.

Sethi, N. 2016. "Opposition Criticises Government's Move to Dilute Forest Rights Act." *Business Standard*, May 5. Accessed June 15, 2016. http://www.business-standard.com/article/economy policy/opposition-criticises-government-s-move-to-dilute-forest-rights-act-116050500042_1.html.

Sharma, P. 2016. "Rs 13 cr attached in NC Hills scam." *The Telegraph*, January 4. Accessed June 3, 2016. http://www.telegraphindia.com/1160104/jsp/northeast/story_62018.jsp#.V1EhCpF9600.

Thyniang, A. 2015. "My vote of confidence for the abolition of ADCs." *The Shillong Times*, October 13. Accessed June 3, 2016. http://www.theshillongtimes.com/2015/10/13/my-vote-of-confidence-for-the-abolition-of-adcs/.

TNN. 2015. "Congress-rules states debunk changes to green laws." *The Times of India*, April 8. Accessed June 15, 2016. http://timesofindia.indiatimes.com/india/Congress-ruled-states-debunk-changes-to-green-laws/articleshow/46843579.cms.

Vani, M. S. 2002. "Panchayat Raj and Water Resource Management in India: Law and Policy." In *Workshop on Policy Futures for Water Resources Management in India : From prescription and impact assessment to strategic analysis*, October, 3-5, 2002, Hyderabad, India. International Water Management Institute, New Delhi and International Crops Research Institute for the Semi-Arid Tropics, Hyderabad, India.

FURTHER READING

Aggarwal, A., S. Das and V. Paul. 2009. *Is India ready to implement REDD Plus? A preliminary assessment*. New Delhi: The Energy and Resources Institute (TERI).

DFID. 2005. *Incorporating stakeholder's perceptions in participatory forest management: The law and policy context*. New Delhi: Department of International Development.

Bag, H., N. Ojha and B. Rath. 2010. *NTFP Policy regime after FRA: A study in select states of India*. Bhubaneshwar, Odisha: Regional Centre for Development Cooperation.

Kothari, A., N. Pathak and A. Bose. 2009. *Forests, rights, and conservation: The scheduled tribes and other traditional forest dwellers (recognition of forest rights) Act 2006*, Legislative Briefing Note. Pune, India: Kalpavriksh.

Lele, S., R.V. Ramanujam and J. Rai. 2015. "Cooperative procurement and marketing of tendu leaves in Madhya Pradesh: Image and reality." In *Environment and Development, Discussion paper series*. Bangalore, India: Ashoka Trust for Research in Ecology and the Environment.

Lele, S. 2014. "What is wrong with Joint Forest Management?" In *Democratizing Forest Governance in India*, edited by Lele, S. and A. Menon, 25-26. New Delhi: Oxford University Press.

MoEF. 2010. *Report of the National Committee on Forest Rights Act*. New Delhi, India: Ministry of Environment and Forests, and Ministry of Tribal Affairs, Government of India.

MoEFCC. 2014. *National policy on REDD+: Final draft*. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India. Accessed June 20, 2016. http://www.moef.nic.in/sites/default/files/Draft%20National%20REDD%2B%20Policy%20and%20Strategy%202014_0.pdf.

Nayak, B. P., P. Kohli and J.V. Sharma. n.d. *Livelihood of local communities and forest degradation in India: Issues for REDD Plus. Policy brief*. New Delhi: The Energy and Resources Institute (TERI).

Rawat, J. K., S. Dasgupta and R. Kumar. 2004. "Assessment of Tree Resources outside Forest based on Remote Sensing Satellite Data." In *Proceedings of Map India Conference 2004*, January, 28-30, 2004, Delhi, India.

Shrivastava, K. S. 2014. "India readies to implement UN's REDD+ program." *Down to Earth*, May 2. Accessed June 20, 2016. http://www.downtoearth.org.in/news/india-readies-to-implement-uns-redd-programme-44218.

Chapter 12 : BENEFIT SHARING MECHANISMS UNDER REDD+: LEARNING FROM THE JOINT FOREST MANAGEMENT PROGRAM

Bhaskar Sinha[1]

INTRODUCTION

The fifth assessment report of the Intergovernmental Panel on Climate Change (IPCC) confirms that human influence on the climate system is clear and growing, with impacts observed across all continents and oceans. It further concludes with 95 percent certainty that humans are the main cause of current global warming. It is, therefore, necessary that we limit the emission of greenhouse gases (GHG) with possible solutions in all sectors and countries through global cooperation. This will help avoid the risks of severe, pervasive, and irreversible effects on people and ecosystems, and long-lasting changes in all components of the climate system (IPCC 2014). Impacts of climate change will amplify existing risks and create new risks to natural and human systems. Moreover, risks and adverse impacts are unevenly distributed and are generally greater for disadvantaged people and communities in countries at all levels of development, with more severe and early effects on developing countries due to lesser adaptive capacities (Stern 2006, IPCC 2014).

Global efforts to mitigate climate change began with adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and protocol to the convention (1997), known as Kyoto Protocol, which is based on the principle of common but differentiated responsibilities and respective capabilities. Additionally, actions are prioritized every year in subsequent Conference of the Parties (COP) meetings to the UNFCCC based on deliberations and negotiations. The protocol mandated that developed countries reduce emissions of GHGs, and introduced three flexible mechanisms to meet emission reduction targets in order to combat impacts of climate change. The Clean Development Mechanism (CDM) was one of the flexible mechanisms with two objectives: to provide a cost-effective mechanism for the developed world to offset GHG emissions, and to contribute to sustainable development by transferring new low-carbon technologies to developing countries that host CDM projects (UNFCCC 1997). However, although CDM has helped developed countries meet their commitments to Kyoto protocol at a cheaper rate, CDM could not incentivize a large number of developing countries to adopt cleaner

technologies. Another critique of CDM is that it allowed a few major developing countries like China, India, Brazil, and Mexico to exploit the benefits of CDM by investing in projects that helped them reap more profits rather than reduce emissions cost-effectively (Wara 2008, Paulsson 2009).

Benefits and opportunities under CDM in the forestry sector were confined only to Afforestation and Reforestation (A&R) projects, which not only contributed to local, regional, and national economies but also generated local, national, and global environmental and social benefits. Furthermore, A&R CDM projects helped establish recognition of "carbon services" provided by forests at the global level, and presented a valuable opportunity to forest owners, forest departments, and forest-dependent communities in developing countries to create win-win partnerships while responding to the global challenge of climate change mitigation (UNFCCC 2013). In spite of such direct economic benefits and other co-benefits in the form of ecosystem services from CDM A&R projects, total Certified Emission Reductions (CER) issued under CDM so far is 0.8 percent of the entire CERs issued up to March 31, 2017 (UNFCCC 2017a). Furthermore, the Land use, Land Use Change and Forestry sector contributed 16 percent to global emissions in 1990 and a significantly reduced 11 percent in 2010 (UNFCCC 2014), implying that this sector has immense potential to reduce emissions and improve livelihoods of dependent people, but it did not benefit from CDM. The majority of developing countries could not register any CDM A&R projects – only 24 countries together registered 66 projects up to March 2017 (UNFCCC 2017b). Stringent modalities and procedures, higher transaction costs, inadequate technical expertise, and complex land holding patterns of developing countries are some reasons believed to explain the lower number of CDM A/R projects registered under CDM (Paulsson 2009, Thomas *et al*. 2010). Moreover, no incentive for activities related to controlling deforestation and forest degradation exists under CDM, even though these are considered major environmental threats not only furthering climate change but also exacerbating many issues threatening sustainable livelihoods of forest-dependent people.

Given this background of contrasts, global negotiations evolved to seek an alternate mechanism to incentivize more countries and induce them to participate in efforts to control deforestation and forest degradation. In turn, with further deliberation and discussion, the framework of Reducing Emission from Deforestation and Forest Degradation (REDD+) evolved to address the challenges related to forestry and climate change.

ORIGIN OF REDD+ FRAMEWORK

Globally, 31 percent of total land area (4 billion hectares [ha]) is under forest cover. However, between 1990 and 2000 a net loss of 8.3 million ha per year occurred, and during the following decade, up to 2010, a net loss of 6.2 million ha) per year occurred. A net loss of some 129 million ha of forest occurred between 1990 and 2015, about the size of South Africa and representing an annual net loss rate of 0.13 percent (Food and Agriculture Organization of the United Nations [FAO] 2016). Although the rate of loss has decreased, it remains very high, especially in tropical

regions (FAO 2010, Sloan and Sayer 2015). Apart from the devastating effects of tropical forest loss on biodiversity and on livelihoods of forest-dependent communities, this also significantly impacts global warming by release of carbon dioxide (CO_2), either by burning or degradation of organic matter (Amazon Institute of Environmental Research 2005). Thus, addressing the problem of deforestation and forest degradation is a prerequisite for any effective response to climate change (IPCC 2013). Furthermore, reducing deforestation is the single largest opportunity for cost-effective and immediate reduction of carbon emissions (Stern 2006).

Discussion in the Kyoto Protocol of reducing emissions from deforestation in developing countries to meet the target set by the developed countries ultimately resulted in rejection of this in the face of fundamental issues such as leakage, additionality, permanence, and measurement. At Montreal (December 2005), this proposal was reintroduced into the COP agenda for its 11th session (as requested by the Governments of Papua New Guinea and Costa Rica, supported by eight other Parties, through their submission FCCC/CP/2005/MISC.1). The proposal garnered wide support from Parties and participants who generally agreed about the importance of the issue in the context of climate change mitigation, particularly considering the large contribution of emissions from deforestation in developing countries to global GHG emissions. The COP established a contact group to address the proposal, and that group drafted conclusions about initiating a process to address reduction of emissions from deforestation (UNFCCC 2017).

In Bali (COP-13 2007), the proposal was taken up by the COP to the UNFCCC, which reiterated the importance of REDD+ in a post□2012 climate change regime, and called for more work and negotiation on this topic. The Bali Action Plan created a UNFCCC REDD+ web platform for technical assistance, demonstration activities, country-specific information, and methodologies. The Cancun Agreement (COP-16 2010) encouraged developing country Parties to contribute to mitigation actions in the forest sector by reducing deforestation and forest degradation, practicing conservation, implementing sustainable management of forest, and enhancing forest carbon stocks (REDD+) (see Figure 12.1). Text dedicated to REDD+ appeared in the Cancun Agreements (2010) – Section III c, paragraphs 68-79 and Annex I and Annex II requesting developing countries to undertake more activities in support of REDD+. Other parts of the Cancun Agreements relate to possible establishment of a REDD+ mechanism and development of REDD+ information for a registry. The most controversial issue (REDD+ fund distribution) was omitted from the REDD+ framework and postponed until COP-17 held in Durban (2011). Further, the Durban platform marked an important milestone with agreement on a comprehensive set of guidelines for Measurement, Reporting, and Verification (MRV) of countries' emissions reduction efforts. In Doha (2012), Parties negotiated the issues related to MRV and fund distribution, but failed to resolve a number of outstanding issues pertaining to assurance of a cost-effective, credible verification framework. To date, no universal mechanism or framework for REDD+ has been formulated to implement REDD+ projects across the world; however, many

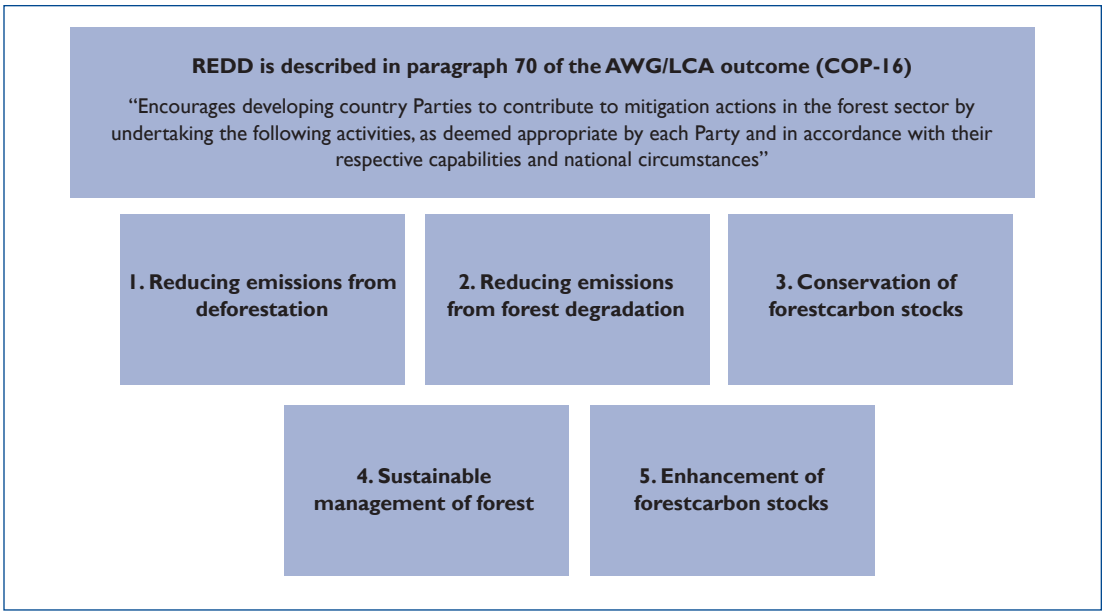


Figure 12.1 Description of REDD+ in Cancun

**Ad Hoc Working Group on Long-term Cooperative Action*

countries are conducting REDD+ pilot projects and concurrently developing the framework.

BENEFIT SHARING MECHANISM: KEY ISSUES

Reducing emissions from deforestation and afforestation is considered a cost-efficient mechanism for mitigating climate change (Stern 2007, Eliasch 2008) and fostering adaptation – "co-beneficial" activities in developing countries (Dutschke and Wolf 2007). This is considered the first real attempt by the international community to create a global forest governance system that would impact countries on national, regional, and local scales (Bayrak and Marafa 2016). REDD+ would not only significantly reduce CO_2 emissions but also reduce mismanagement of tropical forests. But, a challenge related to the REDD+ mechanism is to evolve equitable benefit sharing mechanisms. In an analysis of setting up effective and legitimate carbon governance from CDM to REDD+, Lederer (2011) identified the following three important reasons to be skeptical about linking REDD+ to use of market mechanisms:

- Under the REDD+ mechanism, local governance issues are much more vexing than under the project-based CDM because under REDD+, decisions about who gets compensated are difficult, especially in the context of a tropical forest, the area of which remains ambiguous because of no clear and legally defined ownership (Sunderlin *et al.* 2009).
- Even if ownership is clear, how much each stakeholder should receive is unclear.
- Given the grim experiences of various

indigenous peoples with their own governments, they could be deprived of REDD+ potential benefits.

The review of previous benefit sharing suggested that appropriate benefit sharing systems should aim to provide clear and direct incentives for action, and build support and legitimacy for the REDD mechanism; otherwise, overall effectiveness of the mechanism may be compromised (Lindhjem *et al.* 2011, Luttrell *et al.* 2013). REDD+ confronts a number of challenges, notably regarding resources for capacity building and benefit sharing. Furthermore, in the absence of consistent governance standards, success of REDD+ in combatting climate change in the Anthropocene would be only partial (Cadman *et al.* 2016).

The present chapter explores proposals for benefit sharing mechanisms in various countries, and proposes a mechanism for India based on capacities and commitment.

BENEFIT SHARING MECHANISMS: EXPERIENCES IN VARIOUS COUNTRIES

The framework of REDD+ includes scoping, referencing, financing, and distributing benefits. Effective implementation of the REDD+ framework in any country would depend upon guidelines for operation based on existing governance structure, and technical and financial capacities of the country in all four aspects of REDD+. Currently, no universal framework for implementing REDD+ is in place; however, experimental projects now implemented across the world could contribute to design of guidelines for different countries/regions (Tassa, Da RE, and Secco 2010). Moreover, benefit sharing mechanisms are a central design aspect of REDD+ as they help create necessary incentives to reduce carbon emissions (Luttrell *et al.* 2013), and should be based on experiences and existing institutional mechanisms (Lindhjem *et al.* 2011).

In the context of developing guidelines for equitable distribution of benefits among stakeholders in India, it is important to review existing/proposed mechanisms from other parts of the world. Subsequently, based on the review, a mechanism for distribution of incentives in the Indian context is proposed.

Brazil

Brazil has adopted two mechanisms for REDD+ benefit sharing – a national funding mechanism and a project-based approach.

- Regarding the national funding mechanism, the Government has established the "Amazon Fund" to manage funding received from carbon payments. The Brazilian National Development Bank is authorized to raise national or international, private or governmental funds to support actions to prevent, monitor, and fight Amazon deforestation (World Wide Fund for Nature [WWF] 2008). The "Technical Committee" is responsible for decisions to finance projects related to natural resource management (sustainable forest management, protected area management, public forest management, environmental control and patrolling, economic activities based on sustainable use of natural resources, land ownership regulation, biodiversity conservation, and biodiversity sustainable use). Members of the Technical Committee include representatives from

the Federal Government (Environment Ministry and the Strategic Affairs Secretariat), Governments of the Amazon states, and civil society (Non-Governmental Organizations [NGOs], private enterprises, universities, and unions).

- Under the project-based approach, forest areas undergoing a higher rate of deforestation are selected as protected areas, and sustainable extraction is promoted (e.g., the Juma Project, which aims to reduce forest degradation and enhance social benefits to the local community, thus strengthening the social and environmental structures [Baker and McKenzie 2009, Khatri *et al.* 2010]).

Brazil has implemented different activities that might serve as precedents for future REDD activities. Amazon Institute for Environmental Research conducted a study based on simulation under which Amazonas, the largest state with 98 percent of its original forest cover, would receive the most (25 percent) benefits; Mato Grosso, with high historical deforestation and only 55 percent of its original forest cover, would receive the second-most benefits (23 percent); and the remaining benefits would be approximately evenly divided among other states (Environmental Defense Fund 2009). A performance-based payment system like the one in Amazonas could be a strong basis of Brazil's REDD program (Khatri *et al.* 2010).

Nepal

At the international level, of great concern is the discussion about respecting and ensuring the rights of local communities, as well as equity among socio-economic groups and gender equity. To address these equity-related concerns, allocation of the REDD+ payment in Nepal depends on performance and social criteria. Sixty percent of REDD+ payment is based on socio-economic criteria, apportioned as follows: a number of households of Indigenous people (10 percent), a number of Dalit households (15 percent), the ratio of men to women (15 percent), and the population of poor people (20 percent). The remaining 40 percent of the payment is based on level of forest carbon enhancement (forest carbon pool) (24 percent), and enhancement of forest carbon stock (16 percent). This was implemented as a pilot project in three watersheds within the Dolakha, Gorkha, and Chitwan districts of Nepal by International Centre for Integrated Mountain Development with partners of the Federation of Community Forestry Users, Nepal, and the Asia Network for Sustainable Agriculture and Bioresources. The project, financed by the Norwegian Agency for Development Cooperation under the Climate and Forest Initiative, covers over 10,000 ha of community-managed forest, and has an outreach to more than 18,000 households with more than 90,000 forest-dependent people (ICIMOD 2012).

Indonesia

The benefit-sharing mechanism in Indonesia is coordinated and managed by the Government (Ministry of Forestry) with support of the state and various institutions at a different level. A working group on climate change established within the Ministry of Forestry is responsible for developing regulations to support REDD programs, and for helping to enhance co-ordination among different organizations/actors working under REDD (Baker and McKenzie 2009). Based on a revenue sharing scheme released by the Ministry of Forestry, the benefit

is distributed according to type of forest ownership.

Project areas are classified as Indigenous Forest, Community Forest, and Protected Forest. In Indigenous Forest, 10 percent of the revenue would go to the government, 70 percent to the community, and 20 percent to the developer. In Community Forest, the government would receive 20 percent of the revenue, with 50 percent and 30 percent received by the community and developer, respectively. In Protected Forest, 50 percent of carbon payments would go to the government, 20 percent to local communities, and 30 percent to the developer. In all cases, the government share would be split among different levels of government: 40 percent to the central government in Jakarta, 20 percent to the provincial government, and 40 percent to the district government. Thus, the breakdown of revenue distribution depends on type of forest and community or indigenous groups, who receive a greater percentage where they are involved in forest management (Khatri *et al.* 2010).

Vietnam

The benefit-sharing mechanism in Vietnam is managed by the Department of Forestry under the aegis of the Ministry of Agriculture and Rural Development (MARD). A number of institutions in coordination with MARD are involved in implementing REDD+ in Vietnam. The country has pledged to address deforestation and forest degradation through capacity building at both the national and local levels (UN-REDD Vietnam Program).

The Government has identified indigenous minorities associated with the forest over a longer time. In this regard, the Government has opened branch offices at the local level, and local people are responsible for providing consultation and advice to the Government on issues related to REDD+. Vietnam has three basic types of national-level financing mechanisms for ecosystem services. First is the *Regular Government Budget,* in which benefit distribution mechanisms operate via inter-governmental fiscal transfers whereby national or state agencies receive respective fixed budgets or performance-based incentives to be distributed to sub-national units. In the *Targeted Fund*, the funding mechanism depends less on annual budgeting, and administrators have more autonomy in their financial operations. In the *Decentralized Structure with National Tax,* the benefit distribution system grants sub-national units significant autonomy, and assigns a greater regulatory role to the central government. In this case, sub-national governments can participate in development of projects, charge fees on projects under their jurisdictions, or remain uninvolved with projects (Khatri *et al.* 2010).

Peru

Peru implemented REDD+ via a nested approach involving a series of challenges related to new and existing sub-national projects and jurisdictional activities, and integration of these into broader jurisdictional activities. REDD+ programs within the national regulatory framework are related to reference emission levels, MRV, Safeguard Information System, and benefit sharing. Land tenure and users' rights pertaining to land and natural resources are considered criteria to differentiate beneficiaries, and to determine different REDD+ benefits that could be achieved. Further emphasis is on roles of different stakeholders (governmental

and non-governmental) to ensure an equitable, transparent, and efficient distribution of REDD+ benefits, as the country advances in implementation of the nested approach (Ackzell *et al.* 2014).

Tanzania

Tanzania tested benefit-sharing and payment mechanisms through NGOs in REDD+, and stated that distribution of benefits should proceed through village general assemblies. This would ensure involvement of existing government institutions in implementation of REDD+. The village general assembly is involved in monitoring and distribution of the benefits, and ensures transparency in handling finances. Models proposed for sharing benefits resulting from implementation of REDD+ in Tanzania apply to two forest management systems: Joint Forest Management (JFM) and Community-Based Forest Management (Silas 2016).

Kenya

A conceptual framework was developed for benefit-sharing mechanism for REDD+ as "Agreements between stakeholders, such as private sector, local communities, government and non-profit organizations, about the equitable distribution of benefits related to the commercialization of forest carbon." Funds from the international community for REDD+ activities have to be vertically shared among central, regional, and local governments (including NGOs and private developers), and be horizontally shared among different communities, within communities, and within households in those communities. The Kenyan projects were implemented by Mount Elgon Region Conservation Programme in the Mt Elgon area, the Green Belt Movement in Mount Kenya, and Wildlife Works Carbon (WWC) in Taita-Taveta. In Taita-Taveta (the Kasigau Corridor), WWC manages carbon credits on behalf of community members. The money received from international buyers was shared equally among the community, shareholders of the land and WWC (one-third to each). The third belonging to the community was given to a group (e.g., women's group, youth groups etc.) for implementation of an activity to generate new incomes. For every new project approved for the community, a new bank account was opened (Chenevoy 2011).

PROPOSED BENEFIT SHARING MECHANISM FOR OPERATIONALIZING REDD+ IN INDIA

Experiences in implementing different REDD + pilot projects across the globe suggest that the benefit-sharing mechanism must be transparent and based on an existing, robust MRV mechanism. Of further importance is sharing of a major part of economic benefits by the local communities who are the agents of change for protecting and maintaining forest cover, contributing to carbon stock. In addition, part of the benefits must be distributed to strengthen forest governance/monitoring at different levels of the related government institutions. In this regard, one possible distribution mechanism with proportionate incentives among different levels of government agencies and communities is proposed in annexure 12.1.

Pham *et al.* (2013) conducted a comparative analysis of benefit-sharing mechanisms of 13 countries that revealed a diverse range of approaches to and options for benefit sharing. Advantages of building upon existing legal

frameworks are possible reduction in costs of establishing and operating new institutions for sharing benefits from REDD+, and increased chance of political support from the state. The Forest Department (FD) in India is entrusted with the role of planning, monitoring, and management that can lead to sustainable forest management in India, guided by policies, acts, and guidelines. A review of the literature revealed that a distribution mechanism under REDD+ should be transparent and fair based on a robust, existing MRV mechanism and broad mandate of the government. In this context, recognition of JFM committees in India is significant for reception of benefits under REDD+ because these committees have been working closely with FD in managing forests.

Distribution of benefits plays a central role in incentivizing action regarding REDD+ and formulating benefit-sharing mechanisms for developing countries. To incentivize action among stakeholders is critical for success of REDD+ in the long term (Dunlop and Corbera 2016). How to distribute benefits among different countries could be determined by reference to a range of different country-level factors such as relative affordability and availability of carbon enhancements (cost effectiveness), rate of deforestation and forest degradation, amount of existing forest cover or carbon stocks, potential or actual performance of carbon enhancement activities, general status of forest governance, and overall biodiversity and/or socioeconomic conditions of the country (Khatri *et al.* 2010). Mechanisms for sharing benefits vary across countries because compensation is based on national reporting of overall carbon reduction.

India has already communicated that it would report on its emission reduction through the REDD+ mechanism at the national level (http://unfccc.int). The country has lobbied hard to include the "plus" part in the REDD+ mechanism. The plus means inclusion of conservation of forest stocks, sustainable management of forests, and enhancement of forest carbon stocks. This implies that India has emphasized the need to recognize efforts at maintaining and increasing carbon stocks by conservation and sustainable management of forests. Since the 1980s, India, consistent with international commitments and agreements, has taken notable policy and legal measures to check deforestation and promote afforestation.

India is one of the top 10 countries in terms of forest cover globally (FAO 2016). The Forest Survey of India (FSI) is a nodal agency involved in monitoring and reporting on forest cover and other important attributes of India's forests every 2 years. Since its first report in 1987, forest cover of India has moderately increased from 19.52 percent to 21.34 percent in 2015, with an increase in the dense forest area. This can be attributed to conservation policies that have brought India into the top 10 countries with greatest annual net gain in forest area from 2010 to 2015 (FAO 2016). Thus, it would be appropriate to include the assessment of carbon stock along with forest cover, which would represent the net result of protection, conservation, and management of forests (REDD+) by respective states. In the last few Indian State of Forest Reports (ISFR), FSI has been publishing state-wise data on growing stock of forests, as well as Trees outside Forests (TOF) (see Table 12.1), which could be considered as baseline and also a strong rationale to transfer the funds/benefits from center to state. Further, FSI has also included

calculation of carbon stock in India's forests in the last few published ISFRs, which shows its preparedness for monitoring GHG emission in the forestry sector.

International to National Level

How to share benefits is expected to be a key issue in development of REDD+. At the national level, the Government of India (GoI) has established a REDD+ Cell in the Ministry of Environment, Forest and Climate Change (MoEFCC) with the task of coordinating and guiding REDD+ related actions at the national level, and of assuming the role of guiding and collaborating with State Forest Departments (SFD) to collect, process, and manage all relevant information and data relating to forest carbon accounting. National REDD+ Cell would also be responsible for providing guidance on formulation, development, funding, implementation, monitoring, and evaluation of REDD+ activities in the states. The Cell will assist MoEFCC and its appropriate agencies in developing and implementing appropriate policies relating to REDD+ implementation in the country.

According to India's submission to the Subsidiary Body for Scientific and Technological Advice agenda item 4, "all equations, growth and biomass yield models used in the computation of forest carbon stocks will be based on published records and freely and readily accessible to all for evaluation." Therefore, ISFR data will be applied to calculate carbon stock. As already mentioned, the FSI has estimated the amount of carbon stock in India's forests in its last few published ISFRs – useful for calculating total carbon sequestrated and enhancement of carbon stock at the national level. Calculations/ reports of analysis should be rechecked by independent evaluators before submittal to the UNFCCC. Quality Assurance and Quality Control will apply to all processes, procedures, and methodologies used in generating that information. Leading scientific organizations like Indian Institute of Remote Sensing, Indian Institute of Science, National Remote Sensing Centre, Indian Council of Forestry Research and Education, Indian Institute of Forest Management, and other related academic institutions can also assist MoEFCC and FSI in strengthening the methodology and improving precision of data generated.

National to State Level

Involvement of government institutions and representatives of civil society, private, and donor organizations in REDD+ Cell is important for maintaining transparency and accountability at each level. The states would be incentivized by the prospect of enhancing forest growing stock, as change in growing stock is a unique attribute allowing complete assessment of REDD+ activities that include reduction in deforestation and degradation, enhancement of carbon stock, and conservation and overall sustainable management of the forest. Data regarding state-wise growing stock are readily available in the ISFR for calculating total carbon and carbon stock. Distribution of benefits from the center to the state could be in proportion to the change in growing stock of each state (see Table 12.1). The budgetary component of the REDD+ mechanism shall be approved by the REDD+ Cell after analysis of the baseline, enhancement of carbon stock, in consultation with each concerned state. The state with lesser potential for productivity due to climate factors can be compensated further through other government funds in order to overcome the discrepancy.

Table 12.1: Change in growing stock (in %) of Indian States

States	Growing stock (in %) 2011	Growing stock (in %) 2015	Change in growing stock (in %)
Andhra Pradesh and Telengana	6.131	5.328	- 0.803
Arunachal Pradesh	9.380	8.706	- 0.674
Assam	3.553	3.063	- 0.490
Bihar	1.362	1.153	- 0.209
Chhattisgarh	6.688	7.713	+ 1.025
Delhi	0.045	0.028	- 0.017
Goa	0.192	0.233	+ 0.041
Gujarat	2.749	2.858	+ 0.109
Haryana	0.333	0.359	+ 0.026
Himachal Pradesh	5.663	5.869	+ 0.206
Jammu & Kashmir	6.203	6.655	+ 0.452
Jharkhand	2.772	3.186	+ 0.414
Karnataka	6.894	6.649	- 0.245
Kerala	3.169	3.537	+ 0.368
Madhya Pradesh	5.536	6.393	+ 0.857
Maharashtra	7.288	6.640	- 0.648
Manipur	1.349	1.047	- 0.302
Meghalaya	1.098	1.019	- 0.079
Mizoram	1.281	1.204	- 0.077
Nagaland	0.887	0.850	- 0.037
Odisha	5.934	5.614	- 0.32
Punjab	0.579	0.540	- 0.039
Rajasthan	1.917	2.136	+ 0.219
Sikkim	0.345	0.473	+ 0.128
Tamil Nadu	3.551	3.230	- 0.321
Tripura	0.484	0.516	+ 0.032
Uttar Pradesh	3.391	3.811	+ 0.42
Uttarakhand	7.954	7.979	+ 0.025
West Bengal	2.286	2.115	- 0.171

Source: FSI 2011 and 2015

State to Division Level

At the state level, the state FD in collaboration with the State Remote Sensing Agency should be made responsible for preparation of forest carbon stock accounts at forest division level. A REDD+ coordinating committee at the state level is proposed, to include members from Headquarters, Divisional Forest Officer (DFO), a nominee from State Remote agency, researcher/academician, and local people. The committee should collaborate with the DFO to collect, process, and manage all relevant information and data relating to forest carbon accounting. Enhancement in carbon stock can be re-verified by the data of FSI, and be validated through sampling by a separate agency (which may be a research organization/ academic institution) at the district or state level. FD can take a lead in verification and certification by establishing a separate wing at the state/circle/division level.

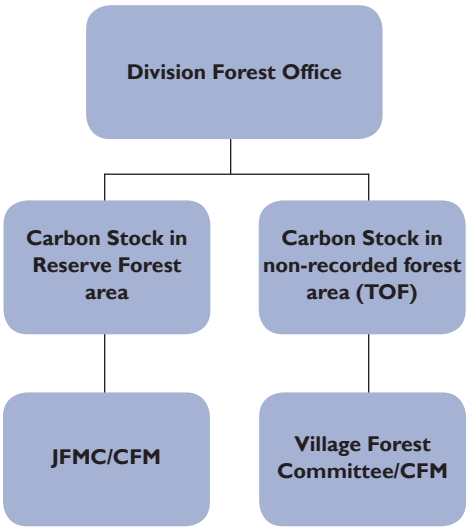


Figure 12.2: Classification of the forest at division level on the basis of ownership

Further, the Forest Division and REDD+ coordinating committee in consultation with the state remote sensing cell should calculate the carbon stocks for 1) forest in recorded forest area, 2) forest in non-recorded forest area (TOF) (see Figure 12.2 above). Allocation of funds for distribution should be on the basis of growing stock in both categories. Prime stakeholders of recorded forest area could be local forest department officials and linked JFM committees and CFM (Community Forest Management) committees. These committees can be further evaluated for their contribution toward carbon stock, and may be proportionally rewarded. In areas of no involvement of local communities, total share could be used by FD for further strengthening FD's activities related to Natural Resource Management (NRM). In addition, FD should be mandated to spend a small portion of its incentive on a capacity building program related to MRV of REDD+ and technical skills pertaining to NRM.

Major stakeholders of forest stock under non-recorded forest area could be village/Gram Panchayat/private land holders. A minimum area that could be mapped (1 ha) and analyzed through remote sensing could be considered the criterion for identifying stakeholders. It would be practically difficult to identify all stakeholders with a lesser tree/forest cover for distribution of incentives. Also important is that in the absence of sound methodology, an error in identifying and quantifying benefits could occur, which could turn out to be counterproductive. In countries like Indonesia, the overall process of REDD+ implementation is overseen by a developer for MRV who facilitates the process, and also negotiates with donors and the government in exchange for a

certain share of the project payments. In India, however, a developer or other agencies cannot be involved in implementation except during re-verification, because FD is the nodal agency for managing forests in India. Further, FD and other related institutions are competent to lead project development because of their technical staff who are well trained for undertaking all activities related to REDD+.

Division to Local Level

As proposed above, a major portion of total benefit has to be distributed among stakeholders other than FD officials responsible for conservation and reduction in deforestation and degradation of forests. Therefore, care has to be taken to identify the right stakeholders and their contributions at a level that could be quantified fairly and transparently based on MRV. This will require specific knowledge and technology along with institutional setup with adequate infrastructure and trained manpower. Under such circumstances, distribution of incentive at the community level is a viable option even though distribution at the individual level would have been ideal. However, Brazil is implementing compensation of individuals/households for forest conservation (Baker and McKenzie 2009), whereby incentives are distributed in terms of direct monetary benefit to an individual household for conservation and enhancement of carbon stock. Every family living in the forest reserve (Amazon and Juma forest reserve) has received a credit card. The state government credits approximately USD 50 every month to each cardholder's account as payment for his/her effort in keeping the forest intact, and BNDES is responsible for incentivizing people and maintaining transparency and accountability.

Regarding India, livelihoods of a large number of forest fringe population (200 million) are directly linked to forest resources. Further, their levels of dependency and carbon sequestration potential of the forest vary significantly. Moreover, people are affected indirectly by project activities such as land use change or restriction in access to forest and forest services. As a result, identification of stakeholders and appraisal of their contributions to enhancement of carbon stock would be a cumbersome process.

The JFM program in India since the early 1990s is an example of state-initiated decentralization whereby the community participates in forest management and protection along with the FD, sharing benefits derived from the same. On the basis of mutual trust and jointly defined roles and responsibilities of local communities and the FD, the JFM Committee is conserving about 23 million ha of forests in 118,213 forest protection/village committees throughout the country (FSI 2011). Along with JFM, CFM has remarkably impacted conservation of natural resources, and has also strengthened local institutions (Singh, Sinha, and Mukherji 2005). Via collective action, CFM has contributed significantly to checking deforestation and forest degradation, increasing local capacities in forest management, and addressing social issues. This implies that community-oriented forest management is more successful in India. Involvement of forest committees (JFM and CFM) and community-centric payment could respect, as well as restore, local rights and enhance the level of conservation. Therefore, benefits at the local level should be distributed at the community level.

At the division level, a REDD+ coordination committee is proposed for classification and

identification of recorded forest area and non-recorded forest area (more than 1 ha). The committee should collect, process, and manage all relevant information and data relating to forest carbon accounting at the local level. The REDD+ coordination committee at the division level and the Forest Division office should be responsible for ensuring equitable and proportionate distribution of benefits due to enhancement of carbon stock in the recorded forest area. On the other hand, village or Gram Panchayat or CFM should be incentivized to increase carbon stock under non-recorded forest area. The committees could spend the money on the basis of their norms, with a small portion of their incentive mandated toward training and education related to NRM. Roles and responsibilities of different institutions are summarized in Table 12.2.

Table 12.2: Roles and Responsibilities of Different Agencies at Different Levels

	Agencies	Responsibilities
National level	MoEFCC	• Coordinating and guiding REDD+ related actions at international and national levels.
	REDD+ Cell	• Guiding formulation, development, funding, implementation, monitoring, and evaluation of REDD+ activities in the states. • Assisting the MoEFCC and its appropriate agencies in developing and implementing appropriate policies relating to REDD+ implementation in the country. • Coordinating with state-level institutions for maintaining transparency and accountability.
	FSI	• Guiding and collaborating with SFDs to collect, process, and manage all relevant information and data relating to forest carbon accounting. • Calculating growing stock at the state level. • Coordinating with State Remote Sensing Cell during preparation of division map. • Monitoring, reviewing, and verifying at division level.
State level	SFD	• Coordinating and guiding REDD+ related actions at state and division levels.
	State Remote Sensing Cell	• Preparing division boundary map. • Demarcating recorded forest cover, non-recorded forest area, and TOF.
	REDD+ Coordination Committee	• Collaborating with the Forest Division office to collect, process, and manage all relevant information and data relating to forest carbon accounting.

	Agencies	Responsibilities
Division level	Division Forest Office	• Identifying JFM Committee. • Distributing benefits among different JFM Committees.
	REDD+ Coordination Committee	• Classifying and identifying recorded forest area, non-recorded forest area, and TOF. • Collecting, processing, and managing all relevant information and data related to forest carbon accounting.
	NGO & Community Representative	• Re-verifying baseline and growing stock. • Auditing
Village level	JFM /Committee/ Gram Sabha	• Conserving and protecting forest. • Utilizing fund.
	NGO & Community Representative	• Training in and maintaining awareness of NRM, especially in REDD+. • Auditing at the local level. • Providing relevant information about audit in public domain.

ROLE OF JOINT FOREST MANAGEMENT IN IMPLEMENTING REDD+

JFM has been implemented for more than two decades in the country, and throughout these years the program has undergone mixed reviews. It has been reported that post-JFM implementation, regeneration status and productivity of degraded forests have improved in some parts of the states of West Bengal, Madhya Pradesh, Orissa, and Andhra Pradesh (Singh, Sinha, and Mukherji 2005; Bhattacharya, Pradhan, and Yadav 2010). Concurrently, this has resulted in an increase in availability of forest products, like Non-Timber Forest Products (NTFP) and fuelwood, which are critically linked to the livelihood of forest fringe communities. Additionally, participation of communities in protecting forest from fire, grazing, and illegal felling also increased because of JFM. With the passing years, JFM gained popularity, and the GoI (through its resolution on February 14, 2000) advised SFDs to extend the scope of JFM from degraded forest areas to dense forest areas. Some states – namely Andhra Pradesh, Chhattisgarh, and Madhya Pradesh – made provision for 100 percent sharing of profits to local people in cases of timber and NTFPs, and this was hailed as a positive move by the Government.

Further, the JFM resolution also cites the benefit of sharing arrangements for its long-term sustainability. Although this arrangement and participation of communities vary from state to state, it could be used for framing the benefit sharing mechanism of REDD+ implementation. If JFM addresses some current challenges such as people's participation, collaboration between SFDs and communities, transparency in resource and benefit sharing,

and monitoring of forest and its utilization, JFM can be strengthened as a program involving communities for protection and conservation of forests (Behera and Engel 2006). Increases in social capital and technical expertise during implementation of JFM and CFM are additional enabling conditions for effective implementation of REDD+ in India. In this context as well, Newton *et al*. (2015) also have recognized that implementing REDD+ benefits experiences of CFM and JFM, and is the right approach because CFM and JFM both share a common motive of managing forests sustainably. Financial incentives generated through carbon added or carbon saved will further augment incentives already derived by JFM Committees through harvesting of NTFP, and contribute to the overall socio-economic development of the country.

REGULATORY FRAMEWORKS AND LEGAL PROVISIONS RELEVANT FOR ACCESS AND BENEFIT SHARING UNDER REDD+ IN INDIA

The notion of REDD+ "co-benefits" was raised in the 2007 Bali Action Plan, along with potential of REDD+ to complement aims and objectives of other multilateral agreements, such as the Convention on Biological Diversity (CBD) and United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP). India is a party to both the conventions, and also pursues REDD+. Therefore, given its commitments to conventions and REDD+ strategies, India must ensure policy coherence in striving to maximize direct and indirect benefits without impacting biodiversity. In India, FD is the nodal agency with sole right to manage forests. Previous forest policies and acts strongly favored utilization of forests for production and land conversion over conservation and rights of forest dwellers. Not until recently has the country voiced its support for conservation of forests by limiting degradation and deforestation, which are also anticipated goals/outcomes of REDD+. The current forest policy of India, the National Forest Policy of 1988, supports a participatory approach to forest management. This action in 1988 led to implementation of the JFM Act in 1990, calling for community participation in forest management and protection (along with FD), with the community sharing benefits derived from the same.

In addition to JFM, other related acts, policies, and frameworks have strengthened rights of forest dependents and tribal communities in conserving biodiversity. Legal instruments like JFM and provisions under the Schedule Tribes and other Traditional Forest Dwellers (Recognition of Forest Rights) Act (2006) aim to safeguard and ensure rights of tribals and forest dwellers while enabling local communities to be key players in local-level governance of natural resources. In addition to this, the Biodiversity Act (2002) emphasizes conservation of biodiversity, sustainable uses of natural resources, and equitable sharing of benefits arising from those uses. The Act also mandates formation of National Biodiversity Authority, State Biodiversity Boards, and Biodiversity Management Committees at the local level with healthy participation of women and scheduled castes and tribes. The National Environmental policy (2006) emphasizes the need for equitable benefit sharing of biological resources and traditional knowledge to confer Intellectual Property Rights on local communities possessing traditional knowledge. Furthermore, legislative provisions of India for conservation of forest and enhancement of biodiversity – Wildlife (Protection) Act,

1972; Forest Conservation Act, 1980; and Environment Protection Act, 1986 – will further promote activities of REDD+ in India.

CONCLUSION

The review of implementation of REDD+ project across the globe suggests that issues related to MRV are key constraints to operation of REDD+. This challenge has hindered establishment of a universal framework for implementing the REDD+ project, and thus assurance of a fair and equitable benefit-sharing mechanism. In this regard, strengthening existing institutional setups related to management of forests of a country may help overcome bottlenecks to development of a framework for REDD+.

Forest officials in India are a trained cadre, and the Forest Department is the nodal agency responsible for management of the country's forests. Government organizations, namely FSI, the National/State Remote Sensing Agencies, and other scientific organizations monitor the different attributes of India's forests – especially forest cover, growing stock, and carbon stock. With the help of forest stakeholders (i.e., JFM communities, CFM communities, NGOs, and FD), and bolstered by data inputs from FSI and remote sensing agencies, an effective mechanism for equitable benefit sharing of REDD+ can be developed in the country on the basis of MRV to check forest degradation and deforestation. An additional suggestion is to encourage evolution of current forest management plans at different scales based on the principles of the REDD+ framework. Developed capacity for actual assessment of change in forest carbon stock at different scales will contribute to implementation of the proposed benefit sharing mechanisms at all four levels (international to national, national to state, state to division and division to local JFM/CFM committees).

This would necessitate developing a more precise estimate of change in forest carbon stock at the lowest level (i.e., area under JFM committees). Forest officials may be advised to undertake effective record keeping and monitoring of forest degradation and deforestation, and calculation of carbon stock. It is also important to demarcate and geo-reference forest boundaries properly to the lowest level, and update these at regular intervals for better monitoring. Leading institutions and NGOs with relevant expertise may be involved in building capacities of forest officials in this regard. This would not only help India benefit from international market/mechanisms, but would also help create a robust monitoring mechanism for forest governance at all scales, from villages to the national level. Eventually, this would ensure both alleviation of poverty and economic development, as promised by REDD+ for legitimacy of the mechanism.

REFERENCES

Ackzell, L., C. Buss, J. Carino, P. Dewees, G. Dunning, J. Griffiths, and K. Clark. 2014. "Considerations for REDD+ benefit sharing in Peru." *The Forest Dialogue Steering Committee 2014*. http://theforestsdialogue.org/sites/default/files/peru_country_report_bs_english.pdf

Covington & Burling LLP and Baker & McKenzie. 2009. "Background Analysis of REDD Regulatory Framework." *Report prepared for the Terrestrial Carbon Group and UN-REDD*. May.

Bayrak, M. M. and L. M. Marafa. 2016. "Ten Years of REDD+: A Critical Review of the Impact of REDD+ on Forest-Dependent Communities." *Sustainability* 8 (7): 620.

Behera, B. and S. Engel. 2006. "Institutional analysis of evolution of joint forest management in India: A new institutional economics approach." *Forest Policy and Economics* 8 (4): 350-362.

Bhattacharya, P., L. Pradhan, and G. Yadav. 2010. "Joint forest management in India: Experiences of two decades." *Resources, Conservation and Recycling* 54 (8): 469-480.

Cadman, T., T. Maraseni, H. O. Ma, and F. Lopez-Casero. 2016. "Five years of REDD+ governance: The use of market mechanisms as a response to anthropogenic climate change." *Forest Policy and Economics*.

Chenevoy, A. 2011. *Benefit Sharing Mechanisms (BSM) for REDD+ in Kenya: Exploring the options* (Doctoral dissertation, Masters thesis report, Institut Superieur d'Agriculture).

Dunlop, T. and E. Corbera. 2016. "Incentivizing REDD+: how developing countries are laying the groundwork for benefit-sharing." *Environmental Science & Policy* 63: 44-54.

Dutschke, M. and R. Wolf. 2007. "Reducing Emissions from Deforestation in Developing Countries: The Way Forward, Climate Protection Programme." Eschborn, Germany: Federal Ministry for Cooperation and Development (GTZ).

Eliasch, J. 2008. *The Eliasch Review. Climate Change: Financing Global Forests*. London, UK: The Stationery Office Limited.

FAO. 2010. *Global Forest Resources Assessment 2010 Main Report*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FAO. 2016. *Global forest resources assessment 2015: How are the world's forests changing*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FSI. 2011. *India State of Forest Report*. Dehradun: Ministry of Environment, and Forests, Government of India.

FSI. 2015. *India State of Forest Report*. Dehradun: Ministry of Environment, Forest and Climate Change, Government of India.

International Centre for Integrated Mountain Development (ICIMOD). 2012. *Options for Payment Mechanisms under National REDD+ Programmes*. ICIMOD Working Paper 2012/6. Kathmandu, Nepal: International Centre for Integrated Mountain Development.

IPCC. 2013. *The Physical Science Basis*. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Geneva, Switzerland: Intergovernmental Panel on Climate Change.

IPCC. 2014. "Climate Change 2014: Synthesis Report." *Contribution of Working Groups I, II and III to the Fifth*

Assessment Report of the Intergovernmental Panel on Climate Change, edited by R. K. Pachauri and L. A. Meyer, 151 pp. Geneva, Switzerland: Intergovernmental Panel on Climate Change.

Khatri, D., B. R. Karki, and B. Bushley. 2010. *REDD+ Payments and Benefit-Sharing Mechanisms in Nepal*. Patan, Nepal: Forest Action Nepal

Lederer, M. 2011. "From CDM to REDD+ -- What do we know for setting up effective and legitimate carbon governance?" *Ecological Economics* 70 (11): 1900-1907.

Lindhjem, H., I. Aronsen, K. G. Bråten, and A. Gleinsvik. 2011. "Experiences with Benefit Sharing: Issues and Options for REDD-plus." Oslo: Pöyry Management Consulting.

Luttrell, C., L. Loft, M. F. Gebara, D. Kweka, M. Brockhaus, A. Angelsen, and W.D. Sunderlin. 2013. "Who should benefit from REDD+? Rationales and realities." *Ecology and Society* 18 (4): 52. http://dx.doi.org/10.5751/ES-05834-180452 http://dx.doi.org/10.5751/ES-05834-180452

MoEF. 1972. *The Indian Wildlife (Protection) Act, 1972*. New Delhi: Ministry of Environment and Forests, Government of India. http://www.moef.nic.in/sites/default/files/wildlife11.pdf

MoEF. 1980. *Forest (Conservation) Act, 1980*. New Delhi: Ministry of Environment and Forests, Government of India. http://envfor.nic.in/division/forest-conservation

MoEF. 1986. *Environment Protection Act, 1986*. New Delhi: Ministry of Environment and Forests, Government of India. http://www.envfor.nic.in/legis/env/eprotect_act_1986.pdf

MoEF. 2002. *The Biodiversity Act, 2012*. New Delhi: Ministry of Environment and Forests, Government of India. http://nbaindia.org/uploaded/Biodiversityindia/Legal/31.%20Biological%20Diversity%20%20Act,%202002.pdf

MoEF. 2006. *National Environment Policy, 2006*. New Delhi: Ministry of Environment and Forests, Government of India. http://www.moef.gov.in/sites/default/files/introduction-nep2006e.pdf

Moutinho, Paulo and Stephen Schwartzman, eds.. 2005. *Tropical Deforestation and Climate Change*. . Belém, Pará, Brazil: Instituto de Pesquisa Ambiental da Amazônia and Washington DC, USA: Environmental Defense.

Newton, P., B. Schaap, M. Fournier, M. Cornwall, D. W. Rosenbach, J. DeBoer, and A. Agrawal. 2015. "Community forest management and REDD+." *Forest Policy and Economics* 56: 27-37.

Paulsson, E. 2009. "A review of the CDM literature: from fine-tuning to critical scrutiny?" *International environmental agreements: politics, law and economics* 9 (1): 63-80.

Pham, T. T., M. Brockhaus, G. Wong, L. N. Dung, J. S. Tjajadi, L. Loft, C. Luttrell, and S. Assembe Mvondo. 2013. "Approaches to benefit sharing: A preliminary comparative analysis of 13 REDD+ countries." *Working Paper* 108. Bogor, Indonesia: Center for International Forestry Research.

Silas, S. R. 2016. "REDD+ benefit sharing under models tested by pilot projects in Tanzania: Inputs towards developing national benefit-sharing mechanism models." *Chinese Journal of Population Resources and Environment* 14 (1): 38-44.

Singh, K. D., B. Sinha, and S. D. Mukherji. 2005. "Exploring Options for Joint Forest Management in India." *Forestry Policy and Institutions Working Paper* No. 7. Rome, Italy: Food and Agriculture Organization of the United Nations.

Sloan, S. and J. A. Sayer. 2015. "Forest Resources Assessment of 2015 shows positive global trends but forest loss and degradation persist in poor tropical countries." *Forest Ecology and Management* 352: 134-145.

Stern, N. 2006. *Stern Review on the Economics of Climate Change*. London, United Kingdom: Her Majesty's (HM) Treasury.

Stern, N. 2007. *The Economics of Climate Change: The Stern Review*. Cambridge, UK: Cambridge University Press.

Sunderlin, W., A. Larson, and P. Cronkleton. 2009. "Forest tenure rights and REDD+: From inertia to policy solutions." In *Realizing REDD+: National strategy and policy options*. Edited by A. Angelsen. Pages 139-124. Bogor, Indonesia: Center for International Forestry Research.

Tassa, D. T., R. Da Re, and L. Secco. 2010. "Benefit sharing mechanisms and governance issues in Participatory Forest Management-REDD related projects: A Community Forest case□study in Tanzania." (In *Berlin Conference on the Human Dimensions of Global Environmental Change*, Berlin, October 8-9).

Thomas, S., P. Dargusch, S. Harrison, and J. Herbohn. 2010. "Why are there so few afforestation and reforestation Clean Development Mechanism projects?" *Land use policy* 27 (3): 880-887.

UNFCCC. 1997. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Bonn, Germany: Secretariat for United Nations Framework Convention on Climate Change. UN Doc FCCC/CP/1997/7/Add.1, Dec. 10, 1997; 37 ILM 22 (1998).

UNFCCC. 2010. Cancun Agreements. Cancun, Mexico: Secretariat for United Nations Framework Convention on Climate Change. http://unfccc.int/meetings/cancun_nov_2010/items/6005.php.

UNFCCC. 2013. *Afforestation and Reforestation Projects under the Clean Development Mechanism: A Reference Manual*. Bonn, Germany: Secretariat for United Nations Framework Convention on Climate Change.

UNFCCC. 2014. *Handbook on Measurement, Reporting and Verification for Developing Countries Parties*. Bonn, Germany: Secretariat for United Nations Framework Convention on Climate Change.

UNFCCC. 2017a. *CDM Insights – Project Activities*. Accessed April 15, 2017. https://cdm.unfccc.int/Statistics/Public/CDMinsights/index.html

UNFCCC. 2017b. *Project Search*. Accessed April 15, 2017. https://cdm.unfccc.int/Projects/projsearch.html

UNFCCC. 2017c. *REDD+ - Land Use and Climate Change*. Accessed August 23, 2017. http://unfccc.int/land_use_and_climate_change/redd/items/7377.php

Wara, M. W. 2008. "Measuring the Clean Development Mechanism's Performance and Potential." *Law Review* 55 (6). Los Angeles: University of California at Los Angeles.

WWF. 2008. *WWF* website. Accessed September 15, 2014. http://www.wwf.org.br/informacoes/english/.

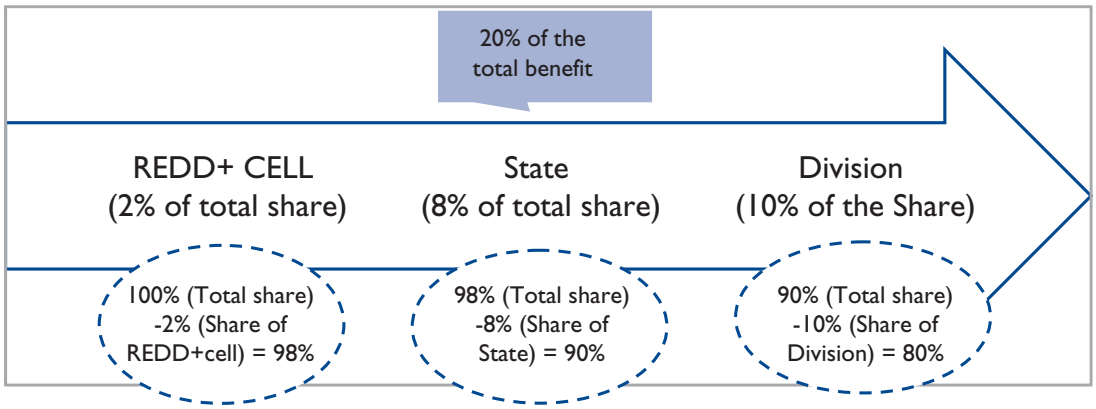
FURTHER READING

Jha, S. K. and B. Sinha. 2017. "Benefit Sharing Mechanism for Operationalization of REDD+ in India." *Indian Forester* 143 (5): 421-430.

Brockhaus, M., G. Wong, C. Luttrell, L. Loft, T. T. Pham, A. E. Duchelle, S. Assembe-Mvondo, and M. Di Gregorio. 2014. *Operationalizing Safeguards in National REDD+ Benefit-sharing Systems: Lessons on effectiveness, efficiency and equity*. Bogor, Indonesia: Center for International Forestry Research.

ANNEXURE 12.1

The REDD+ Cell with support of various state-level institutions will maintain transparency and accountability of benefit sharing mechanism. The cell could also support the state in coordinating with other district/division-level agencies/officials to ensure equitable fund distribution. Approximately 20 percent of the total benefit should be earmarked for government institutions at national, state, and division levels, as transaction cost for strengthening institutions in monitoring and implementation of REDD+ activities. The remaining 80 percent should be distributed among forest-dependent communities for conservation. The share of government should be split into three parts at different levels – the Central Government (REDD+ cell) should get 2 percent, State Government (State Forest Department [SFD]) should get 8 percent, and Division should get 10 percent of the total benefit (see below).



SECTION V
MONITORING AND SAFEGUARDS

A robust measuring, reporting and verification (MRV) system is essential for the success of REDD+, and indeed sustainable forest ecosystem management. Similarly, safeguards are needed to ensure that there are no negative social or environmental outcomes of the interventions. Further, both MRV and safeguards have to follow internationally accepted standards. This section addresses these important issues and contains two chapters. The first (Chapter 13) deals with MRV issues and discusses both the international requirements as well as the current system in use in India. The second (Chapter 14) provides a brief overview of REDD+ Social and Environmental Safeguards (SES) and assesses strengths and weaknesses of India's current SES system against international standards and norms.

Chapter 13: MRV ISSUES IN REDD+ IN THE INDIAN CONTEXT

Devendra Pandey

INTRODUCTION

In India, forest inventory at the local or management unit level was introduced in 1856 to estimate the growing stock of selected species, to prepare management plan for the teak-dominated forests of Pegu (in Burma, now Myanmar), and calculate the annual yield for preparing the management plan. However, until 1884, progress was negligible because of the lack of trained staff at the field level. This led to the establishment of training institutions in India to build the capacity of the field staff (FRI 1961). Subsequently, the forest inventory was gradually expanded in various management units, and substantial forest areas were covered by management plans popularly known as the Working Plan (WP). The quality of the plans also improved after 1919 when good-quality maps at a suitable scale became available from the Survey of India. The WPs were generally valid for 10 years or, in some cases, 15 years. Like traditional forest inventories in other countries, WP inventories in India focused on "sustainable harvest of timber". Forest inventories at the management unit level are continuing even now because of the Government of India regulations. Tree harvesting may take place only when there are approved WPs. During the past decade, inventory methods have been modified with the introduction of modern tools such as Geographic Information Systems (GIS) and remote sensing technology. In many management units, inventories now cover the entire forest area with low intensity of samplings, and only part of the forest area which is to be harvested, in others. Though major forest areas of the country were covered under WPs at any point of time in post independent India, the time frame of each WP was not the same. Therefore, it was not possible to generate estimates of forest resource at the state or national level for a given time frame (Pandey 2007).

National forest monitoring system and role of Forest Survey of India

Forest inventory and mapping of the forest resource on a relatively large area scale (catchment basis), began in 1965 when an externally aided project – Pre-investment Survey of Forest Resources (PIS) was launched with the support of the Food and Agriculture Organization (FAO) of United Nations and

the United Nations Development Programme (UNDP). Statistically robust approaches for inventory and aerial photographs for thematic maps were used. This project laid the foundation for the national forest monitoring system in India. Under the project, some previously unexplored forest areas were inventoried as a step towards establishing wood-based industries.

International experts and specialists in forest inventory worked with Indian counterparts in planning and designing the forest inventory, data collection, processing and analysis for large forest areas (much bigger than management units). Indian professionals and technicians were also trained abroad (mainly in Sweden) to build their capacity for the use of the best available techniques, including use of aerial photographs for identifying forest areas and preparing thematic maps. Appreciating the quality of the output, the Government of India continued the PIS activities even after termination of the project in 1968. The assessment and thematic mapping of the forest resource of selected area of the country was continued till 1981. Finally, in 1981, PIS was introduced in the Forest Survey of India (FSI), being recognized as a fully funded Government of India organization. The Government made plans to begin a National Forest Inventory (NFI) to monitor forest resources and land use change on a 10 year cycle, but the plan could not be implemented because the additional requirement of human resources was not met. In 1986, FSI took on the additional responsibility of monitoring the country's forest cover using remote sensing imagery. By that time, about three-quarters of the country's forests had been inventoried (during the previous 20 years) and thematic maps using aerial photographs of the selected forest areas had been prepared, but no reliable estimates of the national growing stock could be generated.

In 1987, FSI published the first report on India's national forest cover at a 1:1,000,000 scale through the 'State of the Forest Report' by visually interpreting the remote sensing imagery of Landsat having 80 meter (m) resolution. Since then, India's forest cover has been monitored biennially using a wall-to-wall approach that involves assessing the area of the forest cover and any changes made to it. To date, forest cover monitoring has been carried out 14 times. In the past three decades there have seen substantial technological and methodological improvements in forest cover monitoring, particularly in relation to satellite imageries, interpretational techniques, mapping scale and accuracy assessment. Monitoring is now done using digital interpretation of satellite imagery of 23 m resolution at a mapping scale of 1:50,000. The minimum mappable area has come down from 400 hectares (ha) to 1 ha. About 4,000 sample points are verified to assess the accuracy of the satellite imagery analysis. Forest cover is classified into three classes of canopy density: very dense (more than 70 percent), moderately dense (40-70 percent) and open forests (10-40 percent canopy density) (FSI 2015).

In addition to periodic monitoring, FSI completed a special study during 2005-2010 to map the various types of forests found in India using climate, soil and forest cover maps, and extensive ground verification- a kind of ground verification of the forest types classification described by Champion & Seth (1968). Layers of the different forest types broken down into canopy density classes are available in the public domain (www.fsi.org.in).

In 2002, FSI modified the forest inventory design to make the NFI operational, generate national estimates of growing stock, species and diameter distribution, and meet changing information needs. In the new design, the country was stratified into 14 homogeneous physiographic zones based on physiography, climate, vegetation and soil type. Two stage stratified sampling is followed to conduct the forest inventory. In the first stage about 10 percent of the total districts (60 districts) are selected proportionally in 14 physiographic zones, and in the second stage selected districts are divided into grids of $1^{1/4'}$ and $1^{1/4'}$ latitudes and longitudes respectively. Systematic sample plots of 0.1 ha are laid out in each district on 1: 50,000 scale topographic sheets. Parameters like canopy density, height and diameter of tees above 10 cm diameter at breast height (dbh), species composition, regeneration status, incidence of fire, and grazing are measured.

Estimation of soil organic matter, a new parameter required under the United Nations Framework Convention on Climate Change (UNFCCC), was included. As Trees Outside Forests (TOF) make a major contribution to timber production in India, such resources are now being simultaneously inventoried along with the NFI. Further, a new biomass study to measure those components of forest biomass that are not measured by the NFI such as small seedlings, branch-wood, deadwood, leaf biomass and litter, as required under Reducing Emissions from Deforestation and Forest Degradation (REDD+) for carbon stock estimation was completed in 2009. This led to estimation of the carbon stock of India's forests following the Tier 2 approach of the Intergovernmental Panel on Climate Change (IPCC) guidelines (IPCC 2006) and provided country data for the national communication to UNFCCC. With the completion of the new biomass study, a new dimension has been added to the NFI since 2010. The additional parameters needed to estimate the total carbon stock of the forests are now being measured in the sample plots of the NFI and remote sensing applications have been integrated with the NFI to monitor changes in the carbon stocks and the Green House Gas (GHG) inventory (Pandey 2013).

Estimation of carbon stock of India's forest

For estimating the carbon stock of forests, FSI followed the Good Practices Guidance (GPG) developed by the IPCC in 2006. The activity data which relates to the forest area of activity and the carbon stock present in the five pools of the inventory plots were used to estimate the carbon stock of India's forest. A description of five carbon pools is presented in the table 13.1 (FSI 2011). The procedure for estimating the carbon stock was standardised by FSI during 2008-2010 while working on the Second National Communication to the UNFCCC and conducting GHG inventory in the Forest Land remaining Forest and Land Converted into Forest land for the period 1994 and 2004.

Steps involved for estimating the forest carbon are briefly mentioned in the following paragraphs.

Activity data

The biennial forest cover assessed by FSI provides periodic update of basic activity data. Carbon stored in the vegetation is a principal variable which broadly depends upon two factors- the canopy density and the forest type; these two have been considered as stratification variables. Canopy density-wise

Table 13.1: Description of the five carbon pools obtained in the forest ecosystem (FSI 2011)

Pools		Description
Living Biomass	Above ground biomass	All living biomass above the soil including stem, stump, branches, bark, seeds and foliage.
	Below ground biomass	All living biomass of live roots. Fine roots of less than 2mm diameter (country specific) are often excluded because these often cannot be distinguished empirically from soil organic matter or litter.
Dead Organic Matter	Dead wood	Includes all non living woody biomass not contained in the litter, either standing or lying on the ground. Dead wood also includes dead roots and stumps larger than or equal to 10cm in diameter or any other diameter used by the country.
	Litter	Includes all non-living biomass with a diameter less than a minimum diameter chosen by the country (for FSI 5 cm), lying dead, in various states of decomposition above the mineral or organic soil.
Soil	Soil organic matter	Includes organic carbon in mineral and organic soils (including peat) to a specific depth chosen by the country (for FSI 30 cm) and applied consistently through the time series.

spatial information is available from forest cover mapping. The forest type mapping exercise completed by FSI in 2010 provided the second layer of forest type. By regrouping forest types, 15 forest type classes including one plantation class have been made. Overlaying the forest type map on the forest cover map of the country gives 45 strata (3 canopy densities x 15 forest types). Since the forest type of a large area generally does not change within a span of 20-30 years, the forest type map of 2010 will be valid for stratification in the medium-term too.

Carbon stock of sample plots

In the revised NFI from 2002, in addition to parameters of traditional forest inventory, soil samples up to 30 cm depth from sample plots are collected for analysing soil organic carbon, but biomass of trees below 10 cm dbh, biomass of litter and deadwood, and of shrubs and climbers was not measured. Further, the existing volumetric equations of trees do not include stem wood below 10 cm, branch wood below 5 cm diameter or the biomass of the foliage. A special study was carried out by FSI during 2008-09 to estimate the carbon stock in all the five pools. The NFI team revisited the selected sample plots in all the 14 zones of the country to collect additional data on litter and deadwood, shrubs and climbers, and did destructive sampling for branch wood and small trees and saplings to measure the biomass in each physiographic zone. Biomass equations were then developed for the major tree species for the branch wood and foliage. Similarly, biomass equations were developed for the small trees of 0 to 10 cm dbh for different species (FSI 2011). Examples can be seen in Annexure 13.1.

There is a general paucity of below ground biomass (live roots of trees / plants) data worldwide due to the difficulties in its measurement. Country-specific data for India was not generated by FSI even during special study. IPCC has developed default values using a root to shoot relationship established by various researchers in different forest types. FSI used appropriate default values to estimate the carbon in below ground biomass.

Integrating activity data with sample plot data

A GIS technique was used by FSI to overlay and intersect the forest type map on forest cover map, resulting in 45 strata, each having a different forest type and a different canopy density. For example, if forest type is denoted as T and canopy density as D, then strata are T_1D_1, T_2D_1, ---------$T_{15}D_1$, T_1D_2, --------- $T_{15}D_2$, T_1D_3, ---------$T_{15}D_3$. The area of each strata was then determined using GIS techniques. Since all the NFI sample plots have geographic coordinates, they were overlaid on the forest type - canopy density map and NFI points falling in each stratum were identified. For each stratum, sample plot data on each carbon pool was aggregated and synthesized and a generalized factor was determined. Biomass and carbon stock per unit area for each stratum in five carbon pools was then assessed. Multiplication of carbon values with activity data (area) of each stratum and subsequent summation gave the carbon stock of India's forest cover.

For India's 2nd National Communication to UNFCCC, carbon stock of 1994 and 2004 forest covers were estimated (FSI 2011). Activity data of each stratum in subsequent biennial assessments of forest covers has been changing. For each assessment, stratum-wise carbon stocks have been estimated since then by multiplying with per unit area carbon values obtained by NFI in 2010. Carbon stock in 2004 and of the latest forest cover (2013) published by FSI (FSI 2015) is presented in table 13.2.

The area of the forest cover in 2004 was estimated to be 69.02 million ha and in 2013 it was 70.17 million ha. It is observed that the increased carbon stock in 2013 can be

Table 13.2: Carbon stock of India's forests in 2004 and 2013 in million tons

Component	Carbon stock in 2004*	Percentage	Carbon stock in 2013**	Percentage
Above Ground Biomass	2101	31.5	2220	31.5
Below Ground Biomass	663	10.0	695	9.9
Deadwood	25	0.4	29	0.4
Litter	121	1.8	131	1.9
Soil	3753	56.3	3969	56.3
Total Carbon Stock	**6663**	**100**	**7044**	**100**

***Source:** *FSI 2011: Carbon Stock of India's forests*

****Source:** *FSI 2015: India State of Forest Report*

attributed to the contribution of soil carbon, which has increased from 54 ton/ha in 2004 to 56 ton/ha in 2013.

KEY UNFCCC DECISIONS FOR A ROBUST MRV FOR REDD+ AND THEIR IMPLICATIONS

Key decisions on MRV for REDD+ were taken at the Conference of Parties (COP) 13 in 2007 and in COP 16 in 2010 of the UNFCCC.

The Bali Action Plan at COP 13 in 2007 recognized the importance of REDD as well as additional activities and included the role of conservation, Sustainable Management of Forests (SFM) and enhancement of forest carbon stocks in developing countries; here REDD became REDD+. It also introduced the principle of Measurement, Reporting and Verification (MRV) for both developed and developing country Parties in the context of enhancing action at the international and national level to mitigate climate change. This principle was further elaborated through subsequent COP decisions resulting in a comprehensive MRV framework under the Convention.

> For developing country Parties, the existing MRV framework encompasses submitting national communications every four years and Biennial Update Reports every two years, undergoing International Consultation and Analysis, setting up domestic MRV of domestically supported Nationally Appropriate Mitigation Actions (NAMAs), and undertaking MRV of REDD+ activities for the purpose of obtaining and receiving results-based incentives (UNFCCC 2014).

As per the Cancun Agreement at COP 16 in 2010, developing countries willing to undertake REDD+ activities are required to formulate a national strategy and action plan. These countries should establish a National Forest Reference Emission Level (FREL), a National Forest Reference Level (FRL), or a sub-national FREL / FRL level as an interim measure; a robust and transparent National Forest Monitoring System (NFMS) for MRV on the performance of the REDD+ activities in accordance with the national circumstances; and a system for providing information on how the safeguards for REDD+ activities are being addressed and respected. REDD+ covers five activities under the Cancun decision 1/CP.16, which are as follows:

- Reducing emissions from deforestation;
- Reducing emissions from forest degradation;
- Conservation of forest carbon stocks: This may be considered as maintenance of area and carbon stocks in intact forests by effective law enforcement, development measures and land-use planning.
- Sustainable management of forests: This can be understood as maintenance or improvement in existing forest canopy cover and carbon stocks in forests over time through sustainable management practices;
- Enhancement of forest carbon stocks: This could involve restoring carbon stocks in degraded forests or creating forests where none currently exists. Approaches may include afforestation, reforestation, restoration (through natural regeneration, assisted natural regeneration or planting), rehabilitation, or forest landscape restoration.

The methodological guidance in relation to MRV for REDD+ was provided at COP 15, Copenhagen, 2009 which requested Parties to establish, according to national circumstances and capabilities, robust and transparent national forest monitoring systems and, if appropriate, sub-national systems as part of their respective national forest monitoring systems that:

- Use a combination of remote sensing and ground-based forest carbon inventory approaches for estimating, as appropriate, anthropogenic forest-related GHGs by sources and removals by sinks, forest carbon stocks and forest area changes [Monitoring and Measurement].
- Provide estimates that are transparent, consistent, as far as possible accurate, and that reduce uncertainties taking into account national capabilities and capacities [Reporting].
- Are transparent and their results are available and suitable for review as agreed by the COP [Verification].

Measurement

Measurement for REDD+ MRV refers to information on the extent to which a human activity takes place (activity data) with coefficients that quantify the emissions or removals per unit activity (emission factors). For REDD+ this translates into measurements of forest area and forest area change (activity data) and forest carbon stock and forest carbon stock changes (emission factors). Together, this information provides the basis to compile a GHG inventory.

Reporting

Reporting implies the availability and compilation of national data and statistics for information in the format of a GHG inventory. Reporting requirements to the UNFCCC (National Communications) may cover issues other than just those subjected to measurement. The core elements of the national communications are information on emissions and removals of GHGs, and details of the activities a country has carried-out to fulfil its commitments under UNFCCC.

Verification

Verification refers to the process of independently checking the accuracy and reliability of reported information or the procedures used to generate such information. The UNFCCC Secretariat through its experts verify the data reported.

In Cancun, a three-phase process for the developing countries was agreed upon to undertake mitigation through REDD+ activities according to their national circumstances and capacities. Financial and technological supports were expected from the developed countries. The three phases would involve the following (Ravindranath *et al.* 2012):

- Phase 1: Development of a national plan, policies and measures, and capacity-building.
- Phase 2: Implementation of the national plan, policies and measures, and further capacity building, technology development and transfer, and results-based demonstration activities.

Box 13.1: Key issues in MRV for REDD+

- **Country driven process**: Each country has to establish an autonomous MRV system. The national MRV system is a crucial element of REDD+ implementation.
- **Learning-by-doing approach**: The creation of an MRV system must be based on national human resources involved in the MRV development process from the very beginning and gradually enhancing skills whilst progressing towards its full implementation.
- **Safeguards**: The inclusion of the "REDD+ Safeguards" in the monitoring system improves the consideration of biodiversity, governance and the inclusion of indigenous peoples and other forest-dependent communities.
- **Consistency**: A MRV system should provide estimates that are consistent across years. Under certain circumstances, estimates generated from different methodologies in different years can be considered consistent if they have been calculated in a transparent manner.
- **Transparency:** All the data and the methodologies used in the MRV system should be clearly explained and appropriately documented, so that the accuracy can be confirmed.
- **Comparability**: Estimates of emissions and removals should be comparable among countries. For this purpose, Parties should follow the methodologies and standard formats provided by the IPCC and agreed within the UNFCCC for compiling and reporting inventories.
- **Conservativeness**: When completeness or accuracy of estimates cannot be achieved, the reduction of emissions should not be overestimated, or at least the risk of overestimation should be minimized.

- Phase 3: Results-based actions with full measurement reporting and verification.

In the Phase 1 or "readiness" phase, the developing countries are encouraged to develop:

- A national REDD+ strategy
- National or sub-national forest reference emissions level
- A robust and transparent national forest monitoring system
- A system to provide information on the safeguards to maintain environmental integrity, protect the rights of indigenous people and preserve biodiversity

In COP17 at Durban, South Africa, important decisions on REDD+ were made, pursuant to the Cancun decision viz. decisions on systems for providing information on safeguards, as well as modalities for FRLs and REDD+ financing.

KEY OPPORTUNITIES AND CHALLENGES FOR INDIA FOR A ROBUST MRV SYSTEM FOR REDD+

As part of the Cancun Agreement, countries are supposed to develop a robust and transparent national forest monitoring system with the capacity to consistently and accurately monitor changes in the forest cover and carbon stocks over time. There is a general consensus that this forest monitoring system would be a combination of remote sensing and ground-based systems.

Robust National Forest Monitoring System (NFMS)

India has a distinct advantage of having a mature and well-developed NFMS based on remote sensing, using a wall to wall approach with a long-time series of data since 1983, collected biennially on forest cover according to different canopy cover density classes. The NFI covering part of the area of the country is made coterminous with biennial forest cover assessment. The NFI helps in assessing the carbon stock of the forests at national or sub-national scale. With some refinement in the methodology, including use of high resolution technology, it is possible to detect hot spots, location of deforestation and degradation with sufficient accuracy. Similarly, the data on the areas with successful conservation efforts leading to enhancement of carbon stocks and SFM can also be obtained (Ravindranath *et al.* 2012).

Absence of permanent plots

India does not have a permanent sample plots based forest inventory. For developing this, India will have to develop a robust system for monitoring of carbon stocks in forests through a network of permanent monitoring plots to provide sufficiently accurate national and sub-national estimates of carbon stock changes (Ravindranath *et al.* 2012). In the new NFI being launched now by FSI, it is proposed to have permanent plots.

Setting of forest reference emission level

Setting up national or sub-national FRL is one of the most challenging components of the readiness activities in India. This will essentially require time series data on forest area and carbon stock, and analysis of factors driving deforestation and degradation. Further for the plus component of REDD+, it is equally important to understand the drivers of deforestation and degradation, since these drivers are inversely linked to enhancement of carbon stocks, conservation of forests and sustainable management of forests. Such data can potentially be gathered through a combination of remote sensing, forest inventory and other non-spatial information such as administrative records. However, estimation of the consistent historical carbon stock poses the most serious challenge. To some extent it can be addressed by developing correlation between canopy densities and other canopy parameters with their known carbon stock values in recent past. (Ravindranath *et al.* 2012)

System for information on safeguards

Traditionally, the needs of the local and forest dependent communities have been addressed in India and their rights have been mentioned in the Working Plans. There is also a recent legislation, "The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act 2006" popularly known as FRA. Currently there is no system of providing information on environmental and social

safeguards. "In order to effectively monitor safeguards, it will be necessary to evolve a clearly defined set of indicators and criteria for parameters such as forest governance structures, respect for rights of indigenous peoples, and full and effective participation of relevant stakeholders, along with a system to monitor these" (FSI 2009).

There has been no large-scale valuation of ecosystem services or how they support livelihoods, especially those of the poor. Furthermore, dependence of forest-dwelling communities on forests and their role in SFM and benefit sharing mechanisms are not understood (Ravindranath *et al.* 2012).

Inadequate human resource

FSI faces another challenge of dwindling human resources. The numbers of technicians who are the real pillars of the organization have fallen over time. Given the volume of work, for a country like India which has a vast area, the institution is too small. The number of parameters of the forest ecosystem to be measured has increased manifold over time, especially after realizing the role of forests in climate change and periodic assessment of the forest carbon stock. This impedes in the cycle of forest inventory and causes delay in re-measurement of permanent plots. There are not enough professionals to comprehensively analyse the vast amount of data held by FSI. The degree of political priority and commitment has also weakened.

CONCLUSIONS AND RECOMMENDATIONS

"Reducing deforestation and forest degradation as well as activities leading to carbon stock enhancement in developing countries present a unique opportunity for cost-effective global climate change mitigation while delivering multiple benefits such as biodiversity conservation, livelihood generation and maintenance of ecosystem services" (Ravindranath *et al.* 2012). The basic concept of REDD+ is to provide economic incentives such as funding or credits to developing countries for "REDD" activities and "plus" activities (enhancing carbon stock through conservation and SFM). To quantify reductions in CO_2 emissions due to REDD+ activities, compared with the case where no REDD+ activities are undertaken, a reference emission level and a reference level has to be established.

National strategies or action plans and policies are critical for implementation of REDD+, which is still not formulated in India. A national strategy takes into account the development goals, land-use planning, forest planning, drivers of deforestation and forest degradation, land tenure issues, forest governance issues, gender considerations, safeguards, and the participation of all stakeholders into account. It is essential to frame these strategies at the earliest.

In India, FSI is a dedicated institution which takes care of the national forest monitoring and carbon stock assessment on a scientific basis at national level but capacity at the sub-national / state level is weak and low on priority. The understanding of REDD+ and REDD+ activities at the State level has to be enhanced through capacity building. Capacity building includes technical training on MRV, monitoring methods, the establishment of reference levels, and the development of policymaking and law enforcement capabilities. Capacity building aims to foster expertise and to train members of REDD+ participating

organizations and relevant stakeholders to address their respective challenges. Members of concerned organizations, especially government organizations, and stakeholders are considered to be the targets of capacity building. Local communities, members of the private sector, consultants, NGOs, and educational institutions, all of which are important stakeholders, are also potential targets. Forest field practitioners have been traditionally measuring the timber volume and not the biomass of small wood, litter, foliage, branch-wood, or soil organic carbon. A clear methodology easy to understand and operate has to be explained and demonstrated to measure the carbon stock in all the five carbon pools besides training them in the application of remote sensing, GIS, Global Positioning System and other modern tools. In addition, good integration with research and higher-education institutions is important for ensuring long-term sustainability in capacity development and for supporting progress for continuous improvements to the national monitoring system.

Historical data is essential for establishing a reference emission level, which is already available in India. However, the reference emission level or reference level can vary greatly depending on the period of historical data acquisition and the sort of model used. Therefore, full discussions should be held regarding the selection of a model for estimating future trends and the appropriate time interval for using the historical data.

Different actors and sectors need to work together to make the monitoring system efficient in the long term, as part of implementation of REDD+. As many drivers of forest change are outside the forestry sector (e.g. arising from agriculture or fuelwood demand), other sectors also have a role in the statistical design, implementation and, in particular, the monitoring for REDD+ and its impacts (Kissinger *et al.* 2012). Institutional sustainability should be an important principle in setting up a framework, which commonly requires, at a minimum, a national coordination and steering mechanism, centralized monitoring, estimation and reporting infrastructure, and a mechanism for coordinating national and sub-national forest measurement and monitoring stakeholders.

REFERENCES

Champion, S. H. and S. K. Seth. 1968. *A revised survey of the forest types of India*. Delhi: Manager of Publications.

FRI. 1961. *100 years of Indian forestry 1861-1961*, Volume 2. Dehradun: Forest Research Institute,

FSI. 2009. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2011. "Carbon Stock in India's Forest." In *State of Forest Report*, 81-90. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2015. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

IPCC. 2006. *2006 Intergovernmental Panel on Climate Change (IPCC) guidelines for national Greenhouse Gas* inventories, edited by Eggleston, H.S., L Buendia, K Miwa, T Ngara and K Tanabe. Hayama, Japan: Institute of Global Environmental Strategies.

Kissinger, G., M. Herold and V. De. Sy. 2012. *Drivers of Deforestation and Forest Degradation: A synthesis report for REDD+ policymakers*. Vancouver, Canada: Lexeme Consulting.

Pandey, D. 2007. "Forest Resource Assessment in India." *The Indian Forester* 133 (1).

Pandey, D. 2013. "National forest monitoring for REDD+ in India." In *Capacity development in national forest monitoring: Experiences and progress for REDD+,* edited by B. Mora, M. Herold, V. De Sy, A. Wijaya, L. Verchot and J. Penman, 19-26. Bogor, Indonesia: The Center for International Forestry Research and Global Observation of Forest and Land Cover Dynamics.

Ravindranath, N. H., N. Srivastava, I. K. Murthy, S. Malaviya, M. Munsi and N. Sharma. 2012. "Deforestation and forest degradation in India - implications for REDD+ General Article." *Current Science* 102 (8): 1117-1125.

UNFCCC. 2014. *Handbook on Measurement, Reporting and Verification for Developing Countries Parties*. United Nations Framework Convention on Climate Change, Bonn, Germany.

FURTHER READING

Angelsen, A., M. Brockhaus, W. D. Sunderlin, and L. Verchot, eds. 2012. *Analysing REDD+: Challenges and Choices*. Bogor, Indonesia: The Centre of International Forestry Research.

FAO. 2013. *National Forest Monitoring Systems: Monitoring and Measurement, Reporting and Verification (M & MRV) in the context of REDD+ Activities*. Rome, Italy: Food and Agriculture Organization of the United Nations.

FFPRI. 2012. *REDD-Plus: How to measure and monitor forest carbon*. Japan: Forestry and Forest Products Research Institute, REDD Research and Development Center.

GFOI [Global Forest Observations Initiative]. 2016. "GFOI Methods & Guidance Documentation". Available at: http://www.gfoi.org/methods-guidance/.

GOFC-GOLD [Global Observation of Forest and Land Cover Dynamics]. 2016. *GOFC-GOLD REDD Sourcebook* (2016), UNFCCC COP 22, Version 1. http://www.gofcgold.wur.nl/redd/sourcebook/GOFC-GOLD_Sourcebook.pdf.

GOFC-GOLD [Global Observation of Forest and Land Cover Dynamics]. n.d. *REDD+ Training Materials Guidance Document*. GOFC-GOLD Land Cover Project Office and Wageningen, Netherlands: Wageningen University in partnership with the World Bank's Forest Carbon Partnership Facility.

Herold, M., J. Penman and V. De Sy. 2013. "Summary and recommendations for continuous improvements in national forest monitoring and measuring, reporting and verification of REDD+ activities". In *Capacity development in national forest monitoring: Experiences and progress for REDD+,* edited by B. Mora, M. Herold, V. De Sy, A. Wijaya, L. Verchot and J. Penman, 91-99. Bogor, Indonesia: The Center for International Forestry Research and Global Observation of Forest and Land Cover Dynamics.

Hewson, J., M. K. Steininger and S. Pesmajoglou, eds. 2014. *REDD+ Measurement, Reporting and Verification (MRV) Manual*, Version 2.0. Washington, DC, USA: USAID-supported Forest Carbon, Markets and Communities Program.

Mora, B., M. Herold, V. De Sy, A. Wijaya, L. Verchot and J. Penman, eds. 2012. *Capacity Development in National Forest monitoring: Experiences and progress for REDD+*. Bogor, Indonesia: The Centre of International Forestry Research.

ANNEXURE 13.1

New Biomass Equations generated by FSI (example)

Species Name	Equation Description	Equation	R^2
Acacia catechu	small wood->10cmdbh	$y = 141.2x + 2.365$	0.847
Acacia catechu	foliage->10cmdbh	$y = 10.88x + 0.007$	0.844
Acacia catechu	small wood-<10cmdbh	$y = 0.064x^2 + 1.496x - 0.787$	0.955
Acacia catechu	foliage-<10cmdbh	$y = 0.011x^2 - 0.009x + 0.091$	0.996
Bombax ceiba/malabaricum/	small wood->10cmdbh	$y = 159.6x^2 + 0.940x + 14.73$	0.947
Bombax ceiba/malabaricum/	foliage->10cmdbh	$y = 4.900x^2 + 0.064x + 0.443$	0.947
Bombax ceiba/malabaricum/	small wood-<10cmdbh	$y = 0.177x^2 - 0.277x + 0.735$	0.988
Bombax ceiba/malabaricum/	foliage-<10cmdbh	$y = 0.001x^3 - 0.019x^2 + 0.107x + 0.043$	0.962
Butea monosperma(Old) *Butea frondosa*	small wood->10cmdbh	$y = -22.79x^2 + 53.45x - 1.479$	0.848
Butea monosperma(Old) *Butea frondosa*	foliage->10cmdbh	$y = -2.022x^2 + 5.264x + 0.139$	0.823
Butea monosperma(Old) *Butea frondosa*	small wood-<10cmdbh	$y = 0.009x^2 + 0.302x + 0.296$	0.991
Butea monosperma(Old) *Butea frondosa*	foliage-<10cmdbh	$y = -8E\text{-}05x^3 - 0.002x^2 + 0.096x + 0.036$	0.989
Dalbergia sissoo	small wood->10cmdbh	$y = 7.275x^2 + 53.10x + 12.36$	0.831
Dalbergia sissoo	foliage->10cmdbh	$y = -4.684x^2 + 14.72x - 0.024$	0.866
Dalbergia sissoo	small wood-<10cmdbh	$y = 0.141x^2 + 0.780x - 0.374$	0.998
Dalbergia sissoo	foliage-<10cmdbh	$y = 0.0035x^2 + 0.1600x - 0.0726$	0.962
Diospyros melanoxylon	small wood->10cmdbh	$y = 59.91x + 14.92$	0.944
Diospyros melanoxylon	foliage->10cmdbh	$y = 14.79x + 1.501$	0.940
Diospyros melanoxylon	small wood-<10cmdbh	$y = 0.197x^2 + 0.237x + 0.488$	0.985
Diospyros melanoxylon	foliage-<10cmdbh	$y = 0.024x^2 - 0.002x + 0.009$	0.980
Eucalyptus species	small wood->10cmdbh	$y = 162.7x^{1.588}$	0.950
Eucalyptus species	foliage->10cmdbh	$y = 36.36x^{1.622}$	0.955
Eucalyptus species	small wood-<10cmdbh	$y = 0.048x^2 + 0.812x - 0.351$	0.974
Eucalyptus species	foliage-<10cmdbh	$y = 0.016x^2 + 0.003x + 0.010$	0.979
Holarrhena antidysenterica	small wood->10cmdbh	$y = 78.83x - 0.278$	0.883

Species Name	Equation Description	Equation	R^2
Holarrhena antidysenterica	foliage->10cmdbh	$y = 4.906x^2 + 3.206x - 0.016$	0.900
Holarrhena antidysenterica	small wood-<10cmdbh	$y = 0.066x^2 - 0.179x + 0.458$	0.995
Holarrhena antidysenterica	foliage-<10cmdbh	$y = 0.0005x^2 + 0.0078x + 0.0084$	0.996
Mallotus philippinensis	small wood->10cmdbh	$y = 130.2x^2 - 26.37x + 13.13$	0.795
Mallotus philippinensis	foliage->10cmdbh	$y = 8.948x^2 - 2.125x + 1.170$	0.757
Mallotus philippinensis	small wood-<10cmdbh	$y = 0.074x^2 + 0.661x + 0.232$	0.976
Mallotus philippinensis	foliage-<10cmdbh	$y = 0.004x^2 + 0.002x + 0.051$	0.962
Shorea robusta	small wood->10cmdbh	$y = 25.54x^2 + 201.6x - 13.18$	0.962
Shorea robusta	foliage->10cmdbh	$y = 70.37x^4 - 144.1x^3 + 109.8x^2 - 15.52x + 0.896$	0.971
Shorea robusta	small wood-<10cmdbh	$y = 0.009x^4 - 0.221x^3 + 1.559x^2 - 2.768x + 1.808$	0.969
Shorea robusta	small wood-<10cmdbh	y = 0.009x4 - 0.221x3 + 1.559x2 - 2.768x + 1.808	0.969
Shorea robusta	foliage-<10cmdbh	y = 0.0003x3 - 0.0111x2 + 0.1228x + 0.0032	0.969
Syzygium cumini/ Eugenia jambolana	small wood->10cmdbh	y = -228.8x2 + 373.3x - 25.33	0.963
Syzygium cumini/ Eugenia jambolana	foliage->10cmdbh	y = -6.612x2 + 12.38x - 1.059	0.977
Syzygium cumini/ Eugenia jambolana	small wood-<10cmdbh	y = 0.087x2 - 0.044x + 0.497	0.984
Syzygium cumini / Eugenia jambolana	foliage-<10cmdbh	y = 0.006x2 + 0.017x - 0.003	0.974
Tectona grandis	small wood->10cmdbh	y = 33.04ln(x) + 94.43	0.800
Tectona grandis	foliage->10cmdbh	y = 3.524ln(x) + 9.959	0.811
Tectona grandis	small wood-<10cmdbh	y = 0.048x2 + 0.812x - 0.351	0.974
Tectona grandis	foliage-<10cmdbh	y = 0.0057x3 - 0.0742x2 + 0.2955x - 0.1056	0.966
Trewia nudiflora	small wood->10cmdbh	y = 96.50x2 + 13.80x + 7.185	0.890
Trewia nudiflora	foliage->10cmdbh	y = 10.20x2 + 1.126x + 0.945	0.884
Trewia nudiflora	small wood-<10cmdbh	y = -0.002x2 + 0.960x - 0.487	0.987
Trewia nudiflora	foliage-<10cmdbh	y = -0.003x2 + 0.089x - 0.043	0.940

Chapter 14: INTEGRATING ENVIRONMENTAL AND SOCIAL SAFEGUARDS IN REDD+

Sanjay Upadhyay, Shyama Kuriakose and Eeshan Chaturvedi

BACKGROUND

Climate change is widely recognized as one of the most important current environmental problems on the planet. Deforestation and forest degradation is a major source of greenhouse gases that warm the earth (IPCC, 2014). Devising measures to contain and mitigate the effects of climate change is a high priority in international environmental law and policy. The international political reaction to climate change resulted in the adoption of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992, leading in turn to the concept of 'reducing emissions from deforestation in developing countries and approaches to stimulate action' popularly known as Reducing Emissions from Deforestation and Forest Degradation (REDD+). REDD+ incentivizes positive actions that enhance forest carbon stock through forest conservation and Sustainable Forest Management (SFM).

This program may provide financial incentives in the form of 'result based payments' to developing countries that successfully slow or reverse forest loss. The UNFCCC Conference of Parties (COP) articulated five REDD+ activities that developing countries can implement to be eligible to receive these incentives:

- Reducing emissions from deforestation;
- Reducing emissions from forest degradation;
- Sustainable management of forests;
- Conservation of forest carbon stocks; and
- Enhancement of forest carbon stocks.

These activities were further clarified to form a framework[1] which included a set of seven decisions (decisions 9-15/CP.19) on methodological, institutional and funding aspects for REDD+, as per which developing Country parties must:

- Ensure that anthropogenic emissions in the forest areas are measured, reported and verified as per UNFCCC guidelines.
- Have in place:
  - A national strategy or action plan on REDD+;
  - A national or sub-national forest reference emission level that has undergone UNFCCC coordinated technical assessment process;

- A robust and transparent national forest monitoring system (NFMS) for REDD+ activities;
- A system to indicate that safeguards are being addressed.

- Ensure that REDD+ activities are implemented as per the UNFCCC REDD+ Environmental and Social Safeguards.
- Provide the most recent summary of information on how the above-mentioned safeguards are addressed before payments maybe received.

It is in this context that it becomes important to understand the relevance of REDD+ Social and Environmental Safeguards (SES) in more detail.

NEED FOR REDD+ SOCIAL AND ENVIRONMENTAL SAFEGUARDS

First of all, it must be understood that activities aimed at reducing deforestation and degradation require huge investments. Secondly, such activities must ensure benefits and provide that no harm is caused to the interest of forest-dependent local communities, their livelihoods and to biodiversity.

Given the potential risks and conflicts of REDD+ implementation including: risks of artificial baseline setting and asymmetric information, accessing REDD+ finance, risks in meeting and measuring 'performance', risks to equity from inadequate design, risks of illegitimate decision-making processes and policy implementation, carbon and tenure rights, risks of powerful elites securing rights to benefits, and challenges of multilevel governance (Loft *et al*. 2017) among others, safeguards against such negative impacts are required.

Seven safeguards were put in place that must be supported throughout the implementation of REDD+ actions. These are known as the "Cancun safeguards", and were agreed to at the 16th COP to the UNFCCC held in Cancun in 2010.

'Safeguards' is a term that can be traced back to financial institutions such as the World Bank, which use it to refer to a 'risk-based approach', involving pricing and prioritizing risks according to a logic of economically efficient 'risk management' (Rey *et al.* 2017). This is in contradistinction to a 'rights-based approach' where individual or collective rights of those affected are at stake. It is the latter approach which has been adapted in the Cancun Safeguards, wherein it has been indicated that the benefits pursued, must go beyond carbon emission reductions and also enhance land tenure security, biodiversity and other ecosystem services, improve forest governance and empower relevant stakeholders through participation, among other objectives (Rey *et al.* 2017).

Decision 1/CP.16 of Cancun Agreement of 2010, Appendix I para 70[2] laid down seven principal safeguards:

- Policy alignment (national and international)
- Transparency in national forest governance structure[3]
- Respect for knowledge and rights of indigenous peoples and local communities[4]
- Multi-stakeholder participation[5]
- Conservation of national forests and biodiversity[6]
- Actions to address the risks of reversals[7]
- Actions to reduce displacement of emission[8]

EVOLUTION OF INTERNATIONAL PERSPECTIVES GOVERNING INTEGRATION OF SES IN REDD+

REDD+ SESs are still being developed, as can be seen from the subsequent COP decisions after Cancun in 2010. Some of the most important ones are those on the development of guidelines for a Safeguards Information System (SIS) and development of market based mechanisms in relation to financing of REDD+ projects, for implementation of REDD+ activities. Those are discussed briefly below.

Role of Safeguards Information System in REDD+ Implementation

In 2010,[9] Parties to UNFCCC, along with devising the seven principles on safeguards, also agreed that countries seeking to implement REDD+ should have a SIS to demonstrate that the safeguards mentioned above are being respected and met. Thereafter, as per Decision 12/CP.17[10] in Durban 2011, the REDD+ implementing countries confirmed that a SIS must be in place to receive results-based finance for REDD+ with the following guiding principles:

- Be consistent with Cancun guidance;
- Provide transparent and consistent information that is accessible by all relevant stakeholders and updated on a regular basis;
- Be transparent and flexible to allow for improvements over time;
- Provide information on how all of Cancun safeguard elements are being addressed and respected;
- Be country-driven and implemented at the national level; and
- Build upon existing systems, as appropriate.

Further, according to Decisions 12[11] and 9 of COP 19 in Warsaw, 2013, current modalities on SIS include submission of a summary of information every four years by the Member Country through National Communications or through communication channels agreed at the COP. This information may also be uploaded on a voluntary basis via the web platform on the UNFCCC website. The starting point for safeguards reporting is held to be at the time when REDD+ implementation activities begin.[12]

Due to lack of clarity on several aspects of SIS, such as consistency in reporting, ambiguity on the type of information to be provided, and lack of guidance on collection and provision of information, a decision was taken in the COP 20 in Lima, 2014 to prepare guidelines on implementation of SIS.

Financing REDD+ Activities in Accordance with the Safeguards

Since SESs are an integral part of obtaining finance, the same was discussed in several COPs. For instance, in COP 17 in Durban 2011 it was noted that appropriate market as well as non-market based mechanisms should be developed for demonstration activities consistent with the Cancun Safeguards and guidelines. Another important decision taken in COP 19, Warsaw, 2013 was the development of a work program on results based finance to progress the full implementation of REDD+ activities identified in the Cancun decision. It also recognized the integral role of the Green Climate Fund in transfer of funds to developing countries for this purpose.[13]

Other International Decisions, Initiatives, and Procedures on SES

There are several multilateral, bilateral and civil society initiatives contributing to linking SES with REDD+ activities. Some of the prominent ones are briefly described in this section.

UN Convention on Biological Diversity (CBD)

The CBD of 1992 addresses social issues in ways relevant to the UNFCCC and REDD+. In its preamble and various articles, the CBD recognizes important tenets such as dependency of indigenous and local communities on biological diversity; the role of these communities in conservation; rights of Indigenous Peoples and local communities over their traditional knowledge, innovations, and practices; fair and equitable sharing of benefits arising from the utilization of genetic resources[14]; and most importantly, the requirement to obtain prior informed consent from indigenous and local communities for accessing and using their genetic resources or traditional knowledge.[15] These principles can contribute directly to the REDD+ Safeguards and the mechanisms introduced under CBD can also help with implementation of these safeguards.

Forest Carbon Partnership Facility (FCPF)

The World Bank's FCPF is a global partnership of governments, businesses, civil society, and Indigenous Peoples focused on REDD+, forest carbon stock conservation, and the enhancement of forest carbon stocks in developing countries. Its social safeguards requirements for REDD+ have been evolving since 2007, derived primarily from the World Bank's long standing 'Operational Policies and Bank Procedures'. To implement programs on REDD+, FCPF has adopted the Strategic Environmental and Social Assessment (SESA) which ensures REDD+ readiness before implementing any related activity at the country level. An outcome of SESA, the Environmental and Social Management Framework (ESMF) is a framework to avoid and/or mitigate and manage potential risks of the REDD+ projects, activities, and policies, throughout the project period. Currently the FCPF is partnering with 47 developing countries (FCPF n.d.).

Through two funds, the Readiness Fund and the Carbon Fund, support is made available to a limited number of developing countries to conduct all the necessary preparations for REDD+ and then to begin selling their Emissions Reductions Credits. Countries that have made significant progress in their REDD+ readiness endeavors may be selected to participate in the Carbon Fund by documenting five core elements which are i) National REDD+ Strategy; ii) Implementation framework; iii) Measuring, Reporting and Verification (MRV) system; iv) Forest Reference Emission Level/ Forest Reference Level; and v) FCPF Safeguards (Forest Carbon, Markets and Communities Program [FCMC] 2012).

Forest Investment Program (FIP)

The FIP is a combined grant and concessional loan-based financing modality under the World Bank's Strategic Climate Fund and has the strongest statement of livelihood benefits of all the multilateral programs, especially for Indigenous Peoples and local communities (Climate Investment Funds [CIF] n.d.). Though no specific process has been laid down here for project appraisal under this program, FIP has to adhere to the World Bank's Operational

Policies and Procedures along with its own specific social safeguards.

Global Environment Facility (GEF)
The GEF engages 182 member countries and is the largest funder of environmental projects in the world (GEF n.d.). From 2010, the GEF began supporting REDD+ work through its SFM program. Its safeguards focus on avoiding negative social and environmental impacts and on promoting gender equity. The GEF also adopts seven of the World Bank's 10 Operational Policies on Environmental Assessment; Natural Habitats; Involuntary Resettlement; Indigenous Peoples; Pest Management; Physical Cultural Resources; and Safety of Dams (FCMC 2012).

UN's Collaborative Program on REDD
The United Nations (UN)-REDD Program was launched in 2008 as a collaborative initiative of three UN agencies: Food and Agriculture Organization (FAO), United Nations Development Programme (UNDP) and United Nations Environment Programme (UNEP). Through national programs, UN-REDD supports developing countries to prepare for participation in REDD+ mechanisms. Tools developed by this program that can support REDD+ safeguards include a guiding framework on Social and Environmental Principles and Criteria (SEPC); a Country Approach to Safeguards Tool which helps with planning, identifying and prioritizing safeguards and SIS activities; and Benefits and Risks Tool to support countries to address and respect Cancun safeguards (Walcott 2014).

Certain noteworthy bilateral initiatives on REDD+ include Norway's International Climate and Forest Initiative, Australia's International Forest Carbon Initiative and Germany's International Climate Initiative, which give great focus on following safeguards either prescribed at the country level or that of international institutions such as the World Bank. Many non-governmental programs supporting REDD+ readiness have their own safeguards framework as seen in the case of REDD+ Social and Environmental Standards; the Forest Management Certification Scheme under the Forest Stewardship Council; Fairtrade International Standards; Forest Carbon Standard Assessment (FCMC 2012) and World Wide Fund for Nature (WWF's).

ASSESSMENT OF INDIA'S EXISTING SES FRAMEWORK: STRENGTHS AND WEAKNESSES FOR IMPLEMENTING REDD+

India has been a signatory to UNFCCC and has played a proactive role as a developing country in climate negotiations from the beginning. In fact, India was one of the first countries to advocate the concept of actions under REDD which are represented as symbol + in the current avatar of REDD+.[16]

Domestically, for a long time the need was felt in India for a guidance document that could channel the actions of all relevant stakeholders for an effective implementation of REDD+ in the country. In fact, the Reference Document for REDD+ in India released by the Ministry of Environment and Forest and Climate Change (MoEFCC) in 2014 categorically opined that India is willing to implement the REDD+ mechanisms along with the various requirements for REDD+, including formulation and following of a National Strategy or action plan, establishing a national forest emission level, and setting up a transparent national

forest management system for MRV of REDD+ activities (MoEFCC 2014).

The Reference Document is divided into 9 chapters, starting with an introduction and overview of the subject, moving on gradually and logically to the required policy framework to support REDD+ implementation as part of the forest management in the country. The document describes in detail the issues and concepts related to definitions and also the approaches to construct a national forest reference level. It also assigns roles and responsibilities to different governments and other organizations, including Forest Survey of India (FSI), the Indian Council of Forestry Research and Education (ICFRE), the State Forest Departments (SFD), Joint Forest Management Committees (JFMC), Panchayats and *Gram Sabhas*, among others. The need for safeguards to ensure that REDD+ implementation supports the rights of the local communities and indigenous peoples (tribals) and the conservation of biodiversity in natural forests is stressed. The Reference Document comprehensively addresses the need of capacity building across all levels of the government, expert organizations, civil society, other organizations and local communities. Important aspects of NFMS comprising MRV and SIS have been dealt with in the document (MoEFCC 2014).

Building upon the groundwork laid down by the several multilateral and bilateral international agreements concerning REDD+ Safeguards and in light of the Reference Document for REDD+ in India, it is necessary to examine India's readiness for REDD+ implementation through the Cancun Safeguards. This status may be ascertained on the basis of whether India has addressed and respected the seven REDD+ Social and Environmental Safeguards. It is also important to understand whether India has developed its SIS on how REDD+ Safeguards are being addressed and respected.

Policy Alignment

The principle of policy alignment[17] means REDD+ activities must comply with the objectives of national and international forest conventions and agreements. Earlier on, especially in the pre- independence era as well as the immediate post- independence era, forest policies in India focused on exploitation of forests for commercial gains and did not adequately recognize community dependence on or sustainable use of forest resources. Perhaps the need of the hour then was to feed a large population by expanding agriculture and also to meet the industrial demands, especially infrastructure. Large scale deforestation and diversion took place as a result.

In the post- independence era, the first instrument and perhaps the most important instrument to examine in the above context of policy alignment is the Constitution of India itself. It is, therefore, imperative to firstly understand the constitutional position of 'forests' in India. In the first year of Parliament, the policy on forests in 1952, stated that 'national interests' overrode all interests and forests were to be viewed as a national asset. It was made clear that local priorities and interests and the claim of communities around forest areas should be subservient to the larger national interests (Upadhyay *et al.* 2002).

'Forest' which was earlier a state subject under the State List of VIIth Schedule of the Constitution of India, 1950, was shifted to the Concurrent List in 1976 by way of the 42nd

Constitutional amendment.[18] This implied that both Central Government and state government could come up with forest based legislations. One of the key legislations on forests enacted was the Forest Conservation Act, 1980. It is also imperative to understand that there were several Indian states where they had already enacted their own legislations. Thus for example, Rajasthan, Tamil Nadu, Kerala, Andhra Pradesh and Karnataka enacted their own forest legislation but in conformity with the central legislation, the Indian Forest Act (IFA), 1927. This legal position of states and the center needs to be carefully understood while framing programs on REDD+ so that there are no inherent conflicts in administration of the program at the state level when examined from the Central Government level.

The law and policy regime on forests has evolved over time from becoming revenue-oriented to conservation-oriented. The strengths and weaknesses in this regime vis-a-vis REDD+ are highlighted below:

Indian Forest Act, 1927

This central legislation on forests remains unchanged to the need for people's participation in forest management and has to be updated. Most recently, the IFA Amendment Committee of 2016 is going through the process of overhauling this law, whereby aspects of REDD+ implementation can get fine-tuned. Aspects which require particular attention in this exercise include a shift from a revenue oriented approach; clarity on the definition of 'forest'; recognition of participatory forest management; integration of new concepts such as REDD+, carbon credits, climate change, etc.; recognition of traditional rights of forest dependent communities; improving coordination between line agencies; and making penalties within the statute to be more deterrent.

The Forest Conservation Act, 1980

The Forest Conservation Act was enacted to control diversion of forest land for non-forestry purposes, and continues to impose conditions on project proponents for usage of forest land. Some of these conditions include compensatory afforestation, a catchment area treatment plan, safety zone plan creation and payment of Net Present Value for loss of ecological services (ELDF 2009). This act can aid in enhancement of forest carbon stocks, if proper linkages are established between a REDD+ program and administration of this Act. Adding to it are the numerous decisions of the Honorable Supreme Court in the T.N. Godavarman case[19], the longest case on forestry in Indian legal history, which strengthens the forestry framework further from the conservation standpoint. Today, the Supreme Court, especially the T.N. Godavarman case and the National Green Tribunal which has the mandate to adjudicate on the decisions on forest conservation law, are important institutional safeguards which may give strong institutional underpinning to REDD+ projects in India.

National Forest Policy, 1988

The National Forest Policy (NFP) is focused on meeting people's needs and involving them in management of forests along with increasing the forest cover (ELDF 2009). This is one of the most important tenets of implementing REDD+. In fact, a separate mandate on REDD+ needs to be added to give policy impetus to the program. It is important to add here that a renewed attempt to amend and in fact rewrite the new forest policy is also in process and the Indian Institute of Forest Management was

given the mandate to carry out the consultative process to amend the forest policy. They submitted a draft NFP in 2016. However, the process to finalize the NFP has been put on hold.

Joint Forest Management Resolution, 1990

The Joint Forest Management (JFM) resolution draws its legitimacy from the NFP, and lays emphasis on involvement of local communities, protection, afforestation, development of degraded areas and sharing of benefits with communities. Thus on the ground, several JFMCs (approximately one lakh) are in existence whose role can be integrated in the REDD+ activities provided that concerns of tenurial security and traditional rights are addressed first.

The National Environment Policy (NEP), 2006

The National Environment Policy sees a central role for forest conservation and it also promotes reclamation of wastelands and degraded forest lands through multi-stakeholder partnerships, so as to provide incentives for reforestation. Further, the role of forest dependent communities in sustainable forest management (SFM) and their traditional community entitlements over forests is recognized, adding to the relevance of National Environment Policy to REDD+ implementation.

The National Action Plan for Climate Change, 2008 and resultant Green India Mission

National Action Plan for Climate Change (NAPCC) and resultant Green India Mission (GIM) recognizes forest expansion as a means to mitigate climate change while enhancing ecological services without disrupting the livelihoods of those associated with forests. The landscape approach followed within the Mission ensures that the green cover created is holistically beneficial for the forests as well as the people. Convergence with various schemes, such as Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS), Compensatory Afforestation Fund Management and Planning Authority (CAMPA), National Afforestation Programme (NAP), and the National Rural Livelihood Mission (NRLM) are envisioned (ELDF 2016). This Action Plan and its corresponding Missions are other excellent opportunities to implement REDD+.

The National Wildlife Action Plan (2002-2017) and the proposed Draft National Wildlife Action Plan (2017-2031)

The National Wildlife Action Plan and the proposed Draft National Wildlife Action Plan aim at strengthening and enhancing the protected area network as provided under the Wildlife Protection Act (WLPA), 1972 to bring more area under this network for sustainability of wildlife and forest and will have a bearing on the policy mandate of REDD+.

Apart from the law and policies mentioned above, there are also legislations such as the Biological Diversity Act (BDA), 2002 and WLPA which aim at conservation of biodiversity. Further statutes such as Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (also known as Forest rights Act or FRA), Provisions of Panchayats (Extension to the Scheduled Areas) Act (PESA), 1996 respect community control over natural resources and recognize prevailing traditional practices and customary laws.

It is noteworthy that India also came out with a draft REDD+ policy and strategy in 2014 for

development and implementation of REDD+ programs in the country. For the purposes of integration and coordination with other socio-economic sectors, the policy has been made in conformity to the NFP mentioned above.[20] The draft policy seeks to develop a NFMS, set up a National REDD+ Architecture and Governance, create a platform for stakeholder engagement, prepare a National REDD+ information system, introduce a system for managing data on valuation and equitable sharing, have a transparent, equitable and accountable management system in place, plan capacity building activities and eventually develop institutions and their technical capacity in this arena.[21]

Apart from national law and policy regime, it is also important to align REDD+ activities with the various international treaties, conventions, and agreements, among others, of which India is a party. Relevant international agreements include the UN Declaration on the Rights of Indigenous Peoples, 2007; Convention on the Elimination of All Forms of Racial Discrimination, 1969; CBD, 1992; UN Convention to Combat Desertification, 1994; International Tropical Timber Agreement, 2006 (ratified by India in 2008); Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971 (ratified by India in 1982); International Covenant on Civil and Political Rights, 1966 and International Covenant on Economic, Social and Cultural Rights, 1966 (both ratified by India in 1979); Convention on the Elimination of All Forms of Discrimination against Women, 1979 (ratified by India in 1980); ILO Convention No. 107, 1957 (ratified by India in 1958); and Universal Declaration of Human Rights, 1948 (Walcott 2014).

Transparency in National Forest Governance Structure[22]

One of the key safeguards is the safeguard relating to transparency in national forest governance structure. This recognizes the principle of democratic forest governance at the national level, which would include transparency, inclusiveness and effectiveness. There are at least three kinds of institutions that are important to implement the REDD+ mechanism in the Indian context. They are a) regulatory institutions at national, state and local level b) scientific institutions that will address the methodological issues and c) management related institutions that support both the above.

In the first category, the MoEFCC would invariably be the nodal agency in the country involved in conservation and survey of flora, fauna, forests and wildlife, prevention and control of pollution, afforestation and regeneration of degraded areas, and protection of environment in order to promote sustainable development. It is also the agency involved in formulating India's national communication to UNFCCC on REDD+. The SFDs under the state government are the nodal as well as prime implementation bodies of any forest activity in the state. At the local level the Panchayati Raj Institutions (PRI) established after the 73rd amendment have a vital role to play in implementation of any forest based activities. It is clear from above that the fundamental institutions are in place and what is required is a more defined linkage and appreciation of the REDD+ mandate.

The second category of institutions includes autonomous bodies of the MoEFCC, such

as ICFRE which is the apex organization for forestry research and education in the country. It has been granted the status of an Observer organization in the UNFCCC and has worked with the MoEFCC to formulate India's submission on REDD+. Similarly, the Forest Survey India (FSI) is also an organization under the MoEFCC, responsible for monitoring the forest and tree cover of India through remote sensing technology, inventory of forest and non-forest areas, and development of India's forest resources databases. Every two years it comes out with a 'State of Forest Report'. Finally, the Indian Institute of Remote Sensing under the Department of Space is the premier institution for remote sensing and geo-informatics related to natural resource management in India. Other institutions engaged in this area of work include the Indian Institute of Science.

The third category of institution which is required is one to give managerial support to REDD+ implementation arrangements. This could be the Indian Institute of Forest Management, the premier Indian forestry management institution.

Statutory Institutions: Possible Integration with REDD+ Regime

The Draft National REDD+ Policy and Strategy explicitly enumerates the objectives of establishing a transparent NFMS, including the need for transparency, inclusiveness and effectiveness in National REDD+ Architecture. At the moment there is no NFMS. However, the Forest Conservation Act clearances are currently monitored by the regional offices of the MoEFCC. These regional institutions may certainly be strengthened and improved to be the arms of the NFMS for REDD+ implementation. Further, the three tier institutions under the BDA, viz. the National Biodiversity Authority (NBA) at the national level, State Biodiversity Boards (SBB) at state level and the Biodiversity Management Committees (BMC) at local authority level may be used for the REDD+ implementation mechanism and engaged to monitor the access and benefit sharing framework. There is an endeavor to set up National, State, and Local Biodiversity Funds to be used to support conservation and benefit-sharing and this may be further augmented to take care of REDD+ requirements. At the community level, the FRA and Rules made thereunder in 2008 also provide for committees at the village assembly (*Gram Sabha*) level which have a right to manage Community Forest Resources (CFR) where they have had traditional access. These are potentially strong institutions which must be nourished and supported at the village level and can be used for REDD+ implementation, especially in tribal and other forest dependent communities' rich areas.

The JFMCs which have been active since the 1990s are another set of institutions that may be effectively used for REDD+ implementation. The decision making in JFMCs is based on two aspects: namely, quorum and majority which would certainly ensure transparency as mandated by the REDD+ architecture.

The weakness here is that accountability for non-performance of these institutional mechanisms is not stipulated. Therefore, clarification of roles and accountability is required. Clarity on the term 'forest' is another gap requiring urgent attention, as multiple entities in control of the same resource leads to conflict and inefficient performance. Most importantly, there is a lack of proper engagement and coordination amongst various concerned ministries such as the MoEFCC, the

Ministry of Rural Development, the Ministry of Panchayati Raj and the Ministry of Tribal Affairs. These issues in the institutional architecture needs to be resolved either at the committee on Secretaries level or the Cabinet level for full and effective REDD+ implementation.

Respect for Knowledge and Rights of Indigenous Peoples and Local Communities[23]

The Cancun safeguards mandates respect for knowledge and rights of indigenous peoples and local communities, including improvement of their livelihood using incentives and transferring benefits without compromising existing benefits. The Draft National REDD+ Policy and Strategy's objective specifically focusses on this safeguard. The law and policy regime that reflects these objectives and safeguards are as follows:

The FRA grants legal recognition to the rights of traditional forest dwelling communities, including title rights to land under cultivation by tribals' or forest dwellers[24] (up to a maximum of 4 hectares); use and ownership rights to Minor Forest Produce (MFP)[25], to grazing areas, and to pastoralist routes[26]; development rights[27] – to rehabilitation in case of illegal eviction or displacement and other basic amenities[28]; and forest management rights to conserve forests and biodiversity, including community intellectual property[29]. Enactment of the PESA and FRA empowered *Gram Sabhas* to recognize community right holders, with the ownership of MFP and right to protect, regenerate and conserve CFRs.[30] The BDA exempts local communities, traditional healers, *vaids* and *hakims* from seeking permission for accessing bio-resources[31] and the WLPA seeks to involve communities in conservation through creation of "community reserves".[32] The settlement processes under the IFA or the State Forest Acts and the WLPA also includes within its process the rights of any stakeholder (which obviously includes indigenous peoples and local communities) to be recognized, recorded, vested, and respected. The FRA in fact recognizes the habitat rights of the most vulnerable tribal groups, commonly called Particularly Vulnerable Tribal Groups. In its vast geographical variation and distinctions in the tenancy regime numerous state laws have their unique methods of recognizing tribal identity and rights of local communities. Several tenancy laws such as in the states of Jharkhand[33], the revenue codes of central India[34], and the settlement reports of northern hill states of India[35] have elaborate provisions to respect tribal and local community rights.

In spite of these legislative measures which uphold traditional rights of local communities and indigenous tribes, implementation of these laws at the grassroots level is still a challenge.

Multi-stakeholder Participation[36]

This principle would ensure full and effective participation of relevant stakeholders, including the right to Free, Prior and Informed Consent (FPIC) in particular, of indigenous people and local communities, provisions for conflict resolution and a co- ordination process for local level stakeholders' REDD+ planning.

Accordingly the Draft National REDD+ Policy and Strategy includes, apart from its objectives, the agenda of stakeholder engagement, community micro plans for Sustainable Forest Management with active citizens participation, provision for conflict resolution, and a co-ordination process for local level stakeholders'

REDD+ planning. GIM under NAPCC also emphasizes a decentralized participatory approach with the involvement of grass root level organizations in planning, decision making, and implementation and monitoring; this includes JFMCs, Community Forest Management (CFM) groups, *Van Panchayats*, BMCs, and the Forest Committee under rule 4(e) of FRA Rules 2007, among others. Local self-government, including the Gram Sabha, have been given a primary role under the PESA. The Draft National Policy on REDD+ provides for REDD+ implementation through a "Platform for Stakeholder engagement"[37] which it seeks to create and provides that institutions governing community managed forests can also be brought under the CFM framework adhering to the FPIC principle referred above. In addition, the National Environment Policy imbibes the principle of decentralization and multi stakeholder partnerships involving the Forest Department, land owning agencies, local communities, and investors, with clearly defined obligations and entitlements for environmental and livelihood benefits.

Under the current legal regime on forest, the FRA is perhaps the first legislation that in its recognition and vesting of rights process, statutorily mandates the engagements of four departments: namely, the Tribal Development/ Welfare Department, the Forest Department, the Revenue Department and the Panchayati Raj Department. This is an excellent example of a multi-departmental stakeholder engagement in a rights recognition process for tribal and forest dwelling communities. Clearly, such institutions' experiences can be effectively used for multi-stakeholder engagement and participation for REDD+ programmes.

Having stated the above, what is lacking is an effective implementation of the law and policy regime to integrate multi-stakeholder participation as envisaged under the Cancun Safeguards.

Conservation of National Forests and Biodiversity[38]

The Cancun safeguard relating to conservation of national forest and biodiversity would help to incentivize protection and conservation of natural forests and their services and other social and environmental benefits. Primarily, the Draft REDD+ policy and strategy document seeks "to enable India to gain from international REDD+ mechanism for its pro-conservation policies and efforts and at the same time create financial incentives to local communities which are in the forefront of conservation of forests". Specific pro-conservation statutes include the BDA and the Biological Diversity Rules, 2004, the WLPA and the Forest Conservation Act. Further, statutes such as the IFA or the FRA and policies such as the NFP, Draft National Wildlife Action Plan (2017-2031), National Environment Policy and NAPCC broadly look at conservation of national forests and biodiversity. For instance:

- The IFA provides for a framework of conservation of three kinds of forest: namely, reserve forest, protected forest and village forest. The state governments have further expanded some of these classifications to include district forest, demarcated protected forest, and un-demarcated protected forest. The revenue laws include a variety of categorizations of forests such as *bade jhad ke jungle*, *chote jhad ke jungle*, *jhudipi jungle*, *saran, jungle*

khurd, which have now come under the FCA, especially after the order dated 12.12.1996 of the Hon'ble Supreme Court in the T.N. Godavarman vs. Union of India case (CWP No. 202 of 1995).

- The BDA gives way to three levels of conservation of biodiversity efforts in India, namely at the species diversity level, genetic diversity level and ecosystems diversity level.[39] There are various provisions by which the Act envisages the conservation of biodiversity. Thus, for example, it regulates the access to biological diversity through the NBA.[40] It also regulates the commercial utilization of biological resource through the SBB.[41] It regulates the transfer of biological resources or knowledge through a detailed regulatory process.[42] It also empowers the SBBs to restrict activities violating the objectives of conservation.[43] Further, it mandates the central government to formulate national strategies and plans for conservation and promotion and sustainable use of biological diversity, including measures for identification and monitoring of areas rich in biological resources through promotion of in situ and ex situ conservation of biological resources.[44] It empowers the state government to framework rules in consultation with the local bodies for declaring biodiversity heritage sites.[45] It also empowers the central governments to notify threatened species[46] and more importantly it creates the BMCs at the local body level to promote conservation, sustainable use and document biological diversity at the local level.[47]
- The WLPA was enacted with three objectives: streamlining the State Wildlife Acts and replacing them with one National Legislation, establishing a network of Protected Areas, and preventing illegal trade in wildlife and their products. It contains six schedules of fauna and flora which give varying degrees of protection. The different categories of ecosystems that have been designated with varying degrees of protection are national parks, sanctuaries,[48] community reserves,[49] and conservation reserves[50]; these are collectively termed as 'protected area' and tiger reserves[51].
- While the FRA's main purpose is to correct historical injustice by providing for recognition and vesting of forest rights to Forest Dwelling Scheduled Tribes and other traditional forest dwellers, it deals with conservation through the provision for vesting in the community, a right to protect, regenerate, conserve and manage a CFR which they have been traditionally protecting and conserving for sustainable use.[52] Further, the FRA also empowers the rights holders to perform certain duties towards conservation of forest, biodiversity and wildlife.[53] There is also the provision for declaration of Critical Wildlife Habitats in such areas of National Parks and Sanctuaries where it has been specifically and clearly established, case by case, on the basis of scientific and objective criteria, that such areas are required to be kept as inviolate for the purposes of wildlife conservation.[54]

In spite of such strong legislative backing, there are challenges to conservation resulting from issues such as encroachments, forest fires, and forest diversion for development projects, human-wildlife conflict, wildlife poaching, and illegal trade in the country's flora and fauna. Underlying causes for such issues are skewed development priorities, poverty, a high

population index and the impact of past forest management policies.

Actions to Address the Risks of Reversals[55] and to Reduce Displacement of Emission[56]

Risk of reversals of emissions reductions is the risk that despite initial emissions reductions, carbon is released into the atmosphere at a later stage. It describes the possibility of reversing climate benefits through the loss of forest carbon biomass, for example through a fire or pest outbreak that releases carbon back into the atmosphere.[57] This safeguard is most important to ensure permanence in carbon stocks.

Reducing displacement of emissions would help to see that REDD+ tackles drivers of deforestation rather than shifts them from one area to another (locally, nationally, or internationally). For example, REDD+ could stop agricultural expansion in one area, but if this expansion moves to another area, this will cause no net improvement. This is known as displacement of emissions.

While the Draft REDD+ Policy does not adequately address safeguards (f) and (g), it is necessary to examine the national legal and policy framework on forest and wildlife to see whether such safeguards have any congruous provisions. While there are generic provisions addressing the risk of reversal, the specifics are largely covered in the management prescriptions of forest, either through the Working Plan Code in case of reserve forests or the management plans for the Protected Areas. The working plans also deal with aspects of fire protection and other factors of reversal including illegal use of forests and overgrazing. The working plans also cover management of wild fires, insect attacks and pathological problems such as Sal Borer infestations or other epidemics. The regulation of diversion is also through the Forest Conservation Act and WLPA as well as the important Supreme Court orders on forestry. The courts have devised several mechanisms such as compensatory afforestation, catchment area treatment plans, and biodiversity and wildlife conservation plans. Several projects which are sited in forests or wildlife rich areas are also statutorily mandated to assess their impacts and ensure mitigation through environment management plans and other statutory conditions that may be imposed under the clearance procedures. The National Wildlife Action Plan, including the current Draft National Action Plan also addresses the problems relating to invasive species.

While these policies and regulations provide a strong starting point for these actions, the design and implementation must be site-specific.

RECOMMENDED SET OF GUIDELINES FOR FIELD PRACTITIONERS OF REDD+ PROJECTS AND PROGRAMS

In light of the brief overview of REDD+ SES, various UNFCC and other international decisions, initiatives and procedures for integrating SES in REDD+, and an assessment of India's existing SES framework, a draft set of guidelines are listed here for practitioners at the grassroots level for implementation of REDD+ projects and programs. These may include:

- Government Agencies- Forestry Sector, REDD+ Cell;

- Beneficiary local communities;
- Non-Governmental Organizations (NGOs), Civil Society Organizations.

Guidelines recommended for the three categories of practitioners are:

Government Agencies – Forestry Sector and REDD+ Cell

- Familiarity with the latest developments of REDD+ international instruments in the context of UNFCCC including international experience.
- Clarity on India's position nationally, sub-statal as well as in the nested context.
- Clarity on the benefit sharing model, including the institutional architecture at the national, sub-statal or the local level.
- Clarity on risks associated with REDD+ projects and their management.
- Incentives to promote REDD+ projects.
- Identifying and prioritizing areas of forests, bio-diversity and eco-system services to conduct REDD+ activities.
- Knowledge and training on environmental law in general and in particular forests, wildlife and biodiversity related laws.

Benefiting Local Communities

- Conducting local monitoring of risks or benefits of REDD+ activities through community-based agencies such as JFMCs, BMCs, Community Reserve Management Committees and committees established under FRA.
- Building local capacities on verification and MRV.
- Patrolling in project areas to ensure effective implementation.
- Assessing impacts of farming practices, harvest of MFP, community infrastructure, logging, mining, etc. on forest lands and developing innovative practices that are sustainable.
- Developing community-led conservation efforts.
- Taking initiative for preparation of micro-plans and other community specific plans mandated under WLPA and FRA.
- Proactive interaction and coordination with government agencies and NGOs responsible for implementation of REDD+.
- Highlighting traditional practices and its potential linkage with REDD+.
- Knowledge of local laws on environment, especially forests and biodiversity.

Non-Governmental Organizations and Civil Society Organizations

- Initiate various socio-cultural and educational outreach and training activities to empower and engage marginalized or vulnerable groups, forest dependent communities, etc. i.e., raising awareness about land use and SFM.
- Provide training on activities that increase income/ livelihood of local communities by supporting activities which contribute to revenue through sustainable use of forests.
- Help beneficiary communities in accessing a grievance redressal and dispute resolution mechanism.
- Demonstrate through pilot projects in coordination with government departments, equitable distribution of benefits from result based payments arising out of REDD+ activities.
- Knowledge of local laws on environment, especially forests and biodiversity.

REFERENCES

CIF. n.d. "Forest Investment Program- Funds & Programs." *Climate Investment Funds* website. https://www.climateinvestmentfunds.org/fund/forest-investment-program.

ELDF. 2009. *Legal and Institutional Response to REDD +:The Indian Context*. New Delhi: Enviro-Legal Defence Firm (ELDF) and Forest Governance Learning Group (FGLG).

ELDF. 2016. *Policy Brief - Reducing Emissions from Deforestation and Degradation (REDD+) in India and its Linkage with Participatory Forest Management, Strengthening Participatory Forest Management in India (SPFMI).* New Delhi: Enviro-Legal Defence Firm.

FCPF. n.d. "About FCPF." *Forest Carbon Partnership Facility* website, Accessed May 11, 2017. https://www.forestcarbonpartnership.org/about-fcpf-0.

FCMC. 2012. *REDD+ Social Safeguards and Standards Review*. Forest Carbon, Markets and Communities Program, Burlington, Vermont: Tetra Tech.

GEF. n.d. "The A to Z of the GEF. A Guide to the Global Environment Facility for Civil Society Organizations." *The Global Environment Facility* website. https://www.thegef.org/sites/default/files/publications/AZ-CSO_EN_1.pdf.

Loft, Lasse, Thuy Thu Pham, Grace Yee Wong, Maria Brockhaus, Dung Ngoc Le, Januarti Sinarra Tjajadi and Cecilia Luttrell. 2017. "Risks to REDD+: potential pitfalls for policy design and implementation." *Environmental Conservation* 44 (1): 44-55.

MOEFCC. 2014. *Reference Document for REDD+ in India*. New Delhi: Ministry of Environment, Forest and Climate Change, Government of India.

Rey, D., S. Korwin, U. Ribet and L. Rivera. 2016. *Best Practices and Considerations for the Development of REDD+ Country Approaches to Safeguards and Design of Safeguard Information Systems*. London, United Kingdom: Climate Law and Policy (CLP) and SNV.

Upadhyay, S., and V. Upadhyay. 2002. *Environment Protection, Land and Energy Laws*. New Delhi: Lexis Nexis Butterworths.

Walcott, Judith. 2014. *REDD+ Safeguards and Safeguards Information Systems*. Module for REDD+ Academy, UN-REDD Programme.

FURTHER READING

Policies

Draft National REDD+ Policy and Strategy. http://envfor.nic.in/sites/default/files/Draft%20National%20Policy%20&%20Strategy%20on%20REDD.pdf

Strategic Plan, 2012-13 to 2016-17. ww.gov.ls/gov_webportal/important%20documents/national%20strategic%20development%20plan%20201213-201617/national%20strategic%20development%20plan%20201213-201617.pdf

India's Intended Nationally Determined Contribution: Working Towards Climate Justice. http://www4.unfccc.int/

submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf

National Action Plan on Climate Change, 2008. http://www.cseindia.org/userfiles/National%20Action%20Plan%20on%20Climate%20Change.pdf

National Environment Policy, 2006. http://www.moef.gov.in/sites/default/files/introduction-nep2006e.pdf

National Forest Policy, 1980. http://envfor.nic.in/legis/forest/forest1.html

Acts and Rules

Indian Forest Act 1927. http://ls1.and.nic.in/doef/WebPages/ActsNRules/IFA-1927.pdf

Forest Conservation Act, 1980 and Rules, 2004. http://wrd.bih.nic.in/guidelines/awadhesh02c.pdf

The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. http://lawmin.nic.in/ld/PACT/2007/The%20Scheduled%20Tribes%20and%20Other%20Traditional%20Forest%20Dwellers%20(Recognition%20of%20Forest%20Rights)%20Act,%202006.pdf

The Provisions of Panchayat (Extension to Scheduled Areas) Act, 1996. http://www.tribal.nic.in/actRules/PESA.pdf

Biological Diversity Act, 2002. http://lawmin.nic.in/ld/P-ACT/2003/The%20Biological%20Diversity%20Act,%202002.pdf

Wildlife Protection Act, 1972. http://lawmin.nic.in/ld/PACT/1972/The%20Wild%20Life%20(Protection)%20Act,%201972.pdf

Documents on international position on safeguards for implementation of REDD+

Report of the Conference of the Parties on its thirteenth session, held in Bali from 3 to 15 December 2007. UNFCCC, 2007. http://theredddesk.org/sites/default/files/resources/pdf/2010/BAP.pdf

Report of the Conference of the Parties on its seventeenth session, held in Durban from 28 November to11 December 2011. UNFCCC, 2011. https://unfccc.int/resource/docs/2011/cop17/eng/09a01.pdf

Report on the workshop on financing options for the full implementation of results-based actions relating to REDD- plus, including modalities and procedures for financing these results-based actions. UNFCCC, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/awg-lca_unfccc_financing.pdf

Report of the Conference of the Parties on its nineteenth session, held in Warsaw from 11 to 23 November 2013. UNFCCC, 2013. http://unfccc.int/resource/docs/2013/cop19/eng/10.pdf

BRAZIL- an overview from the REDD countries database. The Institute for Conservation and Sustainable Development of Amazonas (IDESAM), 2011. http://theredddesk.org/sites/default/files/resources/pdf/2011/brazil._an_overview_from_the_redd_countries_database_may_2011.pdf

A Road Map to Mainstreaming Gender Considerations into Ghana's REDD+ Process. The Forestry Commission of Ghana, IUCN, 2011. http://theredddesk.org/sites/default/files/resources/pdf/a_roadmap_to_mainstreaming_gender_considerations_into_ghanas_redd_process.pdf

Legal preparedness for REDD+ in Mexico: Country Study. International Development Law Organization, FAO and UN-REDD programme, 2011. http://theredddesk.org/sites/default/files/resources/pdf/2012/legal_preparedness_for_redd_in_mexico_english.pdf

The Role of Women in Asia's Community Forest Enterprises. Rights and Resources Initiative, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/women_in_asias_cfes.pdf

Gender in Forest tenure: pre- requisite for sustainable Forest Management in Nepal. Rights and Resources initiative, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/gender_in_forest_tenure_-_forest_management_nepal_0.pdf

Gender, tenure and community forests in Uganda. CIFOR, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/wp87cifor.pdf

A country-led approach to REDD+ safeguards and multiple benefits: SNV project 'Delivering Multiple Benefits from REDD+ in Southeast Asia'. International Climate Initiative, 2013. http://theredddesk.org/sites/default/files/resources/pdf/A%20country-led%20approach%20to%20REDD%2B%20safeguards%20and%20multiple%20benefits.pdf

Barriers and Entry Points for Women's Inclusion in REDD+ in Asia- Pacific, USAID. United States Agency for International Development (USAID), Women Organizing for Change in Agriculture and Natural Resource Management (WOCAN), UN-REDD, 2014. http://theredddesk.org/sites/default/files/resources/pdf/redd_gender_policy_brief_1.pdf

Sustainable development goals and forests: Integrating perspectives, priorities and experience from Asia. International institute for environment and development, 2014. http://theredddesk.org/sites/default/files/resources/pdf/sustainable_development_goals_and_forests.pdf

A bottom-up approach to building REDD+ safeguards with the Afro-Colombian community in Colombia's Pacific region. WWF forest and climate programme, 2014. http://theredddesk.org/sites/default/files/resources/pdf/final_ip_colombian_safeguards_web_.pdf

Designing a National Safeguard System in Mexico. Comision Nacional Forestal, Mexico, 2014. http://theredddesk.org/sites/default/files/resources/pdf/designing-a-national-safeguards-system.pdf

Country-Led Approaches to REDD+ Safeguards: Early Experiences and Lessons Learned REDD Program CCAD-GIZ. REDD Program CCAD-GIZ, 2015. http://theredddesk.org/sites/default/files/resources/pdf/csa_early_experiences_and_lessons_learned.pdf

Proposed Benefit Sharing System for REDD+ pilot project in Central Suau / Papua New Guinea. International climate initiative, 2015. http://theredddesk.org/sites/default/files/resources/pdf/png_spc_giz_redd_benefit-sharing_proposal.pdf

Guidelines/Manuals

Understanding Community- Based REDD+: A Manual for Indigenous Community Trainers. International Work Group for Indigenous Affairs (IWGIA), Asia Indigenous Peoples Pact (AIPP), 2011. http://theredddesk.org/sites/default/files/resources/pdf/Understanding%20Community%20Based-REDD%2B%20-%20A%20Manual%20for%20Indigenous%20Communities.pdf

Indigenous Peoples and the Green Climate Fund - A technical briefing for Indigenous Peoples, policymakers and support group. Forest Peoples Programme and Indigenous Peoples' Network of Malaysia (JOAS), 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/indigenous-peoples-and-green-climate-fund-230812-finalpdf_0.pdf

Position Paper: Advice on REDD+ Safeguards, Eleventh meeting of the Conference of the Parties, 8-19 October, 2012, Hyderabad, India. Conservation International, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/rd7.pdf

Safeguarding forests and People: A Framework for Designing a National System to Implement REDD+ Safeguards. World Resources Institute, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2013/safeguarding_forests_and_people.pdf

Designing Effective REDD+ Safeguard Information Systems: Building on existing systems and country experiences. International Institute for Sustainable Development, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/reddeffective_safeguard.pdf

Forests: Gender, property rights and access. CIFOR, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/forests_gender_.pdf

The Private Sector in the REDD+ Supply Chain: Trends, challenges and opportunities. ASB Partnership for the Tropical Forest Margins, World Agroforestry Centre (ICRAF), Nairobi, Kenya, International Institute for Sustainable Development, 2012. http://theredddesk.org/sites/default/files/resources/pdf/2012/private_sector_in_redd_supply_chain.pdf

Scoping Study of Good practices for strengthening Women's inclusion in forest and other natural resource management sectors. Women Organizing for Change in Agriculture and Natural Resource Management (WOCAN), United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation (UN-REDD), USAID-funded Lowering Emissions in Asia's Forests (LEAF), 2013. http://theredddesk.org/sites/default/files/resources/pdf/Scoping%20Study%20-%20Gender.pdf

Terms of Reference (ToR) for the Strategic Environmental and Social Assessment (SESA) and Environmental Social Management Framework (ESMF) formulation for the REDD+ Process in Ethiopia. Government of Ethiopia Ministry of Agriculture, 2013. http://theredddesk.org/sites/default/files/resources/pdf/Ethiopia-ToR-SESA-ESMF%20%28FINAL%29%20%282%29.pdf

Safeguards for REDD+ from a Donor Perspective. Climate Focus, 2013. http://theredddesk.org/sites/default/files/resources/pdf/safeguards_for_redd_from_a_donor_perspective_0.pdf

CIFOR's Global Comparative Study on REDD+: Can Safeguards Guarantee Gender Equity? Lessons from research on women in early REDD+ implementation. Center for International Forestry Research (CIFOR), 2013. http://theredddesk.org/sites/default/files/resources/pdf/can_safeguards_guarantee_gender_equity.pdf

Free, Prior and Informed Consent and REDD+: Guidelines and Resources. WWF-US's People and Conservation Programme and WWF's global Forest and Climate Programme, 2014. http://theredddesk.org/sites/default/files/resources/pdf/fpic_and_redd_-_guidelines_and_resources_0.pdf

A Country-Led Safeguards Approach: Guidelines for National REDD+ Programmes. SNV – The Netherlands Development Organization's REDD+ Programme, 2014. http://theredddesk.org/sites/default/files/resources/pdf/snv_csa_guidelines.pdf

Know Your Rights Related to REDD+ : A Guide for Indigenous and Local Community Leaders. Centre for International Environmental Law, 2014. http://theredddesk.org/sites/default/files/resources/pdf/redd_guide_may2014.pdf

REDD+ Safeguards: Practical Considerations for Developing A Summary Of Information. Government of Norway's International Climate and Forest Initiative, 2014. http://theredddesk.org/sites/default/files/resources/pdf/redd_safeguards_0.pdf

Demonstrating 'Respect' for the UNFCCC REDD+ Safeguards: The Importance of Community- Collected Information. Oxford: Global Canopy Programme, 2015. http://theredddesk.org/sites/default/files/resources/pdf/demonstrating_respect_for_the_unfccc_redd_safeguards_-_the_importance_of_community_collected_information_0.pdf

Reports

Policy Brief, Reducing Emissions from Deforestation and Degradation (REDD+) in India and its Linkage with Participatory Forest Management, Strengthening Participatory Forest Management in India (SPFMI), ELDF, November 2016.

Is India Ready to Implement REDD Plus, A Preliminary Assessment, TERI

Forest governance and implementation of REDD+ in India, TERI

India's Forests and REDD+, Ministry of Environment and Forests

REDD+ Social Safeguards and Standards Review, USAID Forest Carbon, Markets and Communities Program (FCMC). http://pdf.usaid.gov/pdf_docs/PA00KCV5.pdf

REDD+ Safeguards and Safeguard Information Systems, UN REDD Programme

Decision booklet REDD+, UNFCCC Secretariat. https://unfccc.int/files/land_use_and_climate_change/redd/application/pdf/compilation_redd_decision_booklet_v1.1.pdf

The History of REDD Policy. http://redd.unfccc.int/uploads/2_164_redd_20091216_carbon_planet_the_history_of_redd_carbon_planet.pdf

REDD+ Implementation: A Manual for National Legal Practitioners, https://wedocs.unep.org/browse

Research Handbook on REDD- Plus and International Law, Christina Voigt

A Review of Three REDD+ Safeguard Initiatives, Nicholas Moss *et al.*, https://www.cbd.int/forest/doc/analysis-redd-plus-safeguard-initiatives-2011-en.

A Guide for Consistent Implementation of REDD+ Safeguards, Client Earth, https://www.clientearth.org/reports/a-guide-for-consistent-implementation-of-redd+-safeguards.pdf

Websites

http://envfor.nic.in
http://www.moef.nic.in
www.unredd.net

SECTION VI

OPERATIONALIZATION AND MAINSTREAMING

This section presents some ideas for operationalization and mainstreaming of key concepts discussed earlier in the book. It has two chapters. The first chapter (Chapter 15) discusses opportunities and challenges for adoption of landscape approach to forest management at the state level. The second chapter (Chapter 16) provides guidance for development of REDD+ projects for raising finance for implementation of activities related to sustainable forest ecosystem management.

Chapter 15: Landscape Approach: Opportunities and Challenges

Rohini Chaturvedi[1]

INTRODUCTION

The aim of this chapter is to contribute to an enhanced understanding of the opportunities and challenges for adoption of a Landscape Approach to Forest Management (hereinafter the landscape approach) at state-level in India, especially in the context of forest restoration.

Deforestation and degradation of forests result not only from proximate factors evident at the site or local level but also indirect factors at multiple scales (Geist and Lambin 2002). These factors may be physical, social, economic, or political. Linking site level interventions with broader processes is thus crucial for achieving impact. Since landscapes facilitate these linkages at a spatial scale there is an increasing world-wide interest in the landscape approach.

While a universally accepted definition for landscape remains elusive, the term loosely refers to a "contiguous area, intermediate in size between an eco-region and a site, with a specific set of ecological, cultural and socioeconomic characteristics distinct from its neighbors" (Newton *et al.* 2012). Although its boundaries are invariably fuzzy and can shift depending on the interest as well as perceptions of the stakeholders involved, in most instances a landscape extends from 100 to 10,000 km^2 (Pfund 2010). Landscapes comprise a mosaic of different land uses and land ownerships as well as multiple ecosystems. The landscape approach not only attends to component units but also emphasizes the interactions among them. In this respect, landscape approach is unlike conventional sectorial approaches that consider various natural resource units – forests, water, farmlands, and so on – in isolation. Instead, the landscape approach is necessarily multi-sectorial (Yaap and Campbell 2012).

A major aim of the landscape approach is to address both conservation and development objectives. Equal importance is, therefore, accorded to restoring and maintaining ecological integrity as well as securing continuous flow of ecosystem services that form the basis of human well-being (Korn *et al.* 2011; Wu 2013). In effect, the landscape approach draws attention to the various ecosystem services that flow to different stakeholders pursuing different land-use strategies. However, since conservation and

multiple uses cannot all be simultaneously maximized, negotiating trade-offs between competing demands becomes central to the landscape approach. In doing so, the landscape approach involves concerned stakeholders, provides tools and concepts that facilitate allocation of land to different uses, explicates the trade-offs and attempts to bring in a negotiated agreement on land use as well as distribution of related costs and benefits. It is anticipated that when interventions are conceived of and implemented at a landscape level, higher values will be generated for both the economy and the environment than when interventions are limited to specific sites (Sayer *et al*. 2013).

One significant innovation of the landscape approach is that it considers ecological and human interactions across multiple spatial scales – local, national, and regional (Reid *et al*. 2010). This is significant since many complex environmental problems exhibit cross-level interactions and require a multi-level governance approach that cuts across spatial scales as well as the public-private divide (Hooghe and Marks 2001). Many natural resources, including forests, have potential for better management and over the years substantial efforts have been invested in improving forest governance through tenurial reform, capacity building, decentralization, participation, and so on. Often these efforts have concentrated on one spatial scale or another. In a landscape approach, however, different actors associated with different land uses and with varying objectives are brought together across spatial scales, thereby challenging existing resource governance structures and the attendant power configurations (Termeer *et al*. 2010). Achieving coordination for the landscape approach, therefore, requires that the opportunities for synergy are identified and potential conflicts are addressed in an integrated manner.

APPROACH, SCOPE AND METHODS

Forests are one of the largest land-use types in India, second only to agriculture. Forest cover accounts for 21.23 percent of the country's area, with Trees Outside Forests (TOF) contributing a further 2.78 percent of green cover (FSI 2013). Since the early years of Independence, the Government of India has a policy framework for forest conservation. The landscape approach is a recent addition to this policy framework, and was introduced with the National Mission for a Green India (popularly called Green India Mission or GIM) in 2009, under the National Action Plan on Climate Change. GIM aspires to protect, restore and enhance India's forest and tree cover as a strategy for climate mitigation and adaptation. The GIM calls for "an integrated approach" that treats forests and non-forest public lands as well as private lands simultaneously, in project units/sub-landscapes/sub-watersheds (MoEF 2010). It also emphasizes inter-sectorial convergence to achieve the objective of sustainable forest-based livelihoods. Since 2014, a landscape approach has also been incorporated in the National Working Plan Code (NWPC), which governs a ten-year, statutorily mandated, planning process for India's forests. The NWPC conceptualizes forest landscapes at a Forest Division level. It emphasizes forest management systems that provide flows of multiple ecosystem services, including provisioning services for forest-dependent communities. Further, these plans must be prepared in consultation with local communities. Outside the regulatory

framework on forests, inter-linkages with forests have also featured in programs for watershed development, livelihood security including employment guarantee, as well as agriculture intensification and food security[2]. These programs have typically involved multiple government departments, at national and state levels. The watershed program, for instance, involves at the national level the Ministry of Environment and Forests (MoEF),[3] the Ministry of Rural Development, and the Ministry of Agriculture.

As already mentioned, landscape approach to forests is a recent addition to the policy framework in India. It is, therefore, premature to assess its effectiveness. This chapter, however, attempts to identify the factors that may facilitate or constrain its implementation, based on the experience with other cross-scale, multi-sectorial programs. Two sets of experiences, from which inferences for the landscape approach could be drawn, were studied. The first was existing experience of cross-sectorial functioning at the state level, with an emphasis on understanding how the forestry sector interfaces with other relevant sectors such as rural development, agriculture, watersheds, and climate change. This interface manifested in programmatic and planning initiatives such as the Working Plan process, the National Mission for a Green India, the State Action Plans on Climate Change (SAPCC), and watershed programs. The second was the personal experience and understanding of the key informants who were directly or indirectly involved in such initiatives. Taken together, the two sets of experiences helped in developing a nuanced understanding of the opportunities and challenges for operationalization of a landscape approach to forest management.

Therefore, this chapter is based on content analysis of contextual and policy documents as well as 21 semi-structured key-informant interviews. The interviewees were identified on the basis of their positions in the governance and institutional structures. Various themes were explored through a set of questions that was iteratively refined through the course of the study, as new issues emerged.

In India, there are several examples of restoration initiatives led by government and non-government entities to achieve objectives of climate change mitigation and adaptation, biodiversity conservation, watershed development, and rural development. While this chapter recognizes the contribution of these efforts, it is focused mainly on the state governments, which are core to the landscape approach for at least four reasons. First, most land is owned by state governments and the state governments have the power over land-use planning. Second, effective implementation of most land-related policies is contingent on buy-in from the states. In the case of forests, the State Forest Departments (SFDs) are often seen as the custodians of forest land and are responsible for forest planning and implementation. This planning is carried out through the Working Plan process. States also contribute financial resources for resource management and development planning processes. Over the years, states have been arguing for greater financial autonomy in determining environment and development priorities and their demands are being gradually addressed. Third, state governments enjoy considerable control over the administrative machinery at the state level. Officers of the Indian Administrative Service (IAS) and the Indian Forest Service (IFS) are centrally recruited and trained. They are subsequently

assigned to state cadres where they spend most of their work-life. Finally, in recent years greater emphasis is being put on "co-operative federalism". Given the salience of the states in forest governance, it is important to understand the state-level perspective on the landscape approach. The study covered four Forest-PLUS partner states – Himachal Pradesh, Sikkim, Madhya Pradesh and Karnataka – where the program is working in selected landscapes.

OPPORTUNITIES

This section discusses opportunities for implementation of the landscape approach at the state level. It is sub-divided into two sub-sections. The first deals with opportunities that are common across the four Forest-PLUS partner states. The second lists some opportunities that are unique or limited to some states.

Common Opportunities

Across all four states there are three common policy spaces that largely draw from national policies and programs.

National Mission for a Green India

The first among these is the National Mission for a Green India which translates into State Missions at the state-level. In all four states, these State Missions have conducted detailed planning with an initial grant released by the Government of India. For instance, Himachal Pradesh used this opportunity to develop vulnerability maps of the state by combining climate change data, socio-economic data, and assessments of adaptive capacity. A prioritization exercise was also carried out to identify the most vulnerable sites and districts in the state, from a climate change perspective. Also, some of the evidence gathered for the exercise is now being used for resource planning in other projects, such as the Climate Proofing Project. On the other hand, Sikkim has prepared a perspective plan for the SFD, in which blank, degraded and open forest patches have been identified along with strategies for their restoration. In translating the National Mission for a Green India's emphasis on 'convergence' into the strategy of State Mission, the SFD anticipates that it will collaborate with other departments for human resources, as and when required.

National Working Plan Code

The second policy space is provided by the revised National Working Plan Code introduced by the Government of India in 2014. This code, which guides the preparation of ten year management plans for notified forest areas, explicitly links conservation and livelihoods. The preamble of the revised Code states that working plans for forest areas should focus on sustainability of productive and environmental functions (soil and water conservation, carbon sequestration, and so on) alongside flow of socio-economic benefits to forest dwellers and other forest-dependent communities. Further, the code explicitly mandates linking of micro-plans and eco-development plans with the working plan, thereby strengthening the involvement of forest-fringe communities in resource governance with commensurate benefits (FRI 2014). The working plan preparation is staggered over time and therefore the experience with the new code is still evolving. In Madhya Pradesh, several working plans were scheduled for revision at the time of the study and efforts were underway to identify overlapping circles based on different perspectives: forest type, agro-climatic zones, Joint Forest Management, and so

on. This exercise could help the Working Plan Officer to focus on dominant 'use value' that emerges in a given area.

Watershed Programs

The third policy space is provided by the watershed programs, currently being implemented in Madhya Pradesh, Karnataka, and Himachal Pradesh, to boost agricultural productivity and improve livelihoods. Karnataka, for instance, has implemented a range of watershed projects since the 1980s as part of a strategy to improve its agricultural productivity. In the early years, watershed programs in Karnataka were implemented by the Department of Agriculture, but after 2000 a separate Watershed Development Department was carved out of the Department of Agriculture. Technical competencies from different departments – agriculture, forests, fisheries, and animal husbandry – were brought into its fold to cultivate a multi-disciplinary team under a single chain of command. The Watershed Development Department is entrusted with the responsibility of formulation, planning, and execution of different activities. All watershed development programs and schemes in the state are implemented through this department. This 'unified' department is perceived to have facilitated engagement across different line departments, which was 'the biggest problem' in the earlier system. It has also facilitated integration in planning at the programmatic level, the watershed level, and the local level. As a senior officer of the watershed department observed, "We have started thinking like a watershed department. It is not 100 percent but it is there."

State Action Plans for Climate Change

Finally, all four states in the study have developed state action plans for climate change, which encapsulate sector wise plans for addressing climate change challenges, in keeping with the National Action Plan for Climate Change. These plans cover different sectors and resources and could be the starting points for initiating a discussion on the landscape approach.

State-specific Opportunities

In addition to the above common opportunities, there are several initiatives rooted in specific states that support landscape approaches. For instance, Himachal Pradesh's Forest Sector Policy and Strategy (2005) mentions the 'Forest Sector Concept' that "encompasses the entire biophysical and environmental components comprising lands and biological resources (i.e. forests, watersheds, wetlands, wildlife, biodiversity, and habitats) and includes the stakeholders and institutions directly or indirectly dependent on or responsible for the management of these components for livelihood security and sustenance" (Government of Himachal Pradesh 2005, Page 1). In order to operationalize strategies that strengthen multiple uses of forests, the policy and strategy proposes a reclassification of forest areas from the existing silviculture-driven categories to those that respond to different uses. These include:

- *Conservation Forests*: To be managed primarily for physical, climatic, hydrological, and ecological considerations to reflect environmental and biodiversity concerns. This category includes the protected areas.
- *Production Forests*: To be managed for the sustained production of timber and non-timber forest products.
- *Community Forests*: To be managed by Joint

Forest Management and Panchayati Raj Institutions for meeting the livelihood requirement of forest-dependent people.

- *Urban Forests*: To be managed for maintaining and enhancing urban landscapes, aesthetic values, and environmental services.

The policy and strategy emphasizes watersheds as key planning concept within which multiple stakeholders and multiple forest values can be brought together to support sustainability of both, forests as well as forest-based livelihoods. To enable an integrated perspective on land-use planning to meet the demands of different departments, it recommends strengthening of the State Land Use Boards. It also envisages synergistic interaction between the SFD, line departments (Agriculture, Horticulture, Animal husbandry, and Irrigation and Public health), State Biodiversity Board, the State Land-Use Board, Panchayati Raj Institutions, community-based organizations and non-governmental organizations. Additionally, Himachal Pradesh notified a policy on Payments for Ecosystem Services (PES) in 2013 (hereinafter PES policy). The aim of this policy is to ensure a sustained flow of forest ecosystem services. The policy not only provides incentives to local communities for ecosystem conservation but also emphasizes an ecosystem approach to land-use decision-making. The PES policy is expected to be operationalized across all the departments that interface with forests, including agriculture, irrigation and public health, and power.

Opportunities for landscape restoration also manifest in political proclivities and cultural contexts. In case of Sikkim, for instance, conservation is a way of life for the local people and is embedded in the state's cultural ethos. This is manifest, for instance, in the celebration of World Environment Day with the fervor of a big festival involving large-scale plantations and maintenance works. The political leadership of the state too is committed to environmental protection. Leadership within the government recognizes that biodiversity is essential for ecosystem resilience and that it holds Sikkim's future insurance (Government of Sikkim 2015). The potential for forestry as a driver of poverty reduction and as a social and political tool, rather than only a technical subject, is also well established. As a senior official from the government noted, "There is strong political will for conservation. If a project or proposal concerns conservation, people in government will put their weight fully behind it."

CHALLENGES

As is evident from the previous section, there are a number of opportunities in the form of policy spaces for implementation of the landscape approach to forest management. These opportunities are, however, tempered with challenges that emerge not only from the fuzziness of landscape as a concept but also the structure and functioning of government, which is not geared towards cross-sectorial and area-based approaches. These challenges can, however, be overcome through innovative thought and action, as briefly discussed in this section.

Spatial Boundary of Landscapes

It is difficult to offer a precise definition of a landscape as several different perspectives can be taken – physical, social, cultural, and agro-climatic. The spatial boundary of a landscape can change, depending on the objectives of

landscape management and the perspective adopted. For instance, if the objective of landscape management is soil and moisture conservation, watershed boundaries may be a useful way of identifying landscapes. The landscape may, however, be identified differently if the purpose of management is wildlife conservation or provisioning of irrigation or reducing poverty among tribal households. Furthermore, while landscapes can extend across multiple states, the jurisdiction of any state government obviously is limited to its own territory. Therefore, for various practical reasons, the demarcation of landscape requires consideration of existing administrative boundaries.

The territorial 'flexibility' of landscapes reduces the operational effectiveness of the concept as it is not easy to translate landscapes into planning or implementation units. This fuzziness also makes it difficult to reach a consensus on the spatial boundary among different government departments, who may prioritize different objectives.

Structural Factors

India does not have a distinct department for landscape management. Instead, the national and the State Governments are organized functionally into sector-specific departments. Traditionally, each of these ministries and departments has distinct goals and priorities, and hierarchical administrative structures. There are only a few channels of communication across these ministries and departments, which typically tend to work independently.

A landscape approach requires that SFDs work collaboratively with other ministries and departments, including but not limited to those related with watersheds, rural development, tribal development, and decentralized governance. It is essential that these departments together set spatially defined objectives, and align their plans and activities in ways that deliver these objectives. Such convergence, however, is difficult to achieve given the current structures of government described above. Furthermore, there are few incentives for collaborative working within existing performance management systems. Accordingly, for agencies entrusted with implementation, often convergence becomes a bureaucratic requirement alone, implying that the nodal agencies must take the responsibility on behalf of all other partners or allocate to other partners some specific role as part of their routine tasks. The result, as a senior SFD officer observed, is a "*governmentalization* of convergence. This implies that either the nodal agency has to do everything or the tasks get assigned to different departments just as regular work."

Even as the seemingly rigid structures of governmental departments prove an impediment to convergence, collaborative working can be achieved provided enabling conditions are in place. In the case of collaborative working between the Departments of Horticulture and Rural Development in Sikkim, these enabling conditions included firstly, a clear recognition that all concerned departments will benefit from working together and that the results will be superior to those of working in 'silos'. Secondly, since convergence implies collective responsibility, all departments must have an equally good track-record of performance. Thirdly, leadership in the different departments must have good working relations. In Sikkim and beyond, these working relationships can

be fostered through the well-knit network of bureaucrats of the IAS and the IFS, which provide trust-based, informal channels of communication. These can potentially facilitate working relationships across sectors. Fourthly, convergence is further facilitated when there are direct policy directives that permit a departure from everyday systems of working and mitigate the risks typically associated with doing things differently. Joint orders from the Ministries of Agriculture and Rural Development supported Sikkim's experiment with convergence between horticulture and rural development. Similar orders from the Ministry of Environment and Forests and the Ministry of Rural Development have provided a huge impetus to tree planting through an employment guarantee scheme.

Finance Issues

The financial challenges for landscape approaches are primarily of three types. First, in the current system of working, all departments has dedicated budgetary allocation with clearly assigned budget lines for different schemes and programs, with attendant financial reporting frameworks. This system is designed to ensure strict compliance and adherence to approved budget lines. Departments that would like to work together in the landscape approach must invest tremendous energy in ensuring that their financial reporting lines are not blurred. This further complicates collaborative, cross-departmental working. Second, the effort required for convergence, including the costs of sustained dialog across departments, development of joint mechanisms for planning and monitoring, as well as capacity building for landscape approaches does not fit in neatly within any budget head. Finding requisite resources for planning and managing landscape approaches is, therefore, a challenge. Third, current financial flows are largely through schemes that flow on varied time-frames, and have different eligibility criteria. Financial planning for landscapes requires that these schemes are aligned, which is difficult to achieve. Furthermore, even when schemes are aligned, there are often gaps which imply that important activities in the landscape remain unfunded. Finally, some view financial allocation as a marker of a department's status and power. They are, therefore, likely to resist any reduction in the financial allocation to their departments. Accordingly, any model for convergence necessarily needs to attend to departmental sensitivities around financial allocations.

One of the ways in which these financial constraints can be overcome is through the creation of a "mission" that has a distinct, time-bound mandate along with a separate budget that is substantially larger than the departmental allocations and sufficient to meet the requirements of the mandate. The creation of such a mission eases challenges associated with different streams of finance flows discussed above and also provides necessary incentives to departments to work together.

CONCLUSION

This chapter examined various opportunities and challenges for operationalization of the landscape approach at state-level in India. The landscape approach is extremely relevant for sustainable management of forest ecosystems and there are a number of policy spaces that are available for its implementation. The Working Plan process, the National Mission for a Green India, watershed programs, State Action Plans on Climate Change, and various

other state-level initiatives and programs offer several policy spaces that are opportunities for operationalization of the landscape approach. However, there are also a number of challenges related to landscape definition and spatial boundaries, structural factors, and financial issues. These challenges need to be addressed to make landscape approach a field reality.

REFERENCES

FRI. 2014. *National Working Plan Code*. Dehradun: Forest Research Institute, Ministry of Environment, Forest and Climate Change, Government of India.

FSI. 2013. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

Geist, H. J. and E. F. Lambin. 2002. "Proximate Causes and Underlying Driving Forces of Tropical Deforestation."*BioScience* 52 (2): 143-150.

Government of Himachal Pradesh. 2005. *Himachal Pradesh Forest Sector Policy and Strategy*. Shimla: Himachal Pradesh Forest Department, Government of Himachal Pradesh.

Government of Sikkim. 2015. *Forestry and Environment Mission, Sikkim 2015*. Gangtok: Forests, Environment and Wildlife Management Department, Government of Sikkim.

Hooghe, L. and G. Marks. 2001. *Multi-level Governance and European Integration.* Maryland, United States: Rowman and Littlefield Publishers.

Korn, H., K. Bockmühl, and R. Schliep, eds. 2011. *Report of the European expert meeting in preparation of SBSTTA-15,* 26-28 September. Bonn, Germany: Bundesamt für Naturschutz (German Federal Agency for Nature Conservation).

MoEF. 2010. *National Mission for a Green India (Under the National Action Plan on Climate Change)*, Draft submitted to Prime Minister's Council on Climate Change. New Delhi: Ministry of Environment and Forests, Government of India.

Newton, A. C., R. F. del Castillo, C. Echeverría, D. Geneletti, M. González-Espinosa, L. R. Malizia, A. C. Premoli, J. M. Rey Benayas, C. Smith-Ramírez, and G. Williams-Linera. 2012. "Forest landscape restoration in the drylands of Latin America." *Ecology and Society* 17 (1): 21.

Pfund, J. L. 2010. "Landscape-scale research for conservation and development in the tropics: fighting persisting challenges." *Current Opinion in Environmental Stability* 2 (1-2): 117-126.

Reid, W.V., D. Chen, L. Goldfarb, H. Hackmann, Y. T. Lee, K. Mokhele, E. Ostrom, K. Raivio, J. RockströM, H. J. Schellnhuber, and A. Whyte. 2010. "Earth System Science for Global Sustainability: Grand Challenges." Science 330 (6006): 916–917.

Sayer, J., T. Sunderland, J. Ghazoul, J. L. Pfund, D. Sheil, E. Meijaard, M. Venter, A. K. Boedhihartono, M. Day and C. Garcia. 2013. "Ten Principles for a Landscape Approach to Reconciling Agriculture, Conservation, and Other Competing Land Uses." *Current Science* 110 (21): 8349-8356.

Termeer, C. J. A. M., A. Dewulf, and M. van Lieshout. 2010. "Disentangling Scale Approaches in Governance Research: Comparing Monocentric, Multilevel, and Adaptive Governance." *Ecology and Society* 15 (4): 29.

Wu, J. 2013. "Landscape Sustainability Science: Ecosystem Services and Human Well-Being in Changing Landscapes." *Landscape Ecology* 28 (6): 999-1023.

Yaap, B. and B. M. Campbell. 2012. "Assessing Design of Integrated Conservation and Development Projects." In *Evidence-Based Conservation: Lessons from the Lower Mekong*, edited by T. C. H. Sunderland, J. A. Sayer, and M. H. Hoang. Abingdon, UK: Routledge.

Chapter 16: DESIGNING REDD+ PROJECTS

Ashwin A.S. and Swapan Mehra

INTRODUCTION

This chapter describes the steps and components that are involved in the development of Reducing Emissions from Deforestation and Forest Degradation (REDD+) projects. There are several international standards; most prominently the Verified Carbon Standard (VCS) [1], under which REDD methodologies on baseline and monitoring have been developed. Frameworks under discussions within United Nations Framework Convention on Climate Change (UNFCCC) also focuses on various components including safeguards and quantifying emissions. This chapter borrows from the UNFCC, VCS and other such standards and draws extensively on the experience of the authors across development of several projects.

The Forest-PLUS Program implemented REDD+ pilot projects in four landscapes in India. This chapter is a synthetic result of these efforts; and the requirements and best practices for REDD+ project development.

COMPONENTS IN DESIGNING A REDD+ PROJECT

Developing a REDD+ project involves nine major modular components:

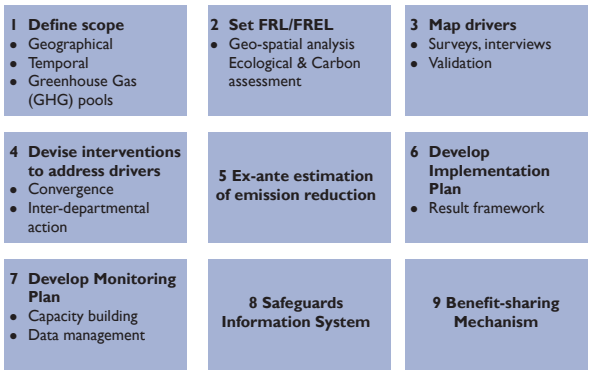


Figure 16.1: Major components of a REDD+ project design

Define Scope

The first step in developing a REDD+ project is delineating and identifying its geographical scope, temporal scope and the Green House Gas (GHG) pools that it will consider. This module is crucial to help understand and decide on the ecological assets to be selected under the REDD+ project, on the ownership of the natural resource (private, public, common) and management-regulatory mechanisms in place to manage these assets.

Geographical Scope

There are three major boundaries that have to be defined in REDD+ projects:

- Project Area
- Reference Region
- Leakage Zone

Project Area is the geographic boundary within which emissions from forests will be reduced. This can be a discontinuous parcel of forests or a sub-national jurisdiction (as defined by the host country). This boundary can be based on political, ecological or administrative considerations. Examples are watersheds, state and district boundaries, circle and divisional boundaries, parcels defined by beats, and satellite scene swaths. The change in carbon stocks within the project area will be monitored over the lifetime of the REDD+ project. The actual extent of a REDD+ project goes beyond the project area as the baseline has to be developed over a 'Reference Region' which forms the control area for the baseline.

Trends of change in forest carbon stock in the *Reference Region* is projected over the project area to develop the baseline. Any positive changes in stock above the baseline is what actually qualifies as emission reduction. The Reference Region is usually larger than the Project Area. *Leakage* is the emissions that are shifted from the Project Area to a location outside the Project Area due to implementation of the REDD+ project. An example of this is the shifting of timber extraction to another forest due to moratorium on felling within the project area under the REDD+ project. All such potential leakage arising from a REDD+ project has to be monitored, and a defined zone to manage the leakage is to be maintained.

Finalizing the Project Area involves spatial mapping of all potential areas through medium to high-resolution remote sensing images and identifying the land use change to assess the rates of deforestation/degradation. Identification of high pressure and critical conservation areas will follow; and those areas with high data availability (based on literature review; existing national, international and project datasets; Remote Sensing and Geographic Information System) will be shortlisted as potential project sites. The final project site will be selected based on multi-variate analysis of critical parameters such as landscape level studies on land cover fragmentation and priority areas with increasing landscape complexity, key biodiversity areas and corridors, key watersheds, availability of human resource to conduct the activities, etc.

Temporal Scope

The project lifetime and the crediting period of the REDD+ project has to be fixed. The lifetime of the project sets the time-frame for all actions of a REDD+ project, such as the investments made, actual actions on the ground, and awareness campaigns. The crediting period is specifically the time horizon within which

the emission reductions are accounted, and are eligible to be certified. The crediting period is also decided by the various conditions set by the carbon market(s) and the standards applied. It essentially cannot be outside the project lifetime.

Green House Gas Sources

GHGs to be accounted in the baseline and as project emissions have to be defined at the beginning of the project. Clarity on the carbon pools is important to estimate the historical change in carbon. A project can earn emission reduction only from the same GHG pools and sources identified for development of the baseline. The major carbon pools to be considered are Above Ground Biomass, Below Ground Biomass, Soil Organic Carbon (SOC), Litter and Deadwood. The GHG associated is mainly carbon dioxide; but oxides of nitrogen and methane are considered in certain cases, such as where peat land conversion is involved or forest fires are to be considered within the ambit of the REDD+ project. Any GHG sources that are not significant (often those calculated to be less than 5 percent of the total GHG impact of the project) also can be ignored.

Forest Reference Level / Forest Reference Emission Level

The forest Reference Level (FRL) or Forest Reference Emission level (FREL) is the baseline of a REDD+ project, and is the backbone of the entire project development exercise. Development of an FRL/FREL includes two conjoint actions – Geo-spatial analysis and ecological assessment (biomass stock and biodiversity assessment). Geo-spatial analysis of the reference region is conducted to map Land Use/Land Cover (LULC) change. Four types of transitions are mapped – change of i) forest land to non-forest land ii) higher-density forest stratum to lower-density forest stratum iii) non-forest to forest land and iv) lower density forest stratum to higher density forest stratum. The historical analysis is done for a period of at least 10 years to capture meaningful trends. Any biases will be weeded out as transition, if studied through at least two periods. This same trend is projected and applied to the project area to develop the FRL/FREL. This change in land class is called activity data. The changes are mapped into a LULC change matrix, where every transition from one stratum to another during the assigned period is mapped. Carbon stock of all the land class is estimated through an ecological survey based on a scientific sampling procedure. The difference in carbon stock per hectare between each land class is the Emission Factor associated with that land transition. Activity data and emission factors are considered together to develop the historical trend in terms of change in carbon stock and resultant emissions from the project area.

Mapping Drivers of Forest Change

As a next step, mapping of drivers that cause the forest change needs to be undertaken. Mapping of drivers involves a series of consultations and primary socio-economic data collection in addition to detailed literature reviews. Sound identification of drivers is the key to build a robust intervention plan for a REDD+ project.

The first step of mapping drivers involves stakeholder mapping to identify all relevant players in the landscape. This is followed by surveys and interactions with stakeholders to understand the dynamics of resources being collected from forests, and the reasons for forest loss. Finally, this exploratory

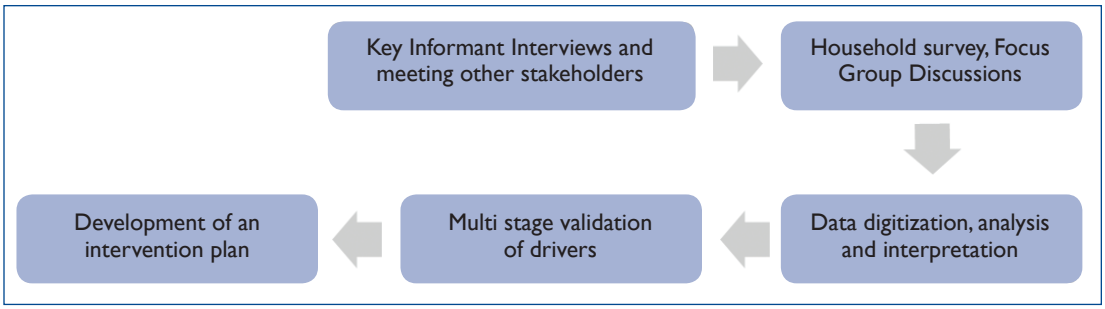


Figure 16.2: Conducting surveys to map drivers and interventions for a REDD+ project

survey should result in finding practical and implementable interventions to conserve and improve forest stock. This participatory analysis involves a meta-analysis of existing literature, conducting socio-economic surveys (e.g. Focus Group Discussions (FGDs), participatory mapping, discussions with experts and key informant interviews (KIIs)). Information flow follows a multi-tiered intelligence gathering and validation process where each driver and quantification of its effects on forest is to be done at various tiers – e.g. community, managers of forests, academic institutes, Community Based Organizations, industries, merchants. Appropriate survey techniques may be applied for each identified group of stakeholders.

Devise Interventions to Address Drivers

On the basis of participatory analysis and consultation meetings, actions to address the drivers of deforestation and forest degradation and conserve the forests etc. will be developed. Examples include minimizing fuel wood consumption by introducing improved cookstoves, livelihood options for reducing shifting cultivation, better silviculture and grazing land management, regulating non-timber forest products' supply chain, etc. The scale and spatial extension of each intervention is to be decided after extensive stakeholder interactions and validation with experts.

Estimation of Emission Reduction

Emission reduction and enhancement from a REDD+ project are estimated *ex-ante*, based on the identified interventions with reference to the FRL/FREL developed earlier. The emission reduction also takes into consideration any project emissions (emissions due to implementation of the project) and leakage. The resultant sum of net reductions in tons of carbon di-oxide equivalent per year and net sequestration through additional efforts in plantations will be the total annual emission reduction accrued to the REDD+ project.

Monitoring, Reporting and Verification plan

The change in carbon stock within the project area is to be monitored periodically. Each parameter to be monitored is listed in an elaborate monitoring plan along with an standard operating procedure explaining the MRV process. Monitoring has to be conducted in a timely manner while meeting

the desired accuracy and precision. A mechanism for internal data verification has to be operationalized for checks and balances at appropriate levels Once analysis is complete, the monitoring reports can also be put up for third party verification, certification and can be published for transparency. Trained staff, data management systems, scientific forest mensuration equipment and geospatial analysis capabilities are core components of an efficient monitoring, reporting and verification system.

Safeguards Information System

Project specific REDD+ safeguards are to be developed to ensure that the project does not cause any social or biological harm. Social parity and gender equality, are to be promoted in deploying intervention actions. Biological diversity is to be conserved, existing forest should never be diverted for monoculture plantations. To ensure that such non-carbon aspects of REDD+ projects are considered while developing a REDD+ project, a Safeguards Information System (SIS) is to be developed. The SIS will have detailed indicators and parameters to be monitored, reported and verified during the life of the REDD+ project. The SIS will be in consonance with the Cancun safeguards and national/regional policies in this regard.

Benefit-sharing Mechanism

Benefits from the REDD+ project should be channeled to all the stakeholders involved in implementation of the project. It is the prerogative of the primary entity (project proponent) to decide the framework on benefit sharing. Incentives need not just be in monetary terms, but also can be in kind and in other forms such as guaranteed employment for a part of the year, access to market, handholding in alternative employment and skill development etc. Putting such a system in place at the design phase itself will help pre-empt any conflict that may arise on sharing the benefits from the REDD+ project. A grievance redressal mechanism also is to be developed along with the benefit-sharing framework. In the Indian context, both can be in line with the Joint Forest Management framework.

Time and Cost Factors

It may take at least 12-15 months to develop a complete REDD+ project design, considering all the validation exercises and coordination actions required. The cost of the project will vary, depending on the size of the project area and the intensity of various activities on the ground. The table below presents the indicative aspects that will help in deciding the effort required in each phase.

Table 16.1: Indicative requirements for successful completion of REDD+ project design

Component	Requirements for Successful Completion
Define the scope	n Multi-variate analyses of landscapes to arrive at potential location(s) suitable as Project Area n Identification of capacity on geo-spatial analysis capability, ecological data collection, social surveys, collation and storing data
FRL/FREL	n Satellite scenes of medium to high resolution of Reference Region, Project Area, Leakage Belt for the time points decided for historical trend analysis n Geo-spatial layers of the project area (forest cover, forest types, land use land cover classification, forest density, villages, roads, plantation, crop land, encroachment, settlements, watershed, slope, altitude, jurisdictional boundaries) n Collection of ecological data based on an appropriate sampling methodology n Laboratory tests (if SOC, litter and deadwood are part of carbon pool) n Scientific forest mensuration equipment kits, trained teams n Data analysis software and systems n Access to secondary literature, census data, other surveys
Map drivers	n Trained survey team n Field tested questionnaires for households, FGDs, KIIs n Validation workshops at various tiers
Devise interventions to address drivers	n Workshops to finalize the scope of each intervention n Inter-departmental convergence n Awareness creation and communication
Ex-ante estimation of emission reductions	n Data analysis software and Data management system
Monitoring, Reporting and Verification plan	n Data management system n Forest mensuration equipment n Objective tools such as Mobile applications for community participatin n Trained staff
Safeguards Information System	n Workshops with social and biodiversity experts
Benefit-sharing Mechanism	n Workshops and interaction camps at various tiers

CONCLUSION

In parallel to designing, the project developing entity should also study the possible international and national sources for leveraging ecosystem finance, in particular carbon finance for the project. Building strategies for developing partnership with private and/or national or multi-lateral agencies for funding and long-term protection of forest will play a crucial role here. These financial sources can be generated through either regulatory, bi-lateral or voluntary markets.

Development of the 'Project Design Document' or PDD can proceed in parallel to all the activities mentioned in the components as described earlier in this chapter. A standard internationally approved template may be followed; or a template can be developed by the project developing entity to explain the various components lucidly.

CONCLUSION

Chapter 17: The Way Forward: A Pragmatic Strategy for Indian Forestry

Sushil Saigal

INTRODUCTION

The key objective of this concluding chapter is to present a strategy to operationalize REDD+, the ecosystem approach, and the landscape approach for promoting sustainable management of India's forest ecosystems. Implementation of this strategy can enhance carbon value of forest ecosystems, and increase or maintain other locally or globally important ecosystem services (and where appropriate, promote sustainable use of these services to support local livelihoods).

India has a well-developed policy and legal framework for management of forests. The key policies in this regard are: (1) National Forest Policy, 1988; (2) National Conservation Strategy and Policy Statement on Environment and Development, 1992; and (3) National Environment Policy, 2006. A number of laws constitute the legislative framework, most important of which are: (1) Indian Forest Act, 1927; (2) Wildlife (Protection) Act, 1972; (3) Forest (Conservation) Act, 1980; (4) Environment (Protection) Act, 1986; (5) Biological Diversity Act, 2002; and (6) Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

To achieve integrated management of forest resources (both goods and services) and increase incentive to implement REDD+, a broader view of sustainable forest ecosystem management will be necessary, along with the robust policy and legal framework for management of forest lands cited above. This strategy is an attempt to facilitate the transition to sustainable forest ecosystem management, key elements of which are as follows:

- Adoption of a landscape approach to holistic land use planning with focus on forest ecosystem services (including carbon sequestration and storage) and sustainable use of those services to support local livelihoods
- Convergence with relevant ongoing initiatives and utilization of existing policy and legal spaces to the extent possible
- Development or adaptation of innovative forest management models to promote context-specific, sustainable forest ecosystem management

- Establishment of a platform to support women and other marginalized groups to understand and engage with carbon sequestration programs, allowing them to gain skills and experience otherwise unobtainable.

Landscape Approach

Key concepts and definitions of the landscape approach have been discussed in the introductory chapter and Chapter 15. In the Indian context, implementation of the landscape approach could occur based on consideration of forest lands, common lands, and private lands, as well as development of an integrated and holistic plan that ensures sustained or increased supply of ecosystem services (including benefits to livelihoods from sustainable use). Depending on local context, the landscape may also include urban or peri-urban areas, as well as the agricultural frontier. Focus on the landscape approach also would dovetail with current national-level thinking, articulated in the mission strategy of the National Mission for a Green India.[1]

> The Mission will foster an integrated approach that treats forests and non-forest public lands as well as private lands simultaneously, in project units/sub-landscapes/sub-watersheds. Livelihood dependencies, for example firewood needs and livestock grazing, will be addressed using inter-sectoral convergence (e.g., livestock, forest, agriculture, rural development, and energy) (MoEF 2010a, G).

Stressing sustainable use to support local livelihoods is critical in the Indian context considering that well over half (58.2 percent) of the country's workforce still engages in the agriculture sector (MoA 2010), and despite rapid progress in recent years, poverty continues to pose a major challenge. According to the Planning Commission, as much as 29.8 percent of the total population and 33.8 percent of rural people were living in poverty in 2010 (Planning Commission 2012a). Sustainable use is also one of the core themes of the Biological Diversity Act, 2002, which defines sustainable use as "use of components of biological diversity in such manner and at such rate that does not lead to the long-term decline of the biological diversity thereby maintaining its potential to meet the needs and aspirations of present and future generations." This definition is also applicable to other ecosystem services.

Convergence and Links to Existing Policy Framework

Convergence with relevant ongoing initiatives and utilization of existing policy and legal spaces is likely to improve the odds of acceptance and adoption of this strategy by relevant stakeholder groups, and increase possibility of its implementation on the ground. That convergence would also allow for leveraging of additional resources, and lead to more probable sustainability beyond the tenure of specific projects and programs. For example, convergence with activities under the Mahatma Gandhi National Rural Employment Guarantee Act, 2005 (MGNREGA) and National Rural Livelihoods Mission (NRLM) would not only help generate additional resources for sustainable forest ecosystem management, but also lead to establishment of more robust

peoples' institutions. Such convergence is also envisaged under the National Mission for a Green India:

> The Mission will add "value" to ongoing programs/ schemes on "greening" being taken up by multiple agencies. Such value addition will come through a) technical inputs on species mix from climate adaptation/mitigation angle, b) improved policy regime to help multiple agencies plant, protect and manage forests and tree growth, and c) advisory services for benefits under REDD Plus/ CDM and would include support in outcome-level monitoring (MoEF 2010a, 9).

The strategy for sustainable forest ecosystem management is consistent with the comprehensive National Environment Policy issued by the GoI in 2006 to "infuse a common approach" and to achieve "balance and harmony between economic, social and environmental needs of the country." This policy has seven main objectives: (1) Conservation of Critical Environmental Resources, (2) Intra-generational Equity: Livelihood Security for the Poor, (3) Inter-generational Equity, (4) Integration of Environmental Concerns in Economic and Social Development, (5) Efficiency in Environmental Resources Use, (6) Environmental Governance, and (7) Enhancement of Resources for Environmental Conservation. The policy also lays down a number of principles including *inter alia* the "public trust doctrine," "precautionary approach," "polluter pays," "equity," and "entities with incomparable values." All of these objectives and principles complement those of sustainable forest ecosystem management.

Innovative Forest Management Models

Developing or adapting innovative forest management models and best practices from different parts of India and from other countries will help introduce national and international best practices to various local contexts. This also will aid in identifying critical gaps that could be filled by results of research into innovative silviculture models, sustainable methods of harvesting NTFPs, and sustainable grazing techniques. Identifying these gaps will lead to even more focused research guided by India's urgent needs in its forestry sector. National policy-makers recognize the requirement and importance of this research, as evidenced by the following extract from a government publication regarding NTFP management:

> …very few attempts have been made for raising the quality and increasing the production of NTFP items, as year after year the total quantum collected invariably shows a downward trend… No systematic work has been done in assessing the potential of NTFPs. Even the utilization of forest produce by local communities for various purposes has not been properly studied and documented…Research on various aspects of NTFPs management generally has not covered utilization of products or commercial basis… (MoEF 2007).

Equity and Gender Issues

Because of variations in forest linkage and dependence patterns across different caste, class, and gender groups, it is important to incorporate equity considerations into the strategy. A beginning for exploring these

linkages and dependence patterns could be participatory analyses within selected landscapes that would seek to understand relationships, power dynamics, constraints, and opportunities affecting various participants and their ability to engage in sustainable forest ecosystem management. Intense focus on women's issues regarding time burdens (e.g., in collection of fuelwood) is appropriate, with identification of ways to reduce those burdens while improving engagement in forest management and other productive activities. Examples of possible solutions could include introduction of solar dryers, improved cook stoves, and bio-digesters. Results of these analyses should aid efforts to mainstream considerations of equity and gender.

STRATEGY

The following pages address strategy points related to forest lands, common lands, and private lands.

Forest Lands

Resource

Nearly a quarter of India's geographical area (23.4 percent) is classified as forest lands (called "recorded forest area"). These are classified mainly into reserved, protected, and unclassed forests in accordance with the Indian Forest Act, 1927 (see Table 17.1).

Some forest lands are part of the country's protected area network. At present, India has a network of 668 protected areas including 102 National Parks, 515 Sanctuaries, 47 Conservation Reserves, and four Community Reserves (MoEF 2012).

Sacrosanct Areas

Because of increasing development pressures on forests, it is important to identify forest areas that provide high-value ecosystem services and thus should be considered sacrosanct. In these areas, mining or other ecologically damaging activities should not be permitted. National policy- makers have emphasized this:

> There may be some areas of forests that we view as sacrosanct, such as special reserves and biodiversity hotspots, where no intrusion is allowed… (Planning Commission 2012b, 22).

Objective of Forest Management

The objective of management of forest lands

Table 17.1: Classification of recorded forest area in India

Category	Area (Million Hectares)	Percentage of Recorded Forest Area
Reserved Forests	43.06	56%
Protected Forests	20.62	26.8%
Unclassed Forests	13.27	17.2%
Total	**76.95**	**100%**

Source: FSI 2009

has to shift from maximizing a limited set of goods and services to optimizing a wider range of ecosystem services (such as carbon sequestration and carbon stock, biodiversity conservation, watershed protection, and landscape beauty and outdoor recreation). Sustainable use of these goods and services, where appropriate, can support local livelihoods for years to come. The following is an extract from the "Vision" for the environment, forestry and wildlife sector, from the most recent five-year plan:

> Managing Environment, Forests, Wildlife and challenges due to Climate Change for faster and equitable growth, where ecological security for sustainability and inclusiveness is restored, equity in access to all environmental goods and ecosystem services is assured through institutionalisation of people's participation (Planning Commission 2012b, 202).

This new thinking is also reflected in reports from expert panels, such as the report on Western Ghats submitted to the GoI.[2]

This broader objective should guide preparation of all new working plans[3] in the country. The revised *National Working Plan Code 2014* developed by the GoI and published by the Forest Research Institute (FRI 2014) provides ample guidance and scope for developing holistic and integrated working plans for all forest divisions in the country. It states that forest management planning "must provide for sustainable management of forests…encompassing the ecological (environmental), economic (production) and social (including cultural) dimensions" (FRI 2014, 11). It also provides for "working circles" for management of community forests, important NTFP, biodiversity conservation and development, wildlife management, ecotourism, and soil and water conservation (FRI 2014). Non-extractive sustainable uses such as ecotourism must be promoted wherever feasible. Ecotourism and participatory eco-development have also been identified as key goals by the GoI (Planning Commission 2012b). Alongside changes in objectives of forest management, the mandate of all Forest Development Corporations in the country also must be reviewed and aligned with the new objective.

While this strategy explicitly supports carbon sequestration and maintenance or enhancement of carbon stocks, that must be only one of several forest ecosystem services in the Indian context. This is also the official position of the GoI.[4]

Landscape Perspective

While broadening forest management objectives will certainly be a step in the right direction, it may not be enough to address some issues that require an even broader landscape perspective (e.g., management of fugitive resources such as wildlife and stream flow).

From the perspective of forest ecosystem health and biodiversity, establishment of corridors to link protected areas (to ensure migration/gene flow and also to respond to potential range shifts due to climate change) is an essential step. These could be established by use of available legal and policy spaces such as "Conservation Reserves" under The Wildlife (Protection) Amendment Act, 2002 (section 36A); "Biodiversity Heritage Sites" under The

Biological Diversity Act, 2002 (section 37); "Eco-sensitive Zone" and "Coastal Regulation Zone" under The Environment (Protection) Act, 1986 (amended 1991) (section 3(2)(v)); and "Critical Wildlife Habitat" under The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 (section 4(2)). An example of the importance of establishing such corridors is the case of Asiatic Elephants. Since the 1960s, their geographic range has shrunk by as much as 70 percent (MoEF 2011), and migratory corridors are critical for long-term survival.

Recognition also is necessary of considerable biodiversity/other ecosystem services values outside lands formally declared as protected areas.[5] For example, of 463 "Important Bird Areas" identified in the country, as many as 199 (43 percent) are not officially protected (NFC 2006). The new Working Plan Code also provides ample scope to look beyond administrative boundaries. The following extract from the Code on water resources management illustrates this:

> The forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in declining ground water levels; there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices dovetailed with the principles of watershed based development approach especially in the source areas of water. Such areas should have restrictions on tree felling but there should be operations to improve the water regimes and natural regeneration. As such, special provisions should be made in the working plan to sustain water resources and livelihood issues of the people living in and around natural inland water sources (FRI 2014, 13).

New Silviculture Focus: Timber to Multiple Products and Services

As the objectives of forest management change and a broader perspective of resource management emerges, new silviculture and management models will be necessary. The traditional focus on timber must broaden, accompanied by development of new models and techniques, reasons for which are conveyed in this section. Government forest lands currently supply only approximately 6.5 percent (3.175 million cubic meters [m^3]) of total wood consumed in the country (c. 48 million m^3) (FSI 2011). Although this contribution of government forest lands to total wood supply is relatively small, timber operations impose considerable demands on time and energy of planners and field managers. Further, timber operations sometimes adversely affect flow of other ecosystem services, as well as local livelihoods at the forest management unit level. Therefore, all commercial timber operations should be reviewed, and their impacts on other ecosystem services and local livelihoods assessed. Similar exercises could also occur regarding commercially important NTFPs extracted on a large scale, such as tendu leaves (*Diospyros melanoxylon*), pine resin (*Pinus roxburghii*), and sal seeds (*Shorea robusta*). Decision-making pertaining to such commercial operations should also consider potential alternative sources of forest products. Notably, several states already ban "green felling" and felling above a particular altitude – in accord with various court judgments and National Forest Policy, 1988, as evident from the following extracts from the policy document:

> The principal aim of Forest Policy must be to ensure environmental stability and maintenance of ecological balance including atmospheric equilibrium which are vital for sustenance of all life forms, human, animal and plant. The derivation of **direct economic benefit** must be subordinated to this principal aim (Paragraph 2.2 of the Policy, emphasis added).
>
> The life of tribals and other poor living within and near forests revolves around forests. The rights and concessions enjoyed by them should be fully protected. Their domestic requirements of fuelwood, fodder, minor forest produce and construction timber should be the **first charge** on forest produce (Paragraph 4.3.4.3 of the Policy, emphasis added).
>
> As far as possible, a forest-based industry should raise the raw material needed for meeting its own requirements, preferably by establishment of a direct relationship between the factory and the individuals who can grow the raw material by supporting the individuals with inputs including credit, constant technical advice and finally harvesting and transport services…The practice of supply of forest produce to industry at concessional prices should cease. Industry should be encouraged to use alternative raw materials. Import of wood and wood products should be liberalized (Paragraph 4.9 of the Policy).

New Silviculture Focus: Quantity to Quality

For several decades, India has focused on increasing forest/tree cover by establishing new plantations. The idea of a minimum one-third area under forest/tree cover dates back to the National Forest Policy of 1952. To achieve this objective, large-scale plantations have been established on both forest and non-forest lands. Just between 1985 and 1992 – when a new policy was imposed on new plantations after establishment of the National Wastelands Development Board – no less than 12 million ha of new plantations were established in the country (MoEF 1998). Now the focus must shift from "quantity" (forest cover) to "quality" (ecosystem services). This has also been acknowledged by the GoI:

> The target of 33% forest and tree cover reflects the tree component without accounting for other vibrant non-tree natural biomes like grasslands...Further recognition of biodiversity characteristics and ecological services rendered by habitats like grasslands, natural desert ecosystems, alpine, and riparian habitats suggests that several biomes, even if devoid of tree component, can be recognized as 'green cover' and accounted so (Planning Commission 2007, Paragraph 9.1.18).
>
> There is a need to change our mindset away from a 'quantity' focus towards a 'quality' focus. We should not merely focus on increasing the area under forest and tree cover, as we have traditionally done, but instead focus on increasing the quality of our forest and tree cover. This would mean greater emphasis on increasing the density of our existing forests, regenerating our degraded forest land, and eco-restoration of our scrub and grass land, mangroves, wetlands, and other ecological assets (Planning Commission 2010, Paragraph 22.4).

The mission strategy of the National Mission for a Green India articulates the new policy thrust clearly:

> The scope of greening will go beyond trees and plantations to encompass both protection and restoration. Emphasis will be placed on restoration of degraded ecosystems and habitat diversity, for example, grassland and pastures (more so in arid/semi-arid regions), mangroves, wetlands and other critical ecosystems. The greening will not only strive to restore degraded forests, but will also contribute in the protection and enhancement of forests with relatively dense forest cover (MoEF 2010a, G).

An important element of improving quality should be interventions for management of invasive species. Protocols for control/management of all major invasive species must be developed.

Innovative Models, Tools, and Techniques with Focus on Sustainable Grazing and NTFP Management

The proposed new silviculture focus requires development or adaptation of innovative forest management models, tools, and techniques for holistic and integrated management of forests. Already much innovation has occurred at the field level in different states, particularly in various forestry sector projects implemented by State Forest Departments. As a first step, these innovative models, tools, and techniques must be identified, collated, and documented. Efforts also should be directed toward developing new models, tools, and techniques to address novel challenges of integrated management where pre-existing methods, tools, and techniques either are absent or cannot be easily adapted. These must be developed for both extractive and non-extractive uses. For example, development of sustainable protocols for harvesting various NTFPs is necessary. Similarly, carrying capacity for livestock within different forest types must be assessed, and sustainable grazing models must be developed. Depending on local context, incorporation into the models of unproductive cattle and transhumance may also be necessary[6].

Sustainable NTFP management and promotion of sustainable grazing practices have been identified as important goals by the GoI to increase sustainable forest ecosystem management and improve livelihoods of local communities. The following extracts from the Twelfth Five-Year Plan demonstrate the national emphasis on these issues:

> To develop the NTFP sector in a holistic way and coordinate the various activities for sustainable management and livelihood, an autonomous agency needs to be set up with branches in all states. For the overall management of NTFP resource including conservation and development of an estimated 6 lakh ha as well as value addition and marketing support, a new scheme for sustainable livelihoods through NTFP management including bamboo needs to be formulated (Planning Commission 2012b, 214).

> There is an urgent need to focus on pasture management and formulation of grazing policy at the national level which will enhance the livelihood, nutrition and quality of life of all fringe forest dwellers.

> A new scheme on rangeland and silvi-pasture management for rehabilitation and productivity enhancement of rangelands, traditional grasslands on common/revenue lands around forest areas is required. Infrastructural and institutional mechanism for fodder storage, value addition facilities, maintenance of germ- plasm banks and nurseries is required to be developed during the Twelfth Plan period (Planning Commission 2012b, 214).

Other necessary interventions are to increase supply of fuelwood (e.g., via farm/agro-forestry and energy plantations) and to decrease demand for fuelwood through introduction of improved cook-stoves and alternative fuels.

After these methods, tools, and techniques are identified, developed, or adapted, they must be widely shared with relevant stakeholders through different platforms. Subsequently, capacity of stakeholders to apply these methods, tools, and techniques also must be developed. Thumb rules (e.g., no tree felling above a particular slope) should be formulated and implemented wherever appropriate.

Economic Valuation

Alongside development of innovative models, tools, and techniques is the pressing issue of valuation. While listing various biological and other resources in an area is an important first step, movement beyond mere listing to proper economic valuation of available resources is a necessary preliminary to preparation of appropriate plans for management of different ecosystem services. The study supported by the MoEF, in collaboration with *The Economics of Ecosystems and Biodiversity* (TEEB), was an important first step in this direction. Some attempts at valuation of forests and forest ecosystem services have also occurred at the state level (for example, in Himachal Pradesh). Such valuation studies could also feed into the process of developing "Net Present Value (NPV)" estimates by the Compensatory Afforestation Fund Management and Planning Authority (CAMPA), which are used to collect compensation for diversion of forest lands for non-forest purposes.[7]

Payments for Ecosystem Services

An issue closely linked to economic valuation is "payments for ecosystem services (PES)." Successful implementation of the PES approach is evident in several countries.[8] The idea has been explored in the Indian context as well, especially at the state level. For example, the Himalayan Chief Ministers' Conclave at Shimla in 2009 demanded payment for various ecosystem services that the Himalayan states provide to the rest of the country:

> The Conclave agreed to pursue the common agenda to protect, conserve and enhance forests and other natural resources of the state. They will work to ensure that financial incentives are provided for natural resources, which capture the cost of ecosystem services, carbon sequestration as well as land and livelihood opportunities. They prioritised the need for the 13th Finance Commission to enunciate the principle of payment to Himalayan states for the protection, preservation and enhancement of forests and other natural resources and desired that the Commission should provide adequate and ample resources for sustainable development.[9]

The basic principle of PES is also reflected in recommendations of the Twelfth and Thirteenth Finance Commissions (2005-10 and 2010-15, respectively).[10] As discussed in the introductory chapter, they recommended grant payments to different states in proportion to forest areas in those states. These payments were packaged as incentives to state governments to maintain/enhance forest cover. The following extract from the report of the Thirteenth Finance Commission describes the rationale for its recommended INR 5,000 crore[11] "Forest Grant":

> Our environmental grants both reward past actions and incentivise future actions. The forest grant that we recommend is essentially a reward for contributing to the ecology and bio-diversity of India, as well as a compensation to states for the opportunity loss on account of keeping areas under forest (Finance Commission 2009, 37)

The Fourteenth Finance Commission further strengthened the PES concept by doing away with special grants and integrating forest cover in the formula for distribution among the states' of their shares of revenue. The Commission devoted 7.5 percent to forest cover in the formula, which should incentivize the states to maintain and enhance forest cover.[12]

The GoI also suggested an Environmental Performance Index based on 16 variables (four relating to forestry) for providing incentive payments to states and union territories through budgetary allocations (Planning Commission 2012b).

Forest Certification

Forest certification is a market-based mechanism that could help promote sustainable forest ecosystem management in the country. Since its launch in the early 1990s, forest certification has grown from a concept to a major program in the international forestry sector. While Forest Stewardship Council is the most prominent international player, several alternative forest certification initiatives also have emerged (Saigal and Vira 2009). Acceptance of the concept of forest certification is growing in India. In September 2010, the Forest Certification Council of India was registered as a Trust. In one of its Annual Reports, the MoEF noted:

> Certification and Eco-labelling are the new mantras to enhance the product positioning for a premium price on one hand and ensuring better forest management practices on the other hand (MoEF 2012, 33).

Focus on Local Communities and Rural Livelihoods

Within most human-dominated landscapes (i.e., most of India), involvement of local communities, especially women, will be key to success of management interventions that are effective and socially just ways of addressing issues related to forest protection, including forest fires. The national forest policy emphasizes need to create "a massive people's movement with the involvement of women" (Paragraph 2.1) to achieve policy objectives. This is also a crucial strategy of the National Mission for a Green India:

> Local communities will be required to play a key role in project governance and implementation. The Mission will

bring primacy to Gram Sabha as an overarching institution to oversee Mission implementation at the village level. The committees set up by the Gram Sabha, including revamped JFMCs, CFM groups, Van Panchayats, Committees set up under Forest Rights Act; Biodiversity Management Committees etc., will be strengthened as the primary institutions on the ground for nested decentralized forest governance in rural areas. Similarly in the schedule VI areas, the traditional village level institution/ village councils will be supported. Likewise, the Mission will support revamping/ strengthening of the Forest Development Agencies to support the field institutions (MoEF 2010a).

A number of existing policy and legal spaces could be used to increase meaningful involvement of local communities, such as declaration of "Village Forests" under the Indian Forest Act, 1927 (section 28); declaration and management of "Community Reserves" under the Wildlife (Protection) Amendment Act, 2002 (section 36C); and constitution of "Biodiversity Management Committees" under the Biological Diversity Act, 2002 (section 41). However, two initiatives are particularly noteworthy – Joint Forest Management (JFM)[13] (see Plate 17.1 below) and the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006.

Panchayati Raj Institutions (PRI) are important stakeholders because The Constitution (Seventy-third) Amendment Act, 1992 and The Panchayats (Extension to Scheduled Areas) Act, 1996 have devolved extensive powers to PRIs to plan and implement schemes for

Plate 17.1: *Forest-PLUS team members interacting with a JFM group in Himachal Pradesh. The JFM program of India is one of the most ambitious community forestry programs in the world.*

economic development and social justice. In essence, these laws aim at establishing PRIs as institutions of local self-government and *Gram Sabha* as the basis of democracy. Schedule XI of the Constitution lists 29 subjects for which *panchayats* are to prepare and implement plans for economic development and social justice within areas under their respective jurisdictions. Some key subjects relevant to JFM that have devolved to PRIs include: (1) social forestry and farm forestry; (2) minor forest produce; (3) fuel and fodder; (4) welfare of weaker sections, particularly Scheduled Castes and Scheduled Tribes; and (5) land improvement, implementation of land reforms, land consolidation, and soil conservation. In addition, the Panchayats (Extension to the Scheduled Areas) Act, 1996 mandates state governments to ensure that the PRIs at the appropriate level and the *Gram Sabha* are *inter alia* endowed with ownership of minor forest produce. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006 devolved considerable powers to *Gram Sabha*.

The GoI has examined options for harmonizing various community involvement and empowerment initiatives. A high-level committee considered management of community forest resource areas (see GoI 2010). The National Mission for a Green India has offered several recommendations for involvement of PRIs in forestry:

> The JFMC will set up by Gram Sabha [sic], its constitution and processes need to be in tune with the provisions as laid out in the State Panchayat and PESA legislation. The JFMC, as a committee of the Gram Sabha, must be given power to protect and manage as well as derive benefits from forests. The Mission will examine provisions of the Indian Forest Act to provide power of a forest officer to such a committee. Provisions in the Panchayat Raj legislations in the States would need to acknowledge the role of JFMC as a committee of the Gram Sabha.
>
> Silvicultural management of the area assigned to JFMC must be as per the plan approved by the Gram Sabha, following the technical approval by the Forest Department.
>
> Forest Department's role would be to provide demand-based support to the Gram Sabha and its mandated committees to strengthen decentralized forest governance leading to sustainable management of the forests.
>
> The FDA at the district /division level will be chaired by the elected representative, [sic] such as the Zila Parishad president which would help in program convergence with the Panchayati Raj institutions... (MoEF 2010a, 27-28).

Inventory for Carbon and Other Ecosystem Services

To formulate effective plans and monitor progress, baselines are needed. Although India has a robust system of forest inventory and mapping, so far it has largely focused on trees, particularly timber. For sustainable forest ecosystem management, we presently lack a comprehensive inventory of forest resources, which is urgently needed. For example, only 70 percent of the country's land area has been surveyed (MoEF 2009). The inventory effort must move beyond timber species to cover a wider set of flora and fauna. Information related to ecosystem

services such as carbon stock, water tables, and stream flow also must be recorded. Biological and other resources of particular value/importance to the local communities (economic or otherwise, including social/ cultural value) should also be assessed by application of appropriate methods. Use of modern techniques such as GPS/ remote sensing should be integrated into the inventory process. Information acquired within different forest divisions should feed into the national forest inventory.

Proposed widening of the scope of the forest inventory process is in line with guidelines in the National Working Plan Code, and is reflected in key national planning documents such as the Twelfth Five-Year Plan, which stresses that environmental management in the country should be based on "Data and facts," "Analytics and modeling," and "Indexing and thresholding" (Planning Commission 2012b, 208). This will, however, require close coordination between State Forest Departments and other relevant government departments and agencies.

Utilized where appropriate should be existing policy and legal spaces such as the Biodiversity Registers under development by the Biodiversity Management Committees (as per provisions of the Biological Diversity Act, 2002).[14] However, a challenge to be addressed is acute shortage of appropriately trained personnel such as resource economists and taxonomists.[15]

Monitoring and Evaluation

The common phrase "what gets measured gets done" applies to sustainable forest ecosystem management. Regular monitoring (internal and independent) is key to successful sustainable forest ecosystem management models introduced within different landscapes. The Forest Survey of India is excellently monitoring forest cover and change of this within the country. The value of its monitoring could increase if data would be categorized according to forest and non-forest lands, and provided to each Forest Division. This would require digitization of boundaries of all forest lands, which should proceed on a priority basis. The Forest Survey of India has now moved beyond forest cover and has begun monitoring other parameters such as growing stock and carbon stock. Scope of monitoring must widen even more to encompass a range of ecosystem services. This will require development of new monitoring tools and methods. Available international experience, as well as modern technology, should be utilized for this purpose. Adoptions of criteria and indicators developed under the sustainable forest management process in the country (Bhopal India Process), and those developed for forest certification, could also be helpful after suitable modifications.

Resource Mobilization through Convergence

Implementation of sustainable forest ecosystem management models will require resources – human as well as financial. In addition to regular government schemes, in states hosting special forestry sector projects, possibility of support through externally-assisted projects could be explored. A promising source of financial resources is CAMPA. Various user agencies pay for compensatory afforestation, additional compensatory afforestation, penal compensatory afforestation, NPV, Catchment Area Treatment Plan, or compliance with

conditions stipulated by the Central Government, while granting approval under provisions of the Forest (Conservation) Act, 1980.[16] The total corpus with CAMPA exceeded INR 40,000 crores by March 2016.[17] The significance of this corpus is evident in a comparison of it with the annual expenditure for forestry and wildlife by the Central Government, which averaged only about INR 887.6 crores per year during the Eleventh Five Year Plan (2007-12) (Planning Commission 2012b).[18] The tremendous scope of CAMPA funds use for promoting sustainable forest ecosystem management and sustainable livelihoods is clear in the following extract from the note released by the GoI's Press Information Bureau when the Parliament of India passed the Compensatory Afforestation Fund Bill in 2016[19]:

> The passing of the Bill has ended the long era of ad-hocism and will help the Centre and State Governments to utilise these amounts in a planned manner. It will facilitate make available more than Rs. 6,000 crores per annum to the States/UTs for conservation, protection, improvement and expansion of forest and wildlife resources of the country. Availability of these amounts will not only help the States/UTs and local communities to ensure better management of their forest resources but will also result in creation of more than 15 crores man-days of direct employment. A major part of these amounts will be used to restock and improve quality of degraded forests, which constitutes more than 40 % of the total forest cover of the country. Rules to be framed by the Central Government in consultation with the States/UTs will provides for use of native species in afforestation activities to be undertaken from these funds. Majority of the employment will be generated in tribal dominated and backward areas of the country. Apart from creation of direct employment, utilisation of these amounts will result in increased availability of timber and various other non-timber forest products, and will thus help in improvement of the overall living standards of the forest dependent communities.

To promote sustainable livelihoods in forest-fringe villages[20] (as an end in itself to address poverty and as a strategy to reduce pressure on forests or to create a stake in sustainable management), attempts to converge flagship government schemes such as MGNREGA and NRLM should occur to the extent possible.[21]

Common Lands

Extent of Common Lands and People's Dependence

Common lands are types of common pool resources that are described in the academic literature in terms of degree of excludability and rivalry (subtractability) (see, for example, Ostrom *et al.* 1994). Common pool resources are defined as "a class of resources for which exclusion is difficult and joint use involves subtractability" (Berkes and Farvar 1989, 7). Management of these resources can proceed under a variety of property regimes, such as state, private, or common property, or no property rights may be recognized (*res nullius* or open access) (Bromley 1992).

In the Indian context, the National Sample Survey Organisation (NSSO) has provided a definition of common property resources: "Resources accessible to and collectively owned\held\ managed by an identifiable

community and on which no individual has exclusive property rights are called common property resources" (NSSO 1999, 4).

NSSO has estimated that common property land resources constitute 15 percent of the country's geographical area (NSSO 1999). Breakdown of common property land resources is as follows:

Community pastures and grazing grounds:	3.45%
Village forests and woodlots:	2.40%
Other:	9.15%

The NSSO took a *de jure* approach to estimation of the extent of common property land resources, and excluded all government forests and revenue lands. Because many revenue lands are *de facto* common lands, the true extent of non-forest common lands is likely greater.

In many states, these lands are important sources of fuelwood and fodder, especially for the poor. Indeed, fuelwood and fodder are the top two products (by value) collected by rural households from these lands (NSSO 1999). The NSSO report also notes that "[t]here is evidence indicating a rapid decline in CPRs, both in size and productivity…the area of CPR land in rural India is declining at a quinquennial rate of 1.9 percent (NSSO 1999, 24).

Resource Mapping

Effective planning requires understanding of the true extent, availability, and status of common lands. For example, a government plan developed a few years ago to establish biofuel plantations on common lands identified 11 potential districts for this where official records indicated availability of 729,312 ha of "culturable wastelands."[22] However, when District Collectors were asked to identify blocks for biofuel plantations, only 40,495 ha (5.55%) could be identified.[23]

Resource Preservation

Because common lands are important complementary sources of fuelwood and fodder, they could considerably reduce pressure on forest lands from acquisition of subsistence products. Preserving areas of common lands is thus important. Unfortunately, steady decline in areas of common lands has occurred over the years due to privatization of these lands (legally as well as illegally [encroachment]). This privatization often hits the poorest the hardest because they lack resources such as adequate agricultural land to fall back upon. Privatization of common lands (especially encroachment) must be discouraged through appropriate incentives and disincentives. This is also the spirit of a Supreme Court judgment delivered in January 2011:

> Before parting with this case we give directions to all the State Governments in the country that they should prepare schemes for eviction of illegal/unauthorized occupants of Gram Sabha/ Gram Panchayat/ Poramboke/Shamlat land and these must be restored to the Gram Sabha/Gram Panchayat for the common use of villagers of the village (Judgment in CIVILAPPEAL NO.1132/2011 @ SLP© No.3109/2011, Paragraph 22).

Control of Unsustainable Use and Over-Exploitation

Many common lands are degrading because of unsustainable use and over-exploitation. They show classic features of "the tragedy of the commons" (see Hardin 1968). In many areas, traditional institutional structures that promoted sustainable management of common pool resources have broken down. Establishment of institutions (used in a broader sense than organizations) to transition categorization of common lands from "open access" to "common property" is urgently needed. This is also one of the recommendations of the Sub-group (VI) of the *Committee on Agrarian Relations and Unfinished Task of Land Reforms* constituted by the GoI. Lessons from several common land development projects, such as the Tree Growers' Cooperatives Project, could be applied for this purpose.

Engagement with Panchayati Raj Institutions

Engagement with and capacity building of PRIs is necessary. Many PRIs are custodians of common lands, especially grazing lands, designated by different names in different states. Again, experience in this regard must be collated, documented, and utilized for context-specific interventions. Engagement with the Revenue Administration (which controls many *de facto* common lands) and State Land Use Boards also is needed.

Productivity Enhancement

Even in areas where common lands are physically available (i.e., free from encroachments), these are often in a degraded condition with low productivity. Appropriate silvi-pasture models must be developed to restore productivity of these lands. In this regard, technical expertise of Indian Council of Agricultural Research and Indian Council of Forestry Research and Education institutions could be tapped through development of appropriate collaborative mechanisms.

Demand Management

Demand side interventions such as introduction of improved cook-stoves and provision of better livestock to encourage stall feeding are socially and culturally appropriate, and are to be undertaken concurrently with attempts to enhance supply of products from common lands. Alternative uses for invasive species such as baskets from lantana, charcoal from *Prosopis juliflora*, and mulch from water-hyacinth not only would reduce greenhouse gas emissions and pressure on alternative sources of such products (often forest lands), but would also contribute to control of invasive species.

Recognition of Critical Role of Common Lands in Providing Ecosystem Services

Apart from providing subsistence products such as fuelwood and fodder, common lands often furnish other important ecosystem services (e.g., biodiversity conservation). An attempt to preserve or enhance these services while preparing plans for development of these lands is necessary.

Watershed Management Program

Various interventions on common lands should be integrated with activities regarding watersheds to increase focus on water resources critical to rural populations and ecosystems. The watershed program has been a major government initiative since the 1990s. A revised Integrated Watershed Management Programme was launched by the Ministry of Rural Development, with a

new set of guidelines issued in 2008 (MoRD 2008). This should be a key program for convergence with activities on common lands.

Monitoring and Evaluation

As with forest lands, regular monitoring of the status of common lands should occur. The study by NSSO in 1999 should become a regular feature. This was also recommended by the Sub-group (VI) of the *Committee on Agrarian Relations and Unfinished Task of Land Reforms* constituted by the GoI.

Private Lands

Resource

In the context of this strategy, "private lands" refers mainly to agriculture lands in rural India. These lands cover more than 42 percent of the country's geographical area (MoA 2013) (see Plate 17.2 below). Thus, agro-ecosystems are the dominant land use in the country and are critical for sustainable forest ecosystem management at the landscape level. Trees – for fuelwood, fodder, timber, or other ecosystem services – are already an integral part of agricultural landscapes in the various parts of the country. Trees on agriculture lands, such as mango, coconut, neem (*Azadirachta indica*), and khejri (*Prosopis cineraria*), contribute significantly to growing stock under "Trees Outside Forests" (TOF). TOF are already meeting an estimated 89 percent of the country's wood demand (FSI 2011), but have considerable further untapped potential as well. A national committee constituted by MoEF noted:

> There is an immense potential for agro-forestry and farm forestry considering the favourable climatic conditions, growing demand for forest produce and opportunities for creation of jobs in the rural/peri urban areas.[24]

Existing and New Farm-/Agro-Forestry Models

Several farm-/agro-forestry models (traditional and contemporary) have been introduced in India. These must

Plate 17.2: *Agriculture is the dominant land use in India, covering as much as 42 percent of the country's geographical area.*

be documented, and their potential for introduction into various agro-climatic zones explored. Concurrently, new farm-/agro-forestry models should be developed in collaboration with national[25] and international[26] research organizations. These models have immense potential for resolving issues related to carbon and livelihoods. For example, while *Prosopis cineraria* models are suited only to the dry northwestern region of the country, these have been so widely adopted by farmers of the region that *Prosopis cineraria*[27] contributes the seventh largest growing stock of TOF nationally (FSI 2011).

Identification of Potential Species

Suitable tree species should be identified that fit with local agriculture practices and are potentially applicable to different agro-climatic zones in the country. The fit of poplar with wheat/sugarcane cultivation in the *terai* plains (e.g., poplar sheds its leaves when wheat requires ample sunlight) was the main reason for its success and widespread adoption by local farmers. Similarly, the nice fit of *Ailanthus excelsa* with local agriculture/livestock practices (e.g., goat rearing) has led to widespread adoption of it in some villages of Ajmer and Jaipur districts of Rajasthan.

Research and Development

Identifying suitable species is not enough, as these species must be further improved through selection and Research and Development (R&D), especially via biotechnology-based approaches. For example, development of more productive tree clones by companies such as ITC Limited led to widespread adoption of these by farmers. In fact, farmers were willing to pay a much higher price for improved seedlings even when normal seedlings were distributed free or at a nominal price by government agencies (see Saigal *et al*. 2002). Incentives for R&D by private-sector players are needed through appropriate policy measures. Research on developing more productive, disease-resistant, and locally suited varieties/clones can encourage and popularize tree growing among farmers. Along with research is need to develop supply chains for certified quality planting material for major farm-/agro-forestry species. This is also a recommendation of a committee on farm-/agro-forestry constituted in 2011 by MoEF.

Cultivation of NTFPs

Cultivation of several NTFPs (especially medicinal and aromatic plants) collected from the wild, which can reduce pressure on forest lands, has increased considerably. The National Medicinal Plants Board (NMPB) has undertaken several important steps to promote this cultivation. The Board supports cultivation of a large number of medicinal plants such as Ashwagandha (*Withania somnifera*), Ghritkumari (*Aloe vera*), Safed Musli (*Chlorophytum borivilianum*), Kokum (*Garcenia indica*), and Satavari (*Asparagus racemosus*).[28] An attempt to exploit available opportunities (such as NMPB schemes) to promote cultivation of selected NTFPs in different regions would be beneficial.

Market Linkages

Establishment of market linkages is one of the most critical aspects of promoting farm and agroforestry. In areas where good linkages have developed, farm-/agro-forestry has flourished, for example in and around Prakasam district in Andhra Pradesh. Company-farmer partnership models (outgrower schemes), such as those developed by ITC Limited, JK Paper Limited,

and Ballarpur Industries Limited in Andhra Pradesh and Odisha, should be encouraged, with removal of policy bottlenecks that hinder them (see Saigal *et al*. 2002). Provision of credit on easy terms is also likely to facilitate adoption of farm and agro-forestry on a large scale.

Removal of Policy Bottlenecks

Another key element is easing of felling and transport restrictions. In spite of considerable policy reforms over the years, many restrictions on tree/NTFP cultivation remain in place, especially related to felling and transport. A comprehensive assessment of these bottlenecks and constraints must be undertaken with intent to remove them. A committee constituted by MoEF on this issue noted:

> The Committee observed that the States which have least restrictions on tree felling and transit specially of preferred agro-forestry spp. by farmers have succeeded in large scale agro-forestry and farm forestry.[29]

The Committee suggested removal of such policy bottlenecks and recommended adoption of a regional approach to facilitate easy movement of farm-/agro-forestry produce. Apart from removal of the obvious policy bottlenecks, a detailed study of areas where farm-/agro-forestry is practiced on a large scale by local farmers should occur to understand reasons for this, with an aim of adopting learning/best practices from these areas elsewhere.

Convergence

Attempts should occur at field level to converge relevant flagship government schemes in the agriculture sector, notably the Rainfed Area Development Programme, the National Horticulture Mission, and the National Mission for Sustainable Agriculture.

SUMMING UP

This concluding chapter has presented a strategy for operationalizing REDD+, ecosystem approach, and landscape approach. Key elements underpinning this strategy are:

- Adoption of a landscape approach to holistic land use planning (see Plate 17.3 and Figure 17.1 below), while focusing on forest ecosystem services, including sustainable use of these to support local livelihoods
- Convergence of relevant ongoing initiatives and utilization of existing policy and legal spaces to the extent possible
- Development or adaptation of innovative forest management models to promote context- specific sustainable forest ecosystem management
- Encouragement of women and other marginalized groups to take up more active roles in communal sustainability practices.

The strategy builds on existing inter-linkages and policy spaces, thereby enhancing its efficacy and practicality. For example, interventions such as fodder development on common lands and farm-/agro-forestry on private lands are likely to reduce pressure on forest lands within the landscape. The focus on involvement of local communities, with particular attention to gender dimensions, is likely to positively affect both forests and rural livelihoods. Therefore, the strategy is likely to lead to better environmental, economic, and social outcomes.

Plate 17.3: *Adoption of a landscape approach covering forest lands, common lands, and private lands in an integrated manner is a key element of the proposed strategy.*

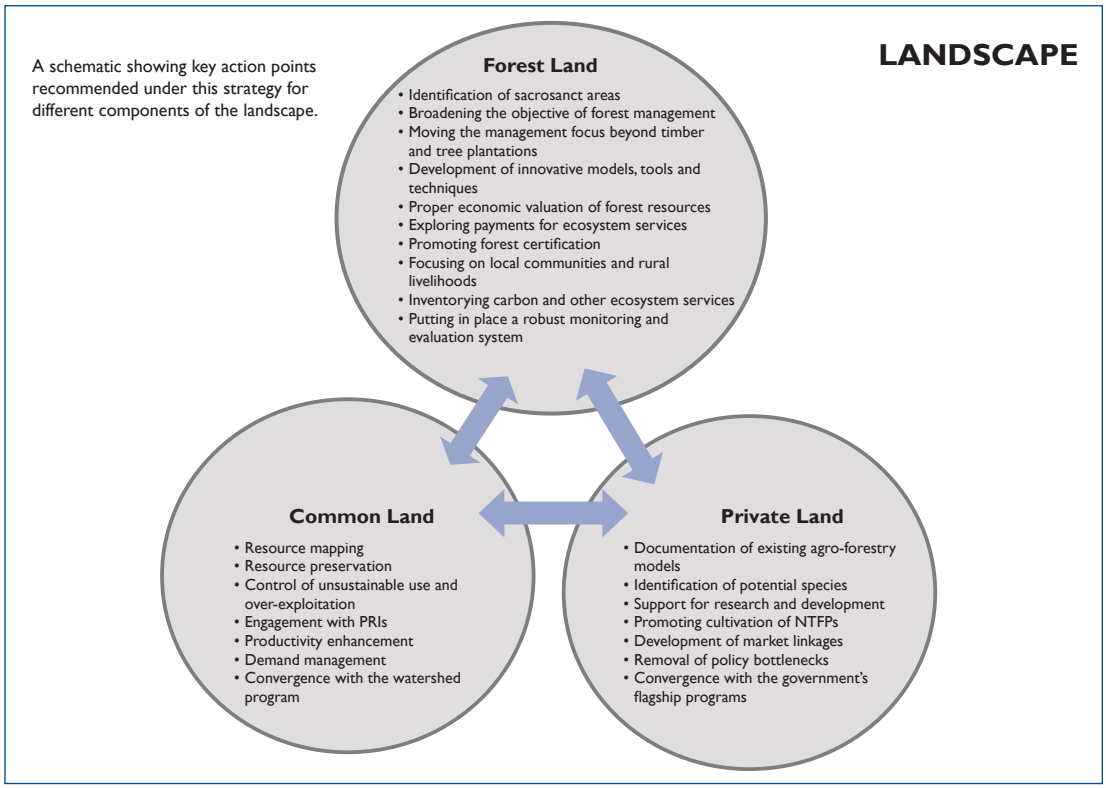


Figure 17.1: A schematic depicting major land categories and action points for operationalization of landscape approach in the Indian context

Implementation of this strategy must proceed with close collaboration among key stakeholder groups at different levels. Because one focus of this strategy is preservation/enhancement of carbon stocks to address climate change concerns and to take REDD+ actions to scale, implementation of actions recommended under this strategy must dovetail with the National Action Plan on Climate Change, especially four of its eight missions – National Mission for a Green India, National Mission for Sustaining the Himalayan Ecosystem, National Mission for Sustainable Agriculture, and National Mission on Strategic Knowledge for Climate Change.

National policy-makers have identified forestry as a key sector for reducing emissions, and two benefits to India's economy will result from investment in forestry – first, activity of forests as carbon sinks, and second, increase of the Gross Domestic Product (Planning Commission 2011).

Actions proposed under this strategy could contribute to the effort to meet India's Intended Nationally Determined Contribution (INDC) to create an additional carbon sink of 2.5 to 3 billion tons of carbon dioxide equivalent through additional forest and tree cover by 2030.[30]

REFERENCES

Berkes, F. and M. T. Farvar. 1989. "Introduction and overview." In *Common Property Resources: Ecology and Community-Based Sustainable Development*, edited by Berkes, F., 1-17. London: Belhaven Press.

Bromley, D. W. 1992. "The commons, property, and common-property regimes." In *Making the Commons Work: theory, practice, and policy*, edited by Bromley, D. W., 3-15. San Francisco: ICS Press.

Finance Commission. 2009. *Thirteenth Finance Commission 2010-2015*, Volume 1. New Delhi: Finance Commission, Government of India.

FRI. 2014. *National Working Plan Code 2014*. Dehradun: Forest Research Institute, Ministry of Environment and Forests, Government of India.

FSI. 1999. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2009. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

FSI. 2011. *State of Forest Report*. Dehradun: Forest Survey of India, Ministry of Environment and Forests, Government of India.

GoI. 2010. *Manthan - Report of the National Committee on Forest Rights Act*, Report by Joint Committee of MoEF and MoTA. New Delhi: Ministry of Environment and Forests, and Ministry of Tribal Affairs, Government of India.

Hardin, G. 1968. "The tragedy of the commons." *Science* 162 (3859): 1243-1248.

Kishwan J., D. Pandey, A. K. Goyal and A. K. Gupta. 2007. *India's Forests*. New Delhi: Ministry of Environment and Forests, Government of India.

Landell-Mills, N. and T. I. Porras. 2002. *Silver Bullet or Fools' Gold? A global review of markets for forest environmental services and their impact on the poor*. London: International Institute for Environment and Development.

MoA. 2010. *Annual Report, 2009-2010*. New Delhi: Department of Agriculture cooperation and Farmers Welfare, Ministry of Agriculture, Government of India.

MoA. 2013. *Annual Report, 2012-2013*. New Delhi: Department of Agriculture Cooperation and Farmers Welfare, Ministry of Agriculture, Government of India.

MoEF. 1998. *Report of the Expert Committee on Review of Afforestation Policies and Rehabilitation of Wastelands*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2009. *India's fourth National Report to the Convention on Biological Diversity*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2010a. *National Mission for a Green India (Under the National Action Plan on Climate Change)*, Draft submitted to Prime Minister's Council on Climate Change. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2010b. *Taxonomy capacity building: Indian initiative*. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2011. *Gajah: securing the future for the elephant in India*, Report of the Elephant Task Force. New Delhi: Ministry of Environment and Forests, Government of India.

MoEF. 2012. *Annual Report, 2011-12*. New Delhi: Ministry of Environment and Forests, Government of India.

MoRD. 2008. *Annual Report, 2007-08*. New Delhi: Ministry of Rural Development, Government of India.

NFC. 2006. *Report of the National Forest Commission*. New Delhi: National Forest Commission, Ministry of Environment and Forests, Government of India.

NSSO. 1999. *Common Property Resources in India, NSS 54th Round, January 1998 - June 1998*. New Delhi: National Sample Survey Organisation, Ministry of Statistics and Programme Implementation, Government of India.

Ostrom, E., R. Gardner and J. Walker. 1994. *Rules, games, and common-pool resources*. Ann Arbor, US: The University of Michigan Press.

Pai, R. and S. Dutta, eds. 2006. *Measuring Milestones - Proceedings of the National Workshop on Joint Forest Management*, jointly organized by MoEF and Winrock International India, October 17, 2006. New Delhi: Ministry of Environment and Forests, and Winrock International India.

Planning Commission. 2007. *Eleventh Five Year Plan 2007-12: Inclusive Growth*, Volume 1. New Delhi: Planning Commission, Government of India.

Planning Commission. 2010. *Mid-Term Appraisal for Eleventh Five Year Plan 2007-2012*. New Delhi: Planning Commission, Government of India.

Planning Commission. 2011. *Interim Report of the expert group on low carbon strategies for inclusive growth*. New Delhi: Planning Commission, Government of India.

Planning Commission. 2012a. *Press Note on Poverty Estimates, 2009-10*. New Delhi: Planning Commission, Government of India.

Planning Commission. 2012b. *Twelfth Five Year Plan 2012-2017: Faster, more inclusive and sustainable growth*, Volume I. New Delhi: Planning Commission, Government of India.

Saigal, S. and B. Vira. 2009. *Forest Certification: origin, progress, and impact*. New Delhi, India: Winrock International India.

Saigal, S., H. Arora and S. S. Rizvi. 2002. *The New Foresters: The role of private enterprise in the Indian forestry sector*. London: International Institute for Environment and Development.

ENDNOTES

Chapter 1: REDD+ and Other Key Emerging Concepts in Forestry: Relevance for India

1 This section is largely based on UNFCCC's 2014 *Key Decisions Relevant for Reducing Emissions from Deforestation and Forest Degradation in Developing Countries*. It also draws on the UNFCCC website (http://unfccc.int/) and the United Nations Environment Programme's (UNEP) *Forests in a Changing Climate* (2014).

2 However, due to a complex ratification process, the protocol only entered into force on February 16, 2005.

3 The convention only "encouraged" the parties to stabilize GHGs.

4 See Decision 5/CMP.1, a part of the "Decisions adopted by the Conference of Parties serving as the meeting of the Parties to the Kyoto Protocol". Available online at http://unfccc.int/resource/docs/2005/cmp1/eng/08a01.pdf (accessed October 23, 2017).

5 A non-legally binding authoritative statement of principles for a global consensus on the management, conservation, and sustainable development of all types of forests.

6 Forest area is the area recorded as a forest in government records. It is also referred to as "recorded forest area." The recorded forest area could be devoid of vegetation.

7 Forest cover consists of all lands more than one hectare in area with a tree canopy density of more than 10 percent, irrespective of ownership and legal status. Such lands may not necessarily be a recorded forest area. It also includes orchards, bamboo, and palms.

8 Tree cover comprises tree patches outside the recorded forest area, exclusive of forest cover and less than the minimum mappable area.

9 For example, a key target under India's National Forest Policy (1988) is to bring a minimum of one-third of the total land area of the country under forest or tree cover.

10 Based on various State of Forest Reports of the Forest Survey of India. Due to methodological and technological changes over the years, the data for different years are not always strictly comparable, though efforts to harmonize these data have been made, where appropriate, by the Forest Survey of India. However, it does not appear that these inconsistencies in data affect the broad trend that India's overall forest and tree cover has relatively been stable for the past 30 years.

11 40.82 tons/hectare in India as compared to the global average of 71.6 tons/hectare.

12 This is an indicative rather than an exhaustive list.

13 199.63 million out of 853.88 million

14 This classification is based on ocular estimate of around two hectares area observed from the center of the plot. Based on the extent of area/crop affected by grazing, the grazing incidence is classified as "heavy" (> 50 percent), "moderate" (10-50 percent), or "light" (< 10 percent).

15 This classification is based on ocular estimate of around two hectares area observed from the center of the plot. Based on the extent of fire damage to the area/crop, it is classified as "heavy" (> 50 percent), "moderate" (10-50 percent), or "mild" (< 10 percent).

16 https://unfccc.int/files/documentation/submissions_from_parties/application/pdf/india_submission_reddplus-strategy.pdf

17 The Twelfth Finance Commission had also provided a forest grant of INR 1,000 Crores.

18 See http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf (accessed October 23, 2017).

Chapter 5: India's Position on REDD+

1 1) Reducing emissions from deforestation, 2) reducing emissions from forest degradation, 3) conservation of forest carbon stocks, 4) sustainable management of forests, 5) enhancement of forest carbon stocks.

2 Unit of measure; one crore is equal to ten million.

3 https://beeindia.gov.in/

4 Presuming that non-forest land is five times more productive than forest land, sequestered carbon in 2030 will be = ½ of (9x5+10)x14 years till 2030x2 tCx44/12) $mtCO_2eq$ = 2823 $mtCO_2eq$.

Chapter 6: Ecosystem Approach and Working Plans

1 This chapter is a synthesis of work previously published in the Forest-PLUS Ecosystem Approach to Forest Management (EAFM) curriculum.

2 Working circles are defined based on the management plan.

Chapter 7: REDD+ and Biodiversity Conservation: Safeguards and a Scope for Synergy

1 http://unfccc.int/2860.php

2 http://unfccc.int/land_use_and_climate_change/redd/items/7377.php

Chapter 8: Managing Forests for Non-Timber Forest Products

1 These chapters are a synthesis of work previously published in the Forest-PLUS sustainable harvesting techniques for non-timber forest products (NTFP), written by Himalayan Research Group (HRG), Institute of Trans-Disciplinary Health Sciences and Technology (ITD-HST) and Prerana under the Forest-PLUS contract.

2 http://envfor.nic.in/legis/forest/forest4.html

3 http://www.aajeevika.gov.in/sites/default/files/resources/mksp-guidelines-ntfp-approved-version.pdf

4 https://www.earthrights.org/sites/default/files/documents/transect-walk.pdf

Chapter 9: Valuing Forest Ecosystem Services

1 Source: http://www.downtoearth.org.in/coverage/protectors-dubbed-criminals-38993

2 Non excludability and non rivalry in consumption (or jointness of use) characterise public goods.

3 Regulating services are the services that ecosystems provide by acting as regulators e.g. regulating the quality of air and soil or by providing flood and disease control.

4 Direct values stem from goods and services whose values are directly measurable in physical and monetary terms such as for non-timber forest products which are collected for sale as opposed to indirect values which do not lend themselves to such market based measures. Examples of the latter include values for habitat, biodiversity, climate regulating services of forests.

5 Use values are values that stem from the use of goods and services such as provisioning or recreational services whereas non – use values accrue without such use (or planned use) of the forest such as existence or bequest values (option values).

6 The interested reader is referred to: Freeman 2003; Kumar 2010; MEA 2005; Ferraro *et al.* 2012; Haines-Young and Potschin 2010; De Groot *et al.* 2010; Dasgupta 2009

7 Chopra and Dasgupta 2008; Verma 2014a; MoEF 1999; NPV report 2006

8 For a wide-ranging definition of PES see Van Noordwijk*et al.*, 2012.

9 Note that specific tools and techniques have been discussed in other sections of the chapter, and are applicable irrespective of the specific plan. The issues and challenges are mirrored to a lesser or greater extent, for all programs which seek to set in place mechanisms for transfer of funds and compensation whether it be in terms of charging NPV for diversion of forest lands, compensating states for opportunity costs of forest conservation or restoration, or designing REDD+ programs for mitigating climate change.

Chapter 10: Clean Development Mechanism: The Indian Forestry Experience

1 The Doha Amendment to the Kyoto Protocol adopted in Doha (Qatar), on December 8, 2012, launched the second commitment period (2013–2020).

2 The Group of 77 is the largest intergovernmental organization of developing countries in the United Nations, which provides the means for countries of the South to articulate and promote their collective economic interests and enhance their joint negotiating capacity on all major international economic issues within the United Nations system, and promote South-South cooperation for development.

3 https://www.emissions-euets.com/cers-erus-market-as-from-2013

4 Article 12.5 of the Kyoto Protocol specifies that emission reductions are only to be certified under CDM if they are additional to any that would occur in the absence of the certified project activity. Additionality under the CDM was further defined by Parties to the Kyoto Protocol in 2005 (Decision 3/CMP.1): "A CDM project activity is additional if anthropogenic emissions of GHGs by sources are reduced below those that would have occurred in the absence of the registered CDM project activity."

Chapter 11: Panchayati Raj Institutions and Forestry

1 A workshop on "Decentralization, Federal Systems in Forestry and National Forest Programs", co-organized by the Governments of Indonesia and Switzerland at Interlaken (Switzerland) in April 2014.

2 Under the Constitution of India, the legislative functions are divided into three lists: Union List, State List, and Concurrent List. For subjects included in the Concurrent List, the legislative responsibility and powers are shared between the central and state governments. Forests were earlier under the State List, but the subject was transferred to the Concurrent List in 1976.

3 http://shodhganga.inflibnet.ac.in/bitstream/10603/86858/9/09_chapter%204.pdf

4 http://agriinfo.in/default.aspx?page=topic&superid=7&topicid=1464

5 http://shodhganga.inflibnet.ac.in/bitstream/10603/126688/12/12_chapter%205.pdf

6 The Constitution of India has two Schedules (V and VI) dealing with issues related to tribal areas. The basic

thrust of these provisions is protection of cultural distinctiveness of the tribal communities. While the Schedule V deals with specified tribal areas outside the North East, the Schedule VI deals with administration of specified tribal areas in certain states of North East India.

7 http://pesadarpan.gov.in/documents/30080/0/1_Copy+of+Model+Rules.pdf/e9621822-2dd7-4a05-b5fa-170b793723e4

8 On the fringes of the protected areas, the role of JFMCs is played by the Eco-Development Committees or EDCs.

9 In 2014, MoEF was renamed as the Ministry of Environment, Forest and Climate Change (MoEFCC).

10 'Forest-dwelling Scheduled Tribes' are defined as members of the community of Scheduled Tribes who primarily reside in and depend on forests and forest land for livelihood needs and include Scheduled Tribe pastoral communities. 'Other traditional forest dwellers' are defined as those who have been living for at least three generations, or 75 years, prior to 13 December 2005 (GoI 2006b, Section 2(c) and 2(o)).

11 TNN 2015 and Sethi 2016.

12 It, however, retained control over two major revenue generating NTFPs, *viz*. kendu leaves (*Diospyros melanoxylon*) and bamboo.

Chapter 12: Benefit Sharing Mechanisms under REDD+: Learning from the Joint Forest Management Program

1 Part of this chapter is published in Jha, S. K., & B. Sinha. 2017. "Benefit Sharing Mechanism for Operationalization of REDD+ in India" Indian Forester, 143(5), 421-430; and also in a submitted report entitled "Benefit Sharing Mechanism, Safeguarding Biodiversity and Rights of Local Communities for Operationalisation of REDD+ in India" to Ministry of Environment, Forest and Climate Change (MoEFCC), Government of India (GoI).

Chpater 14: Integrating Environmental and Social Safeguards in REDD+

1 Warsaw Framework for REDD+ at COP's 19th meeting in December 2013.

2 Decision 1/CP.16, Appendix I, *"Guidance and safeguards for policy approaches and positive incentives on issues relating to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries"*, available at http://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

3 Cancun Safeguard (b); Principle 1 of UNREDD SES Framework

4 Cancun Safeguard (c) and Principle 2, UNREDD SES Framework

5 Cancun Safeguard (d) and Principle 2, UNREDD SES Framework

6 Cancun Safeguard (e) and Principles 5 and 6, UNREDD SES Framework

7 Cancun Safeguard (f) and Principle 5, UNREDD SES Framework.

8 Cancun Safeguard (g) and Principle 6, UNREDD SES Framework.

9 Decision 1/CP.16, para 71(d), available at https://unfccc.int/resource/docs/2010/cop16/eng/07a01.pdf

10 Decision 12/CP.17, available at http://unfccc.int/resource/docs/2011/cop17/eng/09a02.pdf

11 Decision 12/CP.19, available at http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=33

5 Decision 9/CP.19, available at http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf

12 Decision 12/CP. 17, available at http://unfccc.int/resource/docs/2011/cop17/eng/09a02.pdf

13 Decision 9/CP.19, available at http://unfccc.int/resource/docs/2013/cop19/eng/10a01.pdf#page=24

14 Article 1, CBD.

15 Available at https://en.wikipedia.org/wiki/Convention_on_Biological_Diversity

16 Action Plan1/CP (Para 1(b) (iii)).

17 Cancun Safeguard (a) Principle 3, UNREDD SES Framework

18 Entry 17-A, Concurrent List, VIIth Schedule, Constitution of India

19 W.P. No. 202 of 1995

20 Para 4, National Policy on REDD+, Draft National REDD+ Policy and Strategy.

21 Para 1, National REDD+ Strategy, Draft National REDD+ Policy and Strategy.

22 Cancun Safeguard (b); Principle 1 of UNREDD SES Framework

23 Cancun Safeguard (c) and Principle 2, UNREDD SES Framework

24 Section 3 (1) (a) of FRA

25 Section 3 (1)(c) of FRA

26 Section 3 (1)(d) of FRA

27 Section 3(2) of FRA

28 Section 4(8) of FRA

29 Section 3 (1)(k) of FRA

30 Section 3 (1) (i), FRA.

31 Proviso to Section 7, BDA

32 Section 36C, WLPA

33 For example, Khatian Part II under Chota Nagpur Tenancy Act and Tenancy Right Santhal Paragna Act

34 See for example, The M.P. and Chhattisgarh Land Revenue Code of 1959

35 See for example, The Andersons Settlement Report and the Jubbal Settlement Report in the State of Himachal Pradesh

36 Cancun safeguard (d) and Principle 2, UNREDD SES Framework

37 Para 1, National REDD+ Strategy, Draft National REDD+ Policy and Strategy.

38 Cancun Safeguard (e) and Principles 5 and 6, UNREDD SES Framework

39 Section 2 (b), BDA: Biological diversity *"means the variability among living organisms from all sources and the ecological complexes of which they are part and includes diversity within species or between species and of eco-systems."*

40 Section 3, BDA.

41 Section 7, BDA.

42 Section 20, BDA.

43 Section 24 (1), BDA.

44 Section 36, BDA.

45 Section 37, BDA.

46 Section 38, BDA.

47 Section 41, BDA.

48 Section 18 read with Section 26A and Section 35, WLPA.

49 Section 36(C), WLPA.

50 Section 36A, WLPA.

51 Section 38V, WLPA.

52 Section 3 (i), FRA

53 Section 5, FRA

54 Section 2 (b), FRA

55 Cancun Safeguard (f) and Principle 5, UNREDD SES Framework.

56 Cancun Safeguard (g) and Principle 6, UNREDD SES Framework.

57 Available at http://theredddesk.org/markets-standards/design-features/permanence-reversals

Chpater 15: Landscape Approach: Opportunities and Challenges

1 This chapter is based on a study carried out by a Forest-PLUS partner in collaboration with IUCN under its DFID KNOW-FOR project (Improving the way knowledge on forests is understood and used internationally).

2 For example, the Sustainable Livelihoods and Ecosystems Management Programme of the Government of India and Global Environment Facility.

3 In May 2014, it was renamed as the Ministry of Environment, Forest and Climate Change.

Chpater 16: Designing REDD+ Projects

1 http://www.v-c-s.org/project/vcs-program/methodologies/

Chpater 17: The Way Forward: A Pragmatic Strategy for Indian Forestry

1 Popularly known as the Green India Mission.

2 Report of the Western Ghats Ecology Expert Panel submitted to MoEF in 2011. The panel suggested designation of the entire Western Ghats as an Ecologically Sensitive Area, and assigned three levels of ecological sensitivity to different regions of it.

3 Forest management plans at the Forest Division level usually remain in place for 10 years.

4 "India: Views on implementing COP decisions on 'Reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries' (REDD-plus)" (emphasis in original). Accessed April 1, 2013. https://unfccc.int/files/documentation/submissions_from_parties/application/pdf/india_submission_reddplus-strategy.pdf.

5 Primarily National Parks and Sanctuaries declared under The Wildlife Protection Act, 1972.

6 Formulation of clear policy on inter-state movement of livestock also is necessary.

7 Pertinent here is decrease in the rate of diversion of forestlands for non-forestry purposes from

approximately 165,000 ha per annum (average for 25 years from 1951-52 to 1975-76) to approximately 36,300 ha per annum after enactment of the Forest (Conservation) Act, 1980 (MoEF 2012).

8 See, for example, Landell-Mills and Porras 2002.

9 Extract from the Shimla Declaration on Sustainable Himalayan Development, Shimla, October 30, 2009.

10 The Finance Commission defines financial relations between the center and states.

11 1 crore = 10 million.

12 Source: http://indiabudget.nic.in/es2014-15/echapvol1-10.pdf (accessed October 16, 2017).

13 According to an estimate, there are over 100,000 Joint Forest Management Committees (JFMCs) protecting/managing around 22 million hectares of forest lands (Pai and Dutta 2006).

14 According to section 41 (1) of the Biological Diversity Act, 2002 "[e]very local body shall constitute a Biodiversity Management Committee within its area for the purpose of promoting conservation, sustainable use and documentation of biological diversity including preservation of habitats, conservation of land races, folk varieties and cultivars, domesticated stocks and breeds of animals and microorganisms and chronicling knowledge relating to biological diversity."

15 The GoI has also recognized the problem and initiated several initiatives such as the All India Coordinated Project on Capacity Building in Taxonomy (AICOPTAX) to address it (MoEF 2010b).

16 Some resources could also be leveraged from the National Clean Energy Fund, which has been created by levying a cess on coal. Around INR 200 crores were leveraged from this fund for providing initial support to activities under the National Mission for a Green India (Planning Commission 2012b).

17 Source: http://pib.nic.in/newsite/mbErel.aspx?relid=147937 (accessed October 16, 2017).

18 This includes expenditure under the Forests & Wildlife and National Afforestation and Eco-Development Board heads. The overall annual expenditure on forestry (all sources) has been estimated at INR 8,500 crores (source: Presentation made by MoEF to the Prime Minister's Council on Climate Change, February 22, 2011).

19 Source: http://pib.nic.in/newsite/mbErel.aspx?relid=147937 (accessed October 16, 2017).

20 The exact figure of forest-fringe villages in the country is not available. In the late 1990s, the Forest Survey of India had carried out an analysis of the 1991 census data and estimated that 170,379 villages in the country included at least some forest land within the village boundaries. These represented 29 percent of total villages in the country, and their total population was estimated at 146.78 million (FSI 1999).

21 Guidelines for convergence between MGNREGA and the National Afforestation Programme have already been developed (Planning Commission 2012b).

22 A category under the land use classification, usually *de facto* common lands.

23 Progress Report of Biofuel Authority, Rajasthan, June 2009.

24 Report of the Committee on the Regulatory Regime regarding Felling and Transit Regulations for Tree Species Grown on Non Forests/Private Lands, 2012.

25 For example, National Research Centre for Agroforestry.

26 For example, World Agroforestry Centre.

27 An important source of fodder and fuelwood.

28 This is not an exhaustive list.

29 Report of the Committee on the Regulatory Regime regarding Felling and Transit Regulations for Tree Species Grown on Non Forests/Private Lands, 2012.

30 Source: http://www4.unfccc.int/submissions/INDC/Published%20Documents/India/1/INDIA%20INDC%20TO%20UNFCCC.pdf (accessed October 16, 2017).