Carbon Trading and Co-benefits Opportunities in Western Himalaya (Uttarakhand)

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FOREWORD

Uttarakhand lies in the northern extreme of India, in what is known as either the central, or by some descriptions, the eastern end of the western Himalayas in the country. About 1/6th of the state lies in the foothills or 'plains', with the rest ascending rapidly up, in a steep gradient, till the northern most end lies in the Upper Himalayan tracts, on a boundary shared with China, Nepal and the adjoining Indian state of Himachal Pradesh. Covered by what is technically a 70% plus forest cover which falls under the jurisdiction of the Forest Department, the state has a rural population which continues to largely depends on forest and common land resources for a substantial part of their livelihoods. This is also because rural infrastructure and markets in the region still require considerable development. In a region as tough to access, and where developing a sustainable job market for a growing population remains a difficult task, developing an understanding of what may well be a sustainable, environmentally friendly income option for the rural poor, makes both, economic and ecological sense.

This is a second edition of the original book published in 2012, updated and with a few new additions, by CEDAR. CEDAR, established in 2006, focuses upon research and analysis of the ecological soundness of systems and livelihoods of the Himalayan ecosystem, and is itself filling an intellectual and analytical space in Uttarakhand's 'on the ground' field of ecological research. Taking this thinking a step further, this book is designed in the form of a manual, and focuses, as the title states, on the issues of Carbon trading and possible benefits from the process, specifically with reference to Uttarakhand. It attempts to simplify and present, in a reader friendly manner, the complex

jargon of the subject, it's procedures and modalities. Although the text relies largely on secondary information as there is little of practical application in the field in the State, it represents an important contribution to the understanding of climate change and carbon trading procedures, and possibilities for the future.

When the idea of this book was originally discussed it was felt that it could fill a space which was yet unoccupied, targeting a range of interested persons - researchers, students of the subject, academics, policy makers as well as interested general readers. I expect it to further spark research, discussion and debate, and contribute to a larger interest of the various stakeholders, in participating in developing policy responses to maximise benefits under both, existing and debated international carbon trading mechanisms. As of now several activities are eligible for carbon trading, and because of the strong social capital of the community based organisations the State has, it is well suited for engagement under carbon trading activities, both under the compliance and voluntary markets. Initiating action in such areas would be a significant economic effort towards preserving Uttarakhand's natural and social capital, and hopefully, this book will be a first step in this direction.

February 18, 2014

Malavika Chauhan
Executive Director, Himmotthan, Dehradun

PREFACE

This book explores the prospects of generating financial rewards from Clean Development Mechanism projects, and the possibility of using REDD+ arrangements for increasing the resilience of vulnerable communities in Uttarakhand.

Since the industrial revolution, humans have caused the release of large quantities of carbon dioxide and various Green House Gasses (GHGs) into the Earth's atmosphere. There is strong evidence that these gasses are changing our planets climate. While the earth has gone through several swings in the course of geological time, never before has a single species impacted climate as much and as quickly as humans have. The 'Earth Summit' in Rio in 1992 focussed global attention on the perils of climate change and gave rise to the now well known Agenda 21. A few years later, in 1997 the Kyoto Protocol aimed at stabilising greenhouse gas concentrations to prevent human induced interference with the Earth's climate.

In the years since, global markets for carbon have developed, the importance of deforestation and forest degradation has been recognized, and efforts made to reign in the anthropogenic release of green house gases into the atmosphere. Market based mechanisms such as Emissions Trading and CDM helped create carbon markets to assist industrialised countries meet their emissions targets. However the refusal of the largest emitter - the United States - to ratify the protocol, and the global recession of 2008 have proved inhibitory and the initial progress made, specially by many European countries, has been somewhat diluted. Nonetheless awareness of global warming and its implications is significant, and in addition to

National Governments several corporations and individuals have attempted to reduce their carbon footprints both through lowered emissions and through accessing voluntary markets to mitigate their GHG footprint.

Developing countries such as India have benefitted from these developments that acknowledge the greater responsibility of Industrialised countries in reducing GHG emissions. CDM credits have been used to improve technologies in polluting industries, and incentivise cleaner forms of energy. REDD+ offers great potential for forested areas such as Uttarakhand where communities can potentially benefit from conserving good quality forest cover.

The high forest cover of Uttarakhand, potential for hydropower (including small hydropower projects), wind and solar power in exposed landscapes at higher attitudes, and potential to bundle small community based initiatives such as biogas, microhydels, and biomass gassifiers hold promise. However, complexities in procedure, difficulties in accurate measurement of net benefits, and ensuring permanence and sustainability of benefits raise questions on how easy or beneficial REDD+ projects will ultimately prove to be.

By attempting to demystify REDD and CDM, and recommending alignment of existing programmes such as MGNREGA and the National Aforestation Programme (NAP) with REDD+, it is hoped that this publication will contribute and raise awareness both in Uttarakhand and in other parts of the Himalaya.

ACKNOWLEDGEMENTS

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Thanks and appreciations also go to CEDAR team in developing the project and people who have willingly helped us out with their abilities.

STRUCTURE OF THE BOOK

In Chapter 1 we trace the history of Climate Change Negotiations. Starting from the early recognition of the warming potential of increased carbon dioxide in the atmosphere as a result of human activity, to strong evidence that global temperatures are rising and that anthropogenic activity is responsible for this increase, the first chapter outlines critical events such as the UN Conference on Human Environment in Stockholm in 1972, UN Conference on Environment and Development in Rio de Janeiro in 1992, the Kyoto Protocol of 1997, and various Conference of Parties (COP).

Chapter II elaborates on the Kyoto Protocol with reference to Clean Development Mechanisms. CDM, defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement emission-reduction projects in developing countries. Such projects can earn saleable certified emission reduction (CER) credits. The mechanism stimulates sustainable development and emission reductions in developing countries, while giving industrialized countries some flexibility on how to meet their emission reduction or limitation targets. This Chapter explains the various aspects of CDM, such as targets and offsets, and how they work.

Chapter III details the trading procedures starting from the types of carbon markets including compliance and voluntary markets, procedures involved in preparing and getting approved a CDM project, time required, and finding the right market for the project. It concludes by outlining the Indian scenario vis-à-vis CDM market.

Chapter IV describes Reduced Emission from Deforestation and Degradation (REDD) and India's position on REDD. The Intergovernmental Panel on Climate Change (IPCC) estimated emissions from deforestation in the 1990s to be 5.8 gigatons of carbon dioxide per year, or about 20% of annual global GHG emissions. The basic idea of REDD is rather straightforward: governments, companies or forest owners in the developing world should be compensated for conserving their forests. Making payments to avoid deforestation and forest degradation was discussed earlier in various Conference of Parties (COPs) but was ultimately rejected largely due to problems related to leakage, additionality, permanence and measurement. After considerable lobbying by the Coalition for Rainforest Nations led by Papua New Guinea in 2005, REDD came into existence. In December 2010, at COP-16, REDD formed a part of the Cancun Agreements. India still needs to put systems and policies in place to facilitate the proper implementation of REDD+.

Chapter V of the book explores the potential benefits from CDM and REDD/REDD+ in Uttarakhand. With 64.79% of the total geographical area classified under forest and with considerable hydro-power resources, Uttarakhand has a huge potential to generate revenue from REDD+ mechanisms. The state also has a fair degree of penetration of alternative energy initiatives such as bio gas, solar power, and water mills. Of the five activities listed in paragraph 70 of the AWG/LCA, Uttarakhand is eligible for four activities[7], one under REDD *(b)* and three under the 'plus' *(c, d and e)*. Furthermore efforts in the direction of REDD+ could likely dovetail with ongoing development programmes of the Central and the State governments such as NREGA and the National Afforestation Programme of the Government of India.

[7] *(b) Reducing emissions from forest degradation;*
(c) Conservation of forest carbon stocks;
(d) Sustainable management of forest;
(e) Enhancement of forest carbon stocks;

However, given the upfront cost of preparing a Carbon Credit report for CDM and REDD+, the challenges associated with bundling of individual units, the cumbersome monitoring requirements, and declining subsidies, it is as yet not clear if these can be economically tapped for carbon credits. At present, hydropower appears to be the most promising area to seek carbon credits.

The book concludes by underlining the large potential for CDM and REDD+ in the state. It notes that in order to tap into this potential the state would have to carry out preparatory work which would include making accessible in easy to understand language the guidelines and procedures related to CDM, mapping of government schemes that provide subsidy on developing alternative energy, using the SHG/Federation model for bundling, and forming a state level body for monitoring and guiding REDD+ programs.

ACRONYMS

AAUs	Assigned Amount Units
AHEC	Alternate Hydro Energy Centre
AWG	Ad Hoc Working Group
BRI	Brace Research Institute
CAMPA	Compensatory Afforestation Fund Management and Planning Authority
CBD	Convention on Biological Diversity
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CEDAR	Centre for Ecology Development and Research
CFCs	Chlorofluorocarbons
CHIRAG	Central Himalayan Rural Action Group
CIRN	Coalition for Rainforest Nations
COP	Conference of the Parties
CWET	Centre for Wind Energy Technology
DNA	Designated National Authority
DOE	Designated Operational Entity
DPR	Detail Project Report
EETS	European Emissions Trading Scheme
EFCS	Enhancement of Forest Carbon Stocks
ERUs	Emission Reduction Units
ET	Emissions Trading
EUETS	European Union Emission Trading Scheme
FAO	Food and Agriculture Organisation
FCCC	Framework Convention on Climate Change
FCPF	Forest Carbon Partnership Facility
FDA	Forest Development Agency
FIP	Forest Investment Program
GEF	Global Environment Fund
GHGs	Green House Gases

GIS	Geographic Information Systems
GWP	Global Warming potential
HEP	Hydroelectric power
HESCO	Himalayan Environmental Studies and Conservation Organisation
HFCs	Hydro Fluorocarbons
IFLDP	Integrated Livestock and Fodder Development program
IGES	Institute of Global Environmental Strategies
IIT	Indian Institute of Technology
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JFMC	Joint Forest Management Committee
JI	Joint Implementation
KP	Kyoto Protocol
LCA	Long-term Cooperative Action
LULUCF	Land Use, Land-Use Change and Forestry
MGNREGAS	Mahatma Gandhi National Rural Employment Guarantee Scheme
MoEF	Ministry of Environment and Forests
MRV	Monitoring Reporting and Verification
MW	Megawatts
NABARD	National Bank of Agriculture and Rural Development
NAP	National Afforestation Programme
NAPCC	National Action Plan on Climate Change
NCDMA	National CDM Authority
ODA	Official Development Assistance
PACE	Promoting Access to Carbon Equity Centre
PDD	Project Design Document
PFCs	Per Fluorocarbons
PPP	Public Private Partnership
RECs	Renewable Energy Credits
RED	Reduction Emissions from Deforestation

REDD	Reduction Emissions from Deforestation and forest Degradation
RGI	Regional Greenhouse Gas Initiative
SBSTA	Subsidiary Body for Scientific and Technical Advice
SGDP	State Gross Domestic Product
SHP's	Small Hydropower Projects
SMF	Sustainable Management of Forests
SPV	Special Purpose Vehicle
UJVNL	Uttaranchal Jal Vidyut Nigam Limited
UN	United Nations
UNEP	United Nations Environment Program
UNCED	United Nations Conference on Environment and Development
UNFCCC	United Nations Framework Convention on Climate Change
UREDA	Uttarakhand Renewable Energy Development Agency
VCS	Voluntary Carbon Standard
VER	Voluntary Emission Reduction
VP's	Van Panchayats
WMO	World Meteorological Organization

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CHAPTER 1

Brief History of Climate Change and International Negotiations

The recognition that gases in the environment trap heat close to the Earth goes back to 1827 when Jean-Baptiste Fourier first noted it (Houghton, 1997). The phenomenon was established in 1861 by John Tyndall using the technique of quantitative spectroscopy. In 1896 Svante Arrhenius, a Swedish scientist, came up with the idea that carbon dioxide emissions from the combustion of coal had the potential to increase the greenhouse effect and lead to global warming (McGraw-Hill Encyclopedia, 1997). Since then scientists are increasingly more unanimous on human induced global warming, a consequence of increased concentration of heat trapping gases in the atmosphere released as a result of human activity. In the mid 1970's several other gases were also identified as greenhouse gases: chlorofluorocarbons (CFCs), methane and nitrous oxide to name a few.

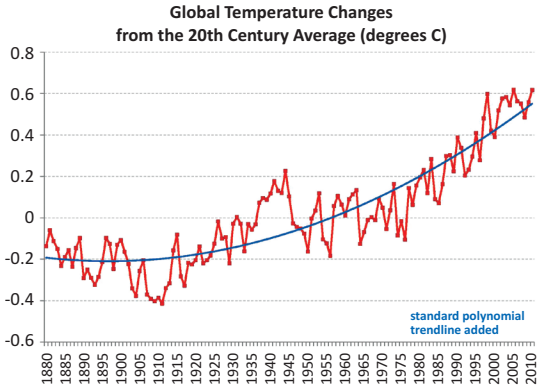


Fig. 1a Global Temperature Changes from 20th Century Average (degrees C) Peter H. Gleick, January, 2011

Global warming potential (GWP) is a relative measure of how much heat a green house gas traps in the atmosphere. It compares

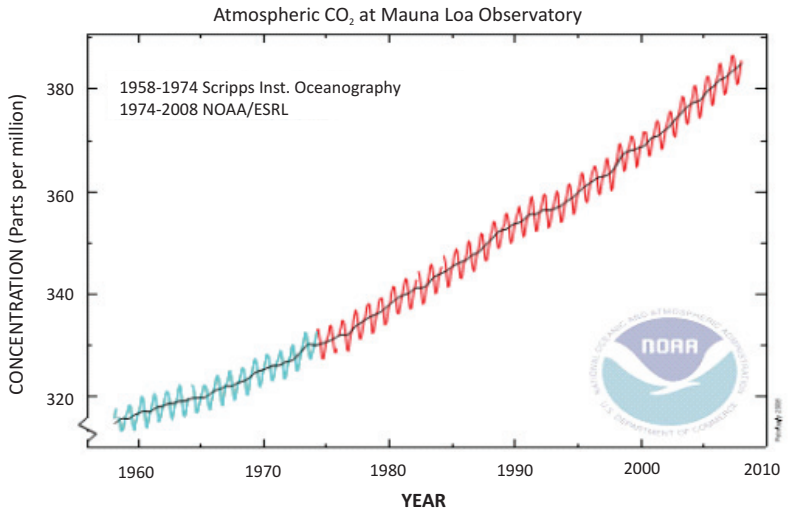


Fig 1b. A composite trigonometry graph of atmospheric CO_2 at Mauna Loa Observatory
(Source: National Oceanic & Atmospheric Administration)

the amount of heat trapped by a certain mass of the gas in to the amount of heat trapped by a similar mass of carbon dioxide. The GWP of carbon dioxide is exactly 1 (it is the baseline unit to which all the other GHG's are compared). GWP is calculated over a specific time interval, commonly 20,100, or 500 years. GWP of major GHG's are given below

Table1. GWP values and lifetimes (from 2007 IPCC AR4)

GHG	Lifetime (years)	GWP time horizon		
		20 years	100 years	500 years
Methane	12	72	25	7.6
Nitrous oxide	114	289	298	153
HFC-23 (hydrofluorocarbon)	270	12,000	14,800	12,200
HFC-134a (hydrofluorocarbon)	14	3,830	1,430	435
Sulfur hexafluoride	3200	16,300	22,800	32,600

In recent years temperatures have risen dramatically, reaching a new high in 2005[7]. In addition to temperature records, there is other evidence to bolster the case that the Earth is warming. The examples include glacier melt in the Himalayas and other parts of the world (Dyurgerov and Meier, 2005) (Figure 2), upward march of plant species, and increase in the length of the growing season (Singh *et. al* 2010). While there is ambiguity about the details of global warming due to incomplete understanding of the complex processes involved, there is a consensus that climate change is happening and humans are largely to blame for it. The amount of greenhouse gases that the humans add to the ambient air is enormous – 26 billion tonnes per year for carbon dioxide alone the total is about 4 metric tonnes per person per year (Henson, 2006). This said, there are skeptics who maintain that a century old record is not enough to prove that humans are the main contributors to global warming. "Earth's atmosphere has gone through countless temperature swings in its 4.5 billion years of existence, the past raises the question: how can we be sure that global warming is not "natural" (Henson, 2006). These concerns were tackled by the Intergovernmental Panel on Climate Change (IPCC) in its 2nd and 3rd Assessment Reports (1995, 2001). Referring to the work of scientists across the globe these reports state that *"there is a new and stronger evidence that most of the warming observed over the last 50 years is attributable to human activities"* (IPCC, Third Assessment Report, 2001).

Governments of concerned nations addressed issues of global environmental needs for the first time when the UN Conference on Human Environment in Stockholm in 1972. The focus of the deliberations was international cooperation to minimize the

[7] The five warmest years since the late 1880s in descending order, according to NASA scientists, are 2005, 1998, 2002, 2003 and 2006-Credit: NASA (http://earthobservatory.nasa.gov/IOTD/view.php?id=80167)

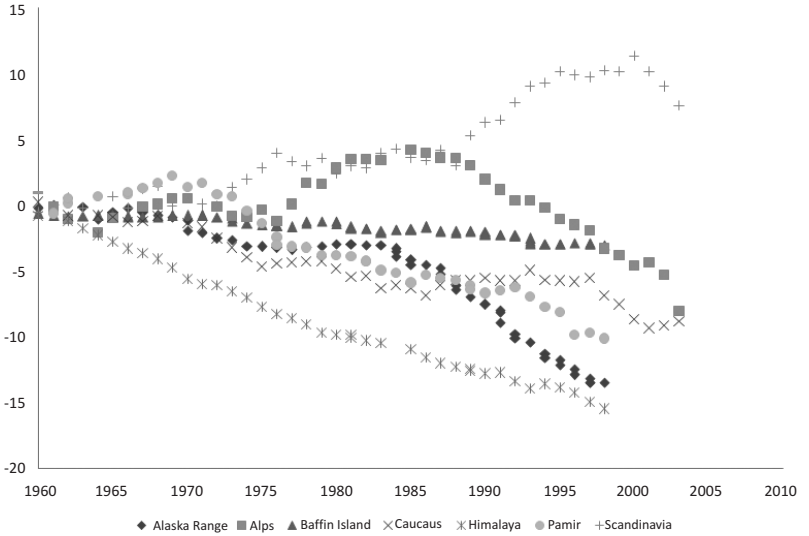


Fig. 2 Rapid retreat of greater Himalayan glaciers in comparison to the global average
(Source: Dyurgerov and Meier, 2005 adopted by Singh et al. 2010)

impact of greenhouse gases on the environment. Subsequently, the United Nations the Intergovernmental Panel on Climate Change was created in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Program (UNEP) as part of the efforts to provide the world with clear scientific knowledge of what is happening to global climate.

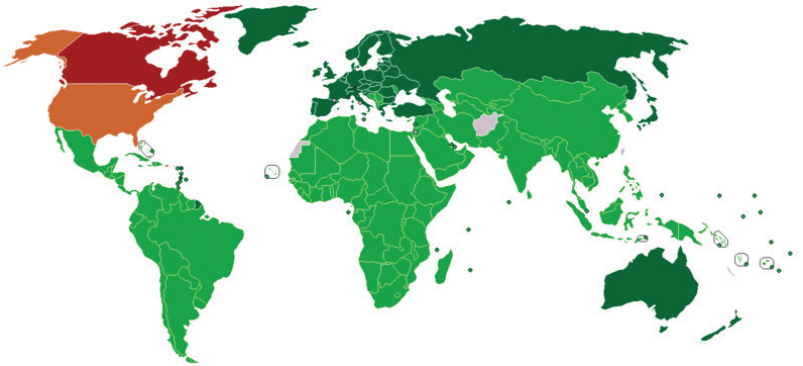
Twenty years later the landmark UN Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992, focused on broader issues of international relationship and environmental trends. The Conference, also known as Rio Convention or the "*Earth Summit*" produced the Rio Declaration and Agenda 21 (a plan of action for the UN organizations, Governments, and major groups to work in areas where human activities have a negative impact on the environment) and also led to agreements on two other legally binding conventions – the United Nations Framework Convention on Climate Change (UNFCCC) and Biological Diversity.

UNFCCC is the key international treaty to reduce global warming and cope with the consequences of climate change.

In 1997, negotiations in Kyoto, (Japan) led to the formulation of the Kyoto Protocol. The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC or FCCC), aimed at reducing global warming by achieving *"stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system".* It was adopted on 11 December 1997 and came into force on 16 February 2005[8]. The IPCC Second Assessment Report of 1995 provided key input to and thereby paved the way for the adoption of the Kyoto Protocol in 1997. Currently, 192 states have signed and ratified the protocol.

Its numerous positive features notwithstanding, the exclusion of deforestation, forest degradation, and conservation of forest carbon stocks from the Kyoto Protocol resulted in the formation of the Coalition for Rainforest Nations (CIRN). Participant nations included Papua New Guinea, Costa Rica and other forest nations. In 2005, at the 11th Conference of the Parties (COP-11), the Coalition for Rainforest Nations lobbied for inclusion of 'reduced emissions from deforestation in developing countries.' Later, in 2007 at Bali UNFCCC meeting (COP-13), an agreement was reached on "the urgent need to take further meaningful action to reduce emissions from deforestation and forest degradation". The parties to the UNFCCC confirmed their commitment to

[8] The Protocol entered into force on 16 February 2005 in accordance with Article 23, that is the ninetieth day after the date on which not less than 55 Parties to the UNFCCC, incorporating Parties included in Annex I which accounted in total for at least 55 % of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession. (http://unfccc.int/kyoto_protocol/status_of_ratification/items/2613.php)



Green = Countries that have signed and ratified Kyoto Protocol
Dark green = Annex I and II countries that have ratified Kyoto Protocol
Grey = Countries that have not yet decided
Brown = No intention of ratifying the Protocol.

Fig. 3 The Kyoto World as of December, 2010
(Source: Kyoto Protocol participation map 2010)

address the global climate challenge through the *Bali Action Plan* and the *Bali Road Map* 7, an agreement to be completed at the COP to the UNFCCC in Copenhagen at the end of 2009. The agreement includes reference to REDD, specifically calling 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; {1.(b)(iii)}".

Since 2005, UNFCCC Parties have had extensive discussions about the scope of REDD. These discussions began with RED (Reducing Emissions from Deforestation) and expanded to REDD (Reducing Emissions from Deforestation and Forest Degradation) in Bali (2007) with consideration of forest degradation, and broadened further to consider forest conservation, sustainable forest management, and enhancement of forest carbon stocks (REDD+).

Box 1. Important years to remember

- 1972 – UN Conference on Human Environment , Stockholm
- 1988- Creation of Intergovernmental Panel on Climate Change (IPCC)
- 1989- Montreal Protocol came into force
- 1990 - IPC C 1st Assessment Report (AR1)
- 1992- Earth Summit Rio de Janeiro
- 1994- United Nations Framework Convention on Climate Change (UNFCC) came into force
- 1995- IPCC 2nd Assessment Report (AR2)
- 1997- Kyoto Protocol adopted
- 1998- Second warmest year since 1880
- 2001- IPCC 3rd Assessment report (AR3)
- 2005 – Kyoto Protocol came into force
- 2005 – Warmest year since 1880
- 2007 – Bali Action Plan adopted
- 2007- IPCC 4th Assessment Report (AR4)
- 2009- Copenhagen Accord
- 2010- Cancun Agreements
- 2012- second Commitment period of Kyoto Protocol adopted

CHAPTER 2

The Kyoto Mechanism

After the Kyoto Protocol became an international law in 2005, many countries struggling to meet their reduction in emission targets accelerated efforts to do so. They were assisted by several market based mechanisms embedded in the protocol, intended to assist countries meet their targets at lowest possible cost and included:

2.1.1. Emissions Trading (ET)

Emissions trading allows countries that have emission units to spare – that is emissions permitted but not "used" - to sell this excess capacity to countries that exceed their emission targets. Thus, a new commodity was created in the form of emission reductions or removals. Since carbon dioxide is the principal greenhouse gas, people speak simply of trading in carbon. Carbon could now be tracked and traded like any other commodity"

2.1.2 Clean Development Mechanism (CDM)

The Clean Development Mechanism (CDM), defined in Article 12 of the Protocol, allows a country with an emission-reduction or emission-limitation commitment under the Kyoto Protocol (Annex B Party) to implement emission-reduction projects in developing countries (Fig. 4). Such projects can earn saleable 'Certified Emission Reduction' (CER) credits, each equivalent to one tonne of CO_2, which can be counted towards meeting Kyoto targets. The mechanism is seen by many as a 'trailblazer'. It is the first global environmental investment and credit scheme of its kind, providing standardized emissions offset instrument, CERs. The mechanism motivates sustainable development and emission reductions in developing countries, while providing

Box 2. Three purposes

Avoids restrictions on their development, as emissions are strongly linked to industrial capacity

- **They can sell emission credits** to nations whose operators have difficulty meeting their emission targets
- **They get money and technology** for low-carbon investments from Annex II (industrialized) countries.

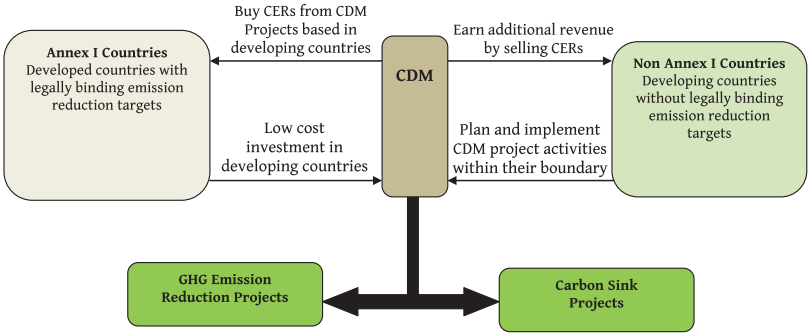


Fig. 4 CDM Mechanism Adopted from: Green Clean Guide

industrialized countries some flexibility in how they achieve their emission reduction targets.

2.1.3 Joint Implementation (JI)

This mechanism, allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn 'Emission Reduction Unit's' (ERUs) from an emission-reduction or emission removal project in another Annex B country, each equivalent to one tonne of CO_2, which can be counted towards meeting its Kyoto target.

Joint implementation offers Annex B Parties a flexible and cost-efficient means of fulfilling a part of their Kyoto commitments, while the host Party benefits from foreign investment and technology transfer.

2.2 TARGETS

A central authority (usually a governmental body) sets a limit or cap on the amount of a pollutant that can be emitted. The limit or cap is allocated or sold to firms in the form of emission permits

Box 3. Key elements of carbon finance projects

- Available only for projects that reduce greenhouse gas emissions
- Projects must contribute to sustainable development of host country
- The emission reduction as a consequence of a project needs to be measured and verified before carbon credits can be calculated and sold

Source: Carbon Finance 2010

which represent the right to emit or discharge a specific volume of specified pollutant. Firms are required to hold a number of permits equivalent to their emissions. The total number of permits cannot exceed the cap, limiting total emissions to that level. Firms that need to increase their emission levels must buy permits from those who require fewer permits. The transfer of permits is referred to as trade. In effect, the buyer is paying a charge for polluting while the seller is being rewarded for having reduced emissions. Thus, in theory, those who can reduce emissions most efficiently will do so, thereby achieving aggregate pollution reduction at the lowest cost to society.

2.3 OFFSETS

Offsets are typically achieved through financial support to projects that reduce the emission of greenhouse gases. The most common project type is renewable energy such as wind, biomass, and hydroelectric. Other examples include energy efficiency projects, the destruction of industrial pollutants, destruction of landfill methane, and forestry projects.

CDM identifies over 200 types of projects suitable for generating carbon offsets, which are grouped into a few broad categories.

These include renewable energy, methane abatement, energy efficiency, reforestation and fuel switching.

2.31 Destruction of industrial pollutants

Industrial pollutants such as Hydrofluorocarbons (HFCs) and Perfluorocarbons (PFCs) have a GWP many thousands of times greater than that of carbon dioxide by volume. Because these pollutants are easily captured and destroyed at source, they present a large and low-cost source of carbon offsets. As a category, HFCs, PFCs, and N_2O reductions represent 71 percent of offsets issued under CDM.

2.3.2 Renewable energy

Renewable energy offsets commonly include wind power, solar power, hydroelectric power and bio-fuel. These offsets help reduce the cost differential between renewable and conventional energy production, increasing the commercial viability of renewable energy sources. Renewable Energy Credits (RECs) are also sometimes treated as carbon offsets, although the two concepts are distinct. Whereas a carbon offset represents a reduction in greenhouse gas emissions, an REC represents a quantity of energy produced from renewable sources. To convert RECs into offsets, the clean energy must be translated into carbon reductions, typically by assuming that the clean energy is displacing an equivalent amount of conventionally produced electricity from the local grid. This is known as an indirect offset (because the reduction doesn't take place at the project site itself, but rather at an external site), and there is controversy about whether REC truly lead to "additional" emission reductions and who should get credit for any reductions that may occur.

2.3.3 Methane collection and combustion

Some offset projects involve combustion or containment of methane generated by farm animals (by use of an anaerobic

digester), landfills or other industrial waste. Methane has a global warming potential (GWP) 23 times that of CO_2. When combusted, each molecule of methane is converted to one molecule of CO_2, thus reducing the global warming effect by 96%. For example in December 2000, the largest pork production company in Chile, initiated a voluntary process to implement advanced waste management systems (anaerobic and aerobic digestion of hog manure) in order to reduce greenhouse gas (GHG) emissions.

2.3.4 Energy efficiency

While carbon offsets, which fund renewable energy projects help lower the carbon intensity of energy *supply*, energy conservation projects seek to reduce the overall *demand* for energy. Carbon offsets in this category fund projects of several types:

1. Cogeneration plants generate both electricity and heat from the same power source thus improving upon energy efficiency
2. Fuel efficiency projects replace a combustion device with one which uses less fuel per unit of energy provided.
3. Energy-efficient buildings reduce the amount of energy consumed in buildings by putting in place efficient heating, cooling or lighting systems. In particular, the replacement of incandescent light bulbs with compact fluorescent lamps can have a dramatic effect on energy consumption. New buildings can also be constructed using less carbon-intensive materials.

2.3.5 Land use, land-use change and forestry

Land use, land-use change and forestry (LULUCF) projects focus on natural carbon sinks such as forests and soil. Deforestation and forest degradation account for about 18 percent of global greenhouse gas emissions—larger than the entire global transportation sector (Meridian Institute, Norway, 2011). These

can be avoided either by paying directly for forest preservation, or by using offset funds to provide substitutes for forest-based products. REDD schemes (Reducing emissions from deforestation and forest degradation), may be included in a post-Kyoto agreement. REDD credits provide carbon offsets for the protection of forests and provide a possible mechanism to allow funding from developed nations to assist in the protection of native forests in developing nations. Almost half of the world's population burns wood (or fiber or dung) for cooking and heating needs. Fuel-efficient stoves can reduce fuel wood consumption by 30 to 50 percent (BRI, 1976).

Types of LULUCF projects include:

- **Avoided deforestation**: the protection of existing forests.
- **Reforestation**: restoring forests on land that was once forested.
- **Afforestation**: creating forests on land that was previously not under forest, typically for longer than a generation.
- **Soil management**: projects that attempt to preserve or increase the amount of carbon sequestered in soil.

CHAPTER 3

Carbon trading procedure

Purchasers can offset their carbon emissions by purchasing carbon allowances from legally mandated cap-and-trade programs such as the Regional Greenhouse Gas Initiative (RGI) or the European Emissions Trading Scheme (EETS). Voluntary purchases can also be made through small-scale, and sometimes uncertified, schemes such as those offered by South African based Promoting Access to Carbon Equity Centre (PACE), which nevertheless offer clear services such as poverty alleviation in the form of renewable energy development. Once it has been accredited by the UNFCCC a carbon offset project can be used as carbon credit and linked with official emission trading schemes such as the European Union Emission Trading Scheme (EUETS) or Kyoto Protocol as Certified Emission Reductions (CER).

3.1 CARBON MARKETS

Two types of markets exist for carbon trading

- **Compliance Market**
- **Voluntary markets**

3.1.1 Compliance Market

The compliance market is driven by governments and corporations subject to carbon constraints under the Kyoto Protocol, EU regulations, and other developed-country climate policies.

In the compliance market, companies, governments or other entities buy carbon offsets in order to comply with caps on the total amount of carbon dioxide that they are allowed to emit. In other words, this market exists in order to achieve compliance with obligations of Annex I Parties under the Kyoto Protocol

and of liable entities under the EU Emissions Trading Scheme. In 2006, about US$5.5 billion of carbon offsets were purchased in the compliance market, representing about 1.6 billion metric tons of CO_2e reductions (World Bank. 2007).

In the early years the compliance market grew at about 100% per year – for both traded volumes and total value (World Bank, 2008). Mechanism (CDM) project activities allows constrained governments and firms to partially satisfy their commitments by purchasing CERs from emissions-reduction projects in developing countries. During 2007, the primary and secondary market for CERs traded 800 million tons of carbon dioxide equivalent valued at US$13 billion In addition to carbon value, the World Bank estimates that the CDM leveraged US$33 billion in clean energy investment in 2007 alone (World Bank, 2008). However in recent years this market crashed post 2008.

As of March 2013 there are over 6,663 total registered CDM projects by host countries. 52.8% of the total projects are registered by China followed by 18.4 percent by India and 4.1 percent by Brazil. Around 75% of the total projects registered are from China, India and Brazil. (Fig 5).

3.1.2 Voluntary market

In the much smaller voluntary market, individuals, companies, or governments purchase carbon offsets to mitigate their own greenhouse gas emissions from various sources. For example, an individual might purchase carbon offsets to compensate for the greenhouse gas emissions caused by personal air travel. Many companies offer carbon offsets as an up-sell at the time of selling a product or service so that customers can mitigate the emissions related with product or service purchase (such as offsetting emissions related to a vacation flight, car rental, hotel stay or consumer goods). In 2008, about US$705 million carbon

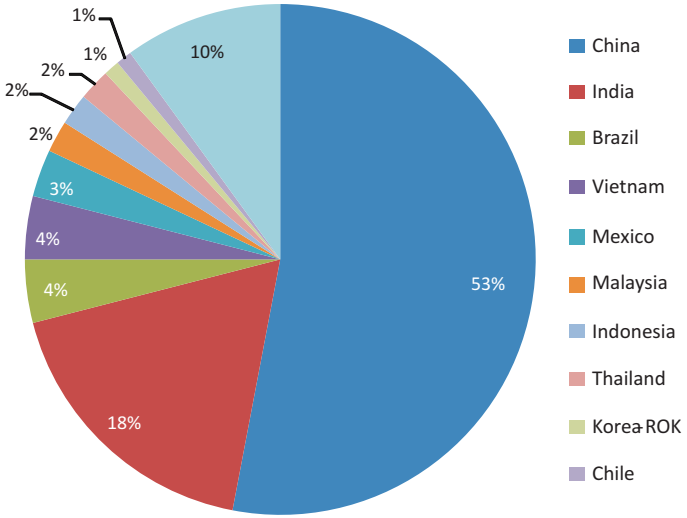


Fig. 5 Distribution of registered projects by host party
Source: UNFCCC, March 2013

offsets were purchased in the voluntary market, representing about 123.4 million metric tons of CO_2e reductions (State of the Voluntary Carbon Markets, 2009).

3.2 PROCEDURE

Obtaining carbon finance is a time and resource consuming process and requires intricate calculations. Carbon finance relies on payments after the delivery of verified data. Hence, a thorough monitoring of all the required data such as resources, energy consumption pattern etc. needs to be done. Finally, it is important to get third party evidence for all numbers in question. The auditing process in carbon finance is very rigorous and an experienced partner might be needed to help get through the validation and registration of the concerned project.

Carrying out a CDM project and receiving final registration by the CDM Executive Board requires multiple steps (Fig. 7). These steps are regarded as the CDM project cycle, and are put in place

in order to safeguard the actual climate benefits of CDM project activities. Pre planning includes (Fig. 6).

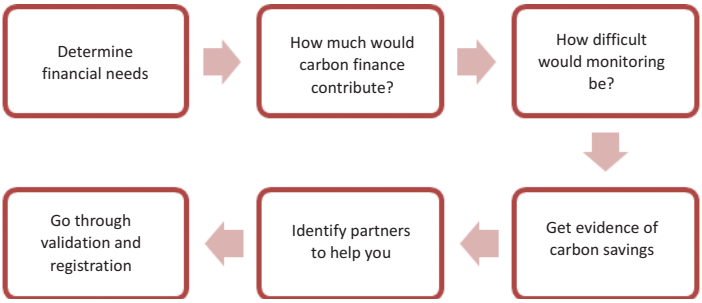


Fig. 6 Preplanning for CDM
Source: Adopted from Carbon Finance guide, 2010

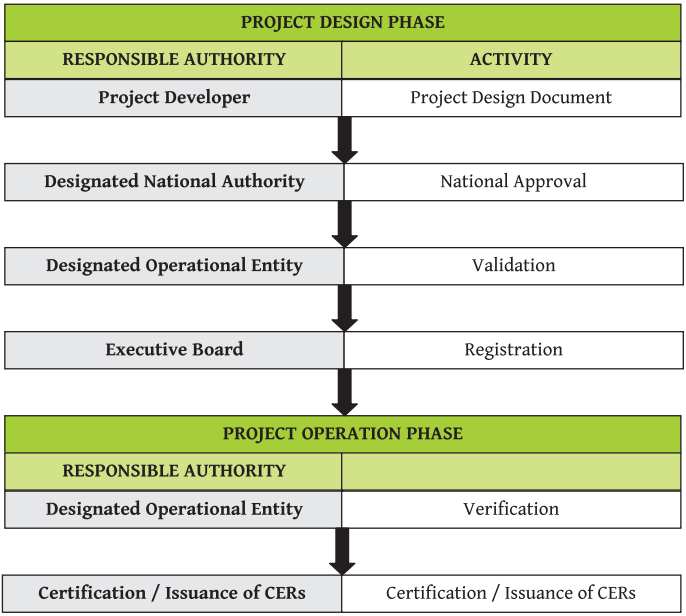


Fig. 7 Auditing process in Carbon finance
Source: Adopted from James-Smith(2005)

3.3 TIME REQUIRED FOR PROCESSING

The process is lengthy and it can take two to three years from the start until the receipt of the first revenues from carbon

finance. Under ideal conditions (all information and structures in place) for small-scale projects, the actual time frame for the PDD (Project Document Design) development would be about seven months; DNA (Designated National Authority) approval - 2 months; Validation – 2 months; and Registration – 3 months.

3.4 FINDING THE RIGHT MARKET

The UN approved CDM route is more difficult for small projects but gives better prices (though at a higher cost) than standards in the voluntary market, which are often easier and quicker to achieve. A comparison between the two helps determine the most suitable market for a particular project.

3.5 STANDARDS TO VERIFY EMISSION REDUCTIONS

3.5.1 Certified Emission Reductions: CERs or Emission Reduction Units (ERUs) are a type of emissions unit (or carbon credits) issued by the Clean Development Mechanism (CDM) Executive Board for emission reductions achieved by CDM projects and verified by DOE (Designated Operational Entities) under the rules of the Kyoto Protocol. CER/ERU is a generic term for any tradable certificate or permit representing the right to emit one tonne of carbon or carbon dioxide equivalent (tCO_2e).

3.5.2 CDM Gold Standard

It exists in two varieties, as an additional quality proof of community benefits for CDM projects as well as a standard in itself for voluntary projects. **Voluntary Gold Standard (VER Gold Standard)** sells at a premium of up to 20% in both markets. It only covers renewable energy and energy efficiency. Apart from producing emission reductions, Gold Standard projects are assessed for the contribution to sustainable development and local stakeholder benefits. It emphasizes community participation, and requires more extensive stakeholder engagement than under normal CDM rules. Moreover, the ***Voluntary Gold Standard***

provides special rules for micro-projects (less than 5,000 tCO_2e/year) to encourage their development.

Table 2: Comparison between Compliance and Voluntary Market

	Compliance Market	Voluntary Market
	The compliance market is driven by governments and firms subject to carbon constraints under the Kyoto Protocol, EU regulations, and other developed-country climate policies.	Participants involved in the voluntary market include providers of different types of offsets, developers of quality assurance mechanisms, third party verifiers, and consumers who purchase offsets from domestic or international providers. Suppliers include for-profit companies, governments, universities, and other organizations.
Process of meeting requirements	Undergoes a complex and prolonged procedure. Is expensive.	Simpler evaluation, limited monitoring, less time consuming and comparatively cheaper.
Approval	UN CDM Executive Board has the final say.	Host country approval required.
Technology	The modalities and procedures are defined under the Kyoto Protocol and are governed by the UN. For many technologies approved carbon credit methodologies can be difficult and especially stringent under the CDM.	There is a possibility to use methodologies that are not currently permitted under the CDM system but which still have the potential to verify greenhouse gas emissions and thereby create marketable carbon credits
Feasibility	CDM methodologies, which involve considerable transaction costs and resource needs and are viable for large projects.	Registration and verification in the voluntary market are less resource intensive than under the CDM. Hence, feasible even for small projects.

Expected Revenue from Carbon Credits	CDM standards have perceived robustness and rigor. Thus credits fetch higher price. CDM credits (CERs) can also be used to meet regulatory requirements by European firms regulated by the Emissions Trading System (EU ETS).	The price for VERs is comparatively less.
Participating Countries	Valid for Greenhouse gas emission reduction projects in developing countries.	Projects can be implemented in countries that have not ratified the Kyoto Protocol
Use	Credits from the projects can be used to offset emissions in industrialized countries.	Credits from projects cannot be used by industrialized countries to meet targets under the Kyoto Protocol.
Additionally	Projects should promote sustainable development in the host country	Often consumers buy them to offset their high carbon footprint
Accountability	It being monitored by DNA (Designated National Authorities) and CDM-Executive Board, CER has more accountability both qualitatively and quantitatively.	Brokers providing services sometimes of questionable or no value. A verification deficit makes it difficult for buyers to assess the true value of carbon credits.

***Source adopted from Kollmuss et al. 2008.*

3.5.3 Voluntary Carbon Standard (VCS)

This has started to emerge as a widely used, scalable and well recognized standard, modeled on the CDM but allowing for methodologies that have not yet been approved under the CDM. Unlike the Gold Standard, the VCS covers forestry and agricultural projects.

3.5.4 VER+

The voluntary standard which is also closely linked to the CDM methodology but has largely been made redundant by the Voluntary Carbon Standard (VCS).

3.5.5 Climate, Community and Biodiversity Standard

This is a widely used additional quality label for forestry and agricultural projects that adds more value to a CDM or VCS methodology. It is not a carbon standard as such but is used in conjunction with other standards.

3.6 THE INDIAN SCENARIO

As per the UNFCCC and IGES (Institute of Global Environmental Strategies) CDM Project Data base on November 30th 2012, there are 959 projects from India registered with the CDM Executive Board. The largest shares of the total registered projects is in the category of wind power (38%) followed by biomass (21%) (Fig. 8). As against this, only 7 projects have been registered under afforestation and reforestation, and only one in the category of

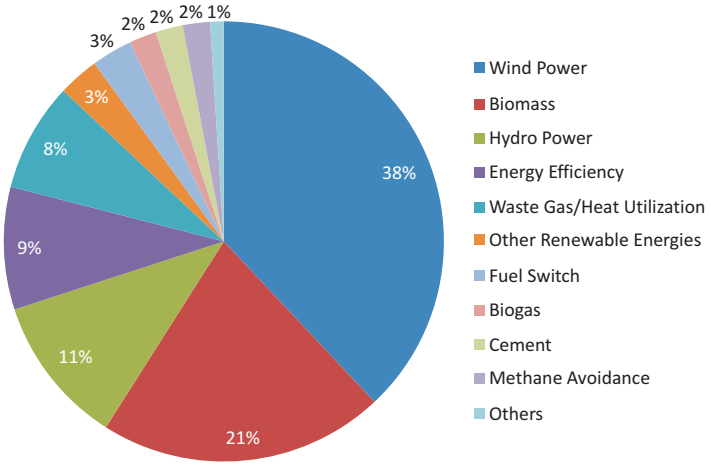


Fig. 8 Types of CDM Projects registered with CDM Executive Board as on 30.11.2012 *(IGES, 2013)*

PFC (per fluorocarbon) reduction. The average annual emission reduction is largest from HFC (hydro fluorocarbons) avoidance due the high global warming potential (GWP) of HFC's.

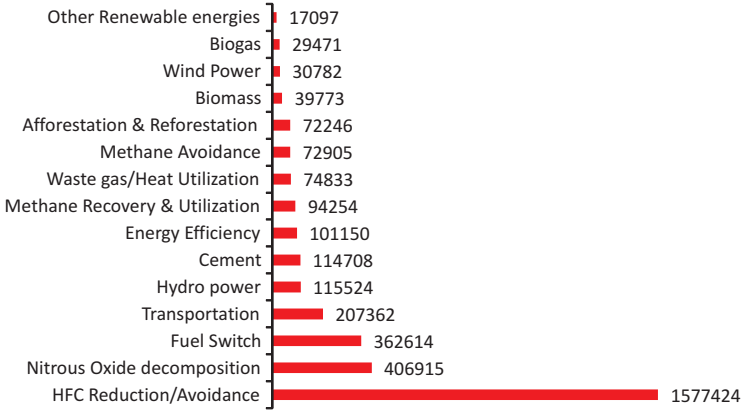


Fig. 9 Average annual emission reductions from various sectors *(IGES, 2013)*

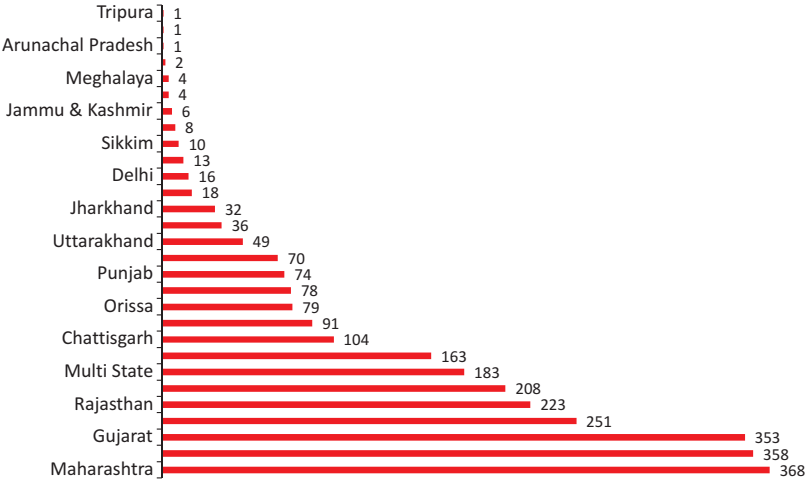


Fig. 10 State wise CDM projects registered with National CDM Authority *Source: NCDMA, 2013*

The largest number of projects 368 are from Maharashtra. Among Himalayan states 91 of the registered projects are from Himachal Pradesh and 49 from the state of Uttarakhand. The share of North Eastern states is miniscule.

CHAPTER 4

REDD plus and India's position

Reduction Emissions from Deforestation and Forest Degradation (REDD), is one of the most hotly debated issues in international climate change deliberations. Globally deforestation is occurring at a rate of approximately 13 million hectares per year, an area larger than the geographical area of Uttarakhand, Himachal Pradesh and Sikkim put together (FAO, 2007 and CBD, 2011). The Intergovernmental Panel on Climate Change (IPCC) estimated emissions from deforestation in the 1990s to be at 5.8 gigatons of carbon dioxide per year or about 20% of annual global greenhouse gas emissions (CBD, 2011). The basic idea of REDD is simple: governments, companies or forest owners in the developing world should be compensated for conserving their forests. The complication, as always, is in the fine print.

Making payments to avoid deforestation and forest degradation was discussed in various conferences of parties but was ultimately rejected essentially because of problems related to leakage[7], additionality[8], permanence and measurement. These problems have been debated thoroughly but remain

[7] Leakage refers to the situation in which a carbon sequestration activity (e.g., tree planting) on one piece of land inadvertently, directly or indirectly, triggers an activity, which in whole or part, counteracts the carbon effects of the initial activity. (For example, protect one forest from lopping and but then lop the same amount in another forest.

[8] Reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of a project activity.

Box 4. From RED to REDD+

RED: stands for Reduction Emissions from Deforestation – proposed by Coalition for Rainforest Nations led by Papua New Guinea in 2005 (COP-11)

REDD: The second '*D*' "degradation" was added in Bali (COP-13) in 2007 and termed as Reduction Emissions from Deforestation and Degradation

REDD+: includes 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.

a bottleneck in implementing REDD. After considerable lobbying by The Coalition for Rainforest Nations led by Papua New Guinea in 2005, REDD came into existence. It was further discussed in Bali (COP-13) 2007. In December 2010, at COP-16, REDD formed a part of the Cancun Agreements, in the Outcome of the Ad Hoc Working Group on long-term Cooperative Action under the Convention.

REDD is described in paragraph 70 of the AWG/LCA outcome:
"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:

(a) Reducing emissions from deforestation;
(b) Reducing emissions from forest degradation; } Points a and b are the REDD points

(c) Conservation of forest carbon stocks;
(d) Sustainable management of forest;
(e) Enhancement of forest carbon stocks; } Point's c, d and e are the "plus points" in REDD+

The two basic mechanisms of REDD funding can be from government funds, for example the Norwegian government's

International Forest and Climate Initiative, or from private parties. The diagram below shows the key elements of the REDD-plus mechanism (Fig. 11)

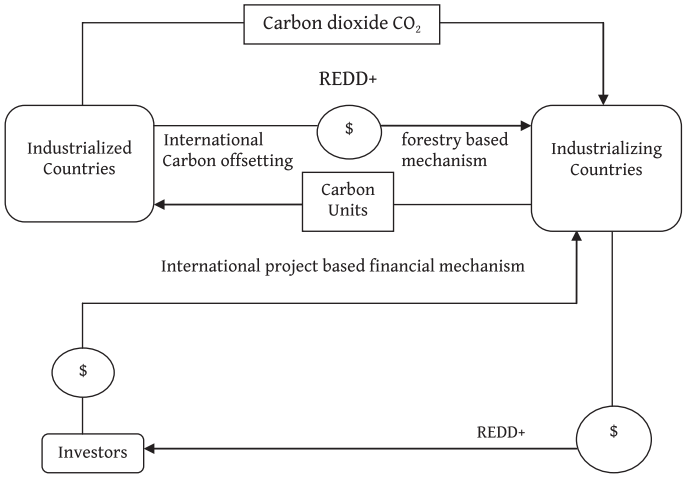


Fig. 11 REDD+ mechanism
Source: Adopted from Carbonex Capital, 2011

4.1 FINANCING REDD

As long as REDD is not part of a binding post-2012 climate deal, it will be funded mainly through the voluntary carbon market. For the preparatory phase, funds are already being made available to countries through bilateral and multilateral arrangements such as the Forest Carbon Partnership Facility (FCPF) of the World Bank and the UN REDD programme. Some countries have as yet not received funding for the preparatory or readiness phase. It is expected that for the second phase of 'policies and measures', multilaterals will still be one of the main sources of funding, for example through the Forest Investment Program (FIP) of the World Bank and through bilateral arrangements (IUCN, 2011)

4.2 IMPLEMENTATION

REDD policies encourages forest users such as indigenous peoples, forest communities and forest land owners as well

as organizations, government agencies, project developers and investors to strengthen activities that conserve forests, sustainably manage forests and enhance forest carbon stocks, and to stop or reduce activities that lead to deforestation and degradation of forests. (IUCN, 2011)

Government agencies will have to develop policy frameworks that provide incentives for REDD action and investment. In particular, communities that live in and depend on forests will implement REDD activities on the ground. However, REDD has not yet received a green signal from UNFCCC. One of the major issues stalling it is the need to create a multilevel (national and international) scheme of implementation. At the international level service buyers will make payments (generated by voluntary or compliance markets) to service providers (governments or sub national entities in developing countries). Direct payments from international to subnational level are only possible where transactions are approved by national government agency as by Designated National Authority (DNA) in the case of CDM.

Box 5. Pro poor approach

An estimated 1.6 billion people worldwide, many of these among the poorest on the earth, depend on forests. Pro-poor approach puts the focus of REDD on the interests of these most vulnerable groups. Key elements include development of sustainable livelihoods for forest communities, good governance, and transparency.

Box 6. Difference between CDM and REDD - plus mechanism

The 2001 Marrekech Accord stipulated that in the context of forest-related mitigation only afforestation and reforestation projects fall under CDM. REDD differs in that it focuses on possibilities to reduce emissions from deforestation and forest degradation as well as on the capacity of forests to conserve carbon. REDD-plus therefore also includes conservation, the sustainable management of forests, and the enhancement of forest carbon stocks.

COP-16 in Cancun agreed on the REDD+ policy approaches and positive incentives, including guidance on activities and safeguards to be promoted and supported. UNFCCC continues to explore financing options for the full implementation of the results-based actions. In the meantime, many countries have called for immediate and significantly scaled-up action to build capacity and readiness to address the multiple challenges associated with reducing emissions from deforestation and forest degradation as well as addressing conservation, sustainable management of forests, and enhancement of forest carbon stocks.

The final step in defining the framework of a REDD proposal is working out where the funds will come from. The sources of financing discussed refer explicitly to revenue that would be used to incentivize emissions reductions under a REDD mechanism, as opposed to other funding that might be targeted at capacity building or conservation of carbon stocks.

4.3 OPTIONS for FINANCING

Source: Finance for REDD can be grouped into three main categories; 1. direct-market, 2. market-linked and 3. voluntary funding mechanisms. In a carbon market based mechanism, REDD certified emissions reductions (CERs) could be used by companies and national governments to meet emission reduction targets in their national cap-and-trade systems. A variation of a market-based approach is the creation of a dual-market, as proposed by Greenpeace, in which REDD credits are linked to but are not fungible with existing CERs. In a dual-market approach it is discretionary whether ERs generated through REDD would be additional to or instead of existing Annex I commitments. In both cases, however, emission reductions could be used to meet compliance targets. A market-linked approach can generate finances through a variety of

mechanisms. An auction process, such as Norway's proposal to auction Assigned Amount Units (AAUs) internationally or Germany's "International Climate Initiative" nationally, would generate revenue through the auction of emissions allowances. At both national and international levels, the auctioning process could generate revenues at scale. Emission reductions generated through auction revenues could also be used towards Annex I commitments although this would not be a requirement. A voluntary fund could operate at the national or international level. Official Development Assistance (ODA) such as Norway's $2.6 billion commitment to REDD is an example of voluntary funding (The Little REDD+ Book, 2008). In general non-Annex I Parties call for new and additional contributions from developed countries. A key feature of voluntary funds is that emissions reductions generated through a fund cannot be used for compliance targets.

Each of these mechanisms has its strengths and weaknesses. A growing consensus is emerging, however, heading towards the concept of REDD++, that a combination of these financial mechanisms will be needed to match the different stages of development and differing needs of tropical rainforest nations. This system is often referred to as the phased approach. REDD+ activities are broken down into the following three phases:

Phase 1: Development of national strategies or action plans, policies and measures, and capacity building

Phase 2: Implementation of national policies and measures and national strategies or action plans that could involve further capacity building, technology, development and transfer, and results-based demonstration activities

Phase 3: Results-based actions that should be fully measured, reported and verified

The major irony in funding process lies in the fact that countries like Brazil and Indonesia, where the deforestation rate is high, kept on receiving funds for their afforestation/ reforestation processes. ***A two-fold motive might be behind it. On the one hand while it helped the developed (donor) countries to quantify their role for environmental protection, on the other hand those developing countries which lacked a proper forest conservation policy and had high rates of deforestation got the opportunity to encash their current efforts for forest conservation by demanding carbon credits for the same.*** A few countries like India, China and Vietnam which have developed specific policies for enhancement of their forest stock are not getting the benefits even from CBCF (Community Based Carbon Forestry) (Pers. Comm. Dr. V.R.S. Rawat (Scientist- E, ICFRE and REDD+ expert). Most of the money is getting disbursed to countries that are drivers of deforestation. This led to the formation of the REDD + partnership which promoted bilateral funding for the countries which were mainly focused on "plus" part of REDD. India too joined the partnership in Oslo in May, 2009. Though the controversy whether market based mechanism would be preferred over fund based mechanism is yet to be resolved, Bolivia has strongly opposed market based mechanism in forest carbon stocks while India and China preferred to follow the middle path keeping a balance between the two mechanisms.

Recently, the United States has proposed to include agriculture along with forestry within the bounds of REDD, referring to it as REDD++. The US is keen for the inclusion of agricultural activities in the market based economy concerned with carbon sequestration. The proposal is yet to be discussed in the UN forum and FCPF. Thus, REDD++ is mainly meant to prevent the conversion of low-carbon but high biodiversity forest lands (reaching minimum threshold of

forest definition) for intensive agricultural cultivation or other short-term benefit practices when high carbon-stock forests are guarded for REDD+ benefits.

4.4 REDD+ IN INDIA: PROGRESS MADE SO FAR

India still needs to put systems and policies in place to facilitate the 'take off' for the proper implementation of REDD+. Policies and legislations like The Forest Conservation Act, 1980 and The Forest Rights Act, 2006 have facilitated the conservation and increment in forest resources besides ensuring the benefits of stakeholders through community forestry and Van Panchayats. India is also sound in the Phase-I activities as far as capacity building is concerned. As countries have the liberty to start with any of the phases of REDD+ depending upon their feasibility, it is time for India to initiate at least phase – II.

Subject to availability of funding, India intends to launch three pilot projects, one each based on the concept of conservation, SMF (Sustainable Management of Forests) and EFCS (Enhancement of Forest Carbon Stocks) (Bali Action Plan) respectively to understand the intricacies of maintaining baseline forest carbon stocks, forest carbon stocks changes, and forest carbon accounting. These projects will be implemented at locations that cover different forest types and socio-geographic regions of the country. For example, a project on conservation could be taken up in the Western Himalayan region comprising States of Uttarakhand, Himachal Pradesh and Jammu and Kashmir, whereas Western Ghats could be suitable to test the concept of SMF.

At present only a few countries like India and China have specific policies for enhancement of forest carbon stocks. To utilize this advantage to the fullest, pilot studies should be completed within a timeline of 2-3 years. These pilot projects may further be cited

as a model for extensive implementation at the national level to move into phase – III of REDD+. Community participation and knowledge partnership are two important factors for effective functioning of REDD+. JFM areas and VPs might prove to be strong candidates for its implementation at the national level in forest areas covering 5,000-10,000 hectares (Pers. Comm. Dr. V.R.S. Rawat). (India's submission to UNFCCC)

Regional level workshops organized by MoEF were conducted in Agra and Nagaland on 3-4 and 9 February, 2013 respectively. The conclusions of these workshops were

- For execution of REDD+ the country needs to take up pilot project for identification of gaps in technological and implementation aspects.
- Building of capacities community and forest staff is required to measure carbon stock inventory and sustainable harvest and the use of GIS technology for forest carbon assessments such be taken up by state governments
- The need to develop a national level strategy and implementation for REDD+ imperative while regional variability should also be considered.
- Research activities in relevant areas of REDD+ should be undertaken and transferred to local people in simple language.

Box 7. DOHA, Qatar (11 December, 2012)

"Overall, it has been a disappointing set of outcomes for forests, in particular because there has been no decision on measurement, reporting and verification (MRV) of emissions reductions. This is the final element required for REDD + demonstration activities to get underway in earnest," - Louis Verchot, Director of Forest and Environment Research CIFOR.

4.4.1 India's approach to REDD+

India has taken a firm stance in favour of a comprehensive REDD+ approach. Since reduction of deforestation, and conservation and improvement of forests are two sides of the same coin, India believes both should be treated at par: that is, fairness requires

that a unit of carbon saved by checking deforestation should be treated the same as a unit of carbon added due to conservation and afforestation measures. India's stand was finally accepted in the 13th Meeting of the Conference of the Parties (COP 13) at Bali when elements of conservation, sustainable management of forests and enhancement of forest carbon stocks were incorporated in the Bali Action Plan.

India is emphasizing the following initiatives related to REDD+:

- India has made a submission to UNFCCC on '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)" on 8th April, 2011.
- A Technical Group has been set up to develop methodologies and procedures to assess and monitor the contribution of REDD+ actions
- A National REDD+ Coordinating Agency is being established
- A National Forest Carbon Accounting Programme is being institutionalized
- India is hosting the Conference of Parties (COP-11) of the Convention on Biological Diversity (CBD) in 2012, to coincide with twenty years of Rio (MoEF, 2010)

A National Mission for a Green India has also been launched as part of the country's National Action Plan for Climate Change. The unique features of the mission are:

- It focuses on increasing the quality of forest cover and improving provision of ecosystem goods and services and not merely on increasing its quantity.
- It proposes a holistic view of greening, not merely focusing on plantations to meet carbon sequestration targets. There

is a clear focus on enhancing biodiversity and restoring ecosystems and habitat diversity.

- There is a deliberate and major focus on autonomy and decentralization to reduce delays and rigidity, while ensuring accountability. (MoEF, 2010)

4.4.2 First REDD+ project In India

A watershed conservation project in the East Khasi Hills district of Meghalaya in northeast India is the country's first REDD + project. The project is implemented by Community Forestry International (CFI) in coordination with local people and organisations. Much of the forests in the region are under community control backed up by the Sixth schedule of the Indian constitution. The forests of the Khasi hills have been under relentless pressure due to subsistence needs of the inhabitants resulting in deforestation and forest degradation. With the initiatives taken by CFI in 2005 the government in Hima Mawphlang started supporting the communities to improve forest management and restoration. With the active participation of the local community in controlling forest fires, regulating unsustainable collection of fuelwood, adopting to fuel efficient stoves, stall feeding of livestock, and the support from CFI over the years the forest of the area regenerated quickly.

The success of the activity was welcomed by neighboring indigenous government (hima), subsequently nine himas joined the activity by forming a federation to effectively manage and restore their forests. The financial and technical support to allow the communities to access local forest conditions and resource mapping is provided by local NGO's

From 2005- 2009 CFI organized REDD+ and IGA pilot activities in two communities in Mawphlang, following the success of the initial pilots the design of REDD+ took place 2010-11 In

early 2012, the readiness activities were conducted, the first phase of the REDD+ project is underway (2012-2016) "activities started" the second phase would be conducted from 2017 – 2021 "activities intensified". The project aims to reduce deforestation and forest degradation by 33% in the first phase and 57% by the end of second phase.

The REDD+ project has adopted Plan Vivo[9] system because it not totally a carbon centric project and all values of ecological and social benefits are considered. The project is not supported any UN sponsored REDD initiative. The project is administered by community forestry federation, it has been endorsed by the Khasi Hills Autonomous District Council and the government of Meghalaya.

It is worthwhile to note that carbon storage and sequestration is considered a minor benefit of the project what is considerable is the unity of indigenous institutions to conserve their forests, rivers and watersheds and improve their livelihoods.

[9] The Plan Vivo foundation is registered Scottish charity. To find more Plan Vivo approaches visit http://www.planvivo.org/

CHAPTER 5

Potential of Carbon Credits in Uttarakhand and possible linkages with ongoing programmes

The state of Uttarakhand was carved out of the Himalayan and adjoining north-western districts of Uttar Pradesh on 9 November 2000, becoming the 27th state of the Republic of India located between 29º5´-31º25´N and 77º45´-81ºE and covering 53,482 sq. km, Uttarakhand has two administrative divisions: Kumaon in the east and Garhwal in the west. These are divided into 13 districts, 95 blocks, and 15, 761 villages. Hills account for over 90 percent of the total area of the state and forests cover close to two third of the state's area. Only about 14 percent of the state's land is used for agriculture[7].

Forests cover 57.7 percent of the state's geographical area (excluding the area above 4000m). 8.2 percent of the state's area is snow covered. The sub-tropical belt (below 1000m) is represented by the evergreen and moist deciduous forests, woodland and savannah. Adjacent to and to the north of the subtropical forest is a band of subtropical pine forest dominated by Chir pine. The temperate forests are open and dry with Chir pine and oak. The alpine zone is separated by a distinct tree-line (3500±200m). This is the zone of treeless vegetation. The major vegetation types include alpine scrub, alpine herbaceous formations locally known as 'Bugyal'.[8] Most of this forest is under the control of

[7] Planning Commission (2009); *Uttarakhand Development Report*, pp. 77-79

[8] Planning Commission of India (2006), *Report of the Task Force on the Mountain Ecosystems (Environment and Forest Sector), Eleventh Five Year Plan* (pages 11-12)

the Forest Department (24 lakh hectare), the Revenue Department (5.14 lakh hectares) and Van Panchayats (5.24 lakh hectares). Impressive though these figures are, they are also, in some ways, misleading. The actual forest cover as per the State of Forest Report 2009 published by the Forest Survey of India is 24.47 lakh hectares (or 44% of the geographical area of the state). Of this, 16 % is very dense forest, 59% is moderately dense and 25% is open forest.[9] Large tracts of forest report low productivity, which suggest potential future REDD+ activities. Much of the forest at altitudes below 2000m is utilized by local people for their subsistence needs. Extraction of large quantities of biomass through branch pruning for fodder and fuel wood requirements has resulted in considerable forest degradation.

Uttarakhand also has a large identified potential of hydroelectric power ("HEP"). Estimated at approximately 18,200 MW, about 3000 MW of the state's HEP potential has been tapped while the remainder is in various stages of being developed. The development of this potential has been an important source of SGDP growth. The identified HEP potential for Jammu and Kashmir is approximately 14,100MW and for Himachal Pradesh is approximately 18,800MW.

Agriculture has historically been the mainstay of the hill economy. Its continued importance can be gauged from the fact that agriculture and allied activities engage over 65 percent of the workforce in Uttarakhand[10], and approximately 78 percent of the population of the state is dependent on agriculture for their livelihoods.[11] 13 to 14 percent of the state's total area is under cultivation. The net sown area of the state is estimated to be 76, 7571 hectares. The total cropped area stands at 1,289,000

[9] NABARD 54

[10] Planning Commission (2009); Uttarakhand Development Report page 54

[11] *State Focus Paper Uttarakhand* 2010-2011 prepared by NABARD, page 5

hectares. Cropping intensity of the state[12] is 166 (which is to say that each unit of agricultural land is cultivated on an average 1.66 times annually). The hill agriculture is marked by reliance on cattle to maintain agricultural productivity and facilitate agricultural operations. Thus there is a high ownership of cattle across the hill districts of the state.

In addition to the above resource base, Uttarakhand has also tried to promote various other alternative sources of energy. These include wind power, solar power, and water mills.

Given the broad outline of the resources at the state's disposal and on the basis of feasibility and sustainability of the same, we have listed major areas which can be tapped by the state to take for carbon trading and sustainable development under UNFCCC's compliance and voluntary market mechanisms.

While we have listed a number of activities in state which are eligible for carbon trading, the one's with greater potential are **Carbon forestry under the REDD+ mechanism and Small Hydropower Projects (SHP's) under CDM**. In theory other activities are eligible for carbon trade but with little feasibility on account of scale and challenges of bundling. For Example: **Biogas and pine needle briquetting are activities which theoretically help in mitigation of GHG's from the atmosphere *(discussed later in the chapter)* but have limited.** Details on the major activities and possible linkages with other activities are discussed in this chapter

5.1 WIND POWER

Bachhelikhal in Tehri district is set to become the first site in Uttarakhand where a wind energy farm will be established. A

[12] Gross cropped area divided by net sown area.

notification to this effect has already been issued for producing 2.4 megawatt (3 turbines, each of 800 KW) of wind power. An investment of Rs 12.5 crore is proposed. Meanwhile, the Uttarakhand Renewable Energy Development Agency (UREDA) is also planning to install wind mapping equipments in order to understand the potential of wind energy in hill state.

It is clear that wind power is as yet in its exploratory phase in the state of Uttarakhand. In an initial survey, the Centre for Wind Energy Technology (CWET) found only one site suitable for tapping wind power. There are also large upfront costs involved in addition for a high degree of technical expertise which is not locally available. Nonetheless, the undulating terrain and narrow valleys of the state may offer considerable future potential for wind power.

5.2 SOLAR POWER

With a steep fall in prices of solar panels post over the past few years, interest in solar power has considerably increased. By 2013, the cost of Solar Panels had fallen to well under US$1 per watt (or about Rs 50,000 per KW) making this comparable to the cost of using diesel generators. Given the tax benefits, Uttarakhand with its extremely high levels of solar radiation (high mountains with thinner atmosphere receive stronger sunlight than the plains) and low cloud cover has the potential to generate significant solar energy. A lack of expertise and enabling policies has however limited large scale solar generation facilities.

However, there has been progress at the small scale. The considerable improvement in lighting technology, with a reduction in cost of highly efficient LED lights has greatly enhanced the scope of solar lanterns which are finding increasing penetration in rural areas.

While storage batteries remain expensive and are among the main deterrents to the spread of small scale solar power, applications such as solar water pumps which can pump up water during the day to remote villages have high potential A 3.7 KW pilot solar pumping project with a 182 meter head is currently being established by Himmotthan society in Chureddhar village of Tehri. Solar cooker technologies have also improved considerably and various newer models using reflectors for example are being piloted by organization such as Central Himalayan Rural Action Group (CHIRAG).

5.3 SMALL HYDROPOWER PROJECTS

Hydro Power projects are generally classified into small and large hydro projects. In India hydro projects upto 25 MW are considered as small hydro Projects where above 25 MW are considered as large hydro projects (UJVNL, 2006) the term Microhydel is typically used for projects which produce 100 KW of electricity using the natural flow of water. Owing to the steep topography and the large number of rivers originating from the state, the Uttarakhand Himalaya has immense potential for generating CDM revenue through Hydroelectric projects. Small Hydro-Power Projects (SHP) are mostly "run of the river/diversion project" systems, which allow the river flow to continue. This is preferable from an environmental point of view as seasonal river flow patterns downstream are not affected and there is no flooding of valleys upstream of the system. The decentralized nature of this form of power generation makes it suitable for the rural population which is dispersed in distribution. It offers employment opportunities to the rural populace who could be engaged in material and labour supply. India 'has an estimated SHP potential of about 15,000 MW. Over 600 SHP projects with an aggregate installed capacity of over 2,000 MW have been perationalised.'[13] Hydropower is considered as clean energy as it:

[13] CVJ Verma and ND Gupta (2008): Non-Conventional Energy Development in India-An Overview

- Does not generate air pollutants
- No waste disposal is required
- No fuel cost are involved (Erokoro, 2007)

Nonetheless, high upfront costs of hydropower are a deterrent significant environmental damage can occur during construction and disposal of construction debris if good practices are not adhered to. Moreover even SHP can impact riverine ecology and sites need to be appropriately selected. Carbon credits can also be difficult to get due to high transaction costs and cumbersome carbon accounting and the test of whether the 'project would have happened without the carbon credit'.

5.4 WATER MILLS

The watermill is a traditional eco-friendly device that harnesses the power of water to grind wheat and other foodstuff. More recently, more efficient watermills and those that can generate small amounts of electricity have been developed. Typically these generate 1-5 KW of power.

Among the pioneers has been HESCO, a Dehradun-based NGO, that studied the revival and modernization of traditional watermills and estimates a potential for 200,000 watermills in the Himalayan region with an estimated power generation capacity of over 200MW. An Asian Development Bank-funded survey in Uttarakhand in 2003 revealed that there were 15,449 watermills in the state, of which nearly 7,000 were defunct. UREDA took on the responsibility of reviving the defunct watermills. The Centre provides a subsidy of Rs 1.10 lakh for electric generation from a watermill. Until now, an estimated 753 watermills have been revived, with UREDA setting a target of reviving another 500 in the year 2011-12. The Uttarakhand government has also facilitated the process of setting up nine companies which are

now upgrading the state's watermills. While watermills produce power only adequate for a small hamlet or cluster of houses, it can provide employment opportunities to people in small businesses like the grinding of wheat, spices and oilseeds.

Watermills tend to work best in isolated areas where grid connectivity is not available. Else these fall into disuse. The scope of expansion of watermills is also limited as many of the best sites are already in use. Nonetheless these offer locally appropriate, sustainable and green solutions for specific areas.

5.5 BIO GAS

The largely rural agrarian society of Uttarakhand is dependant on cattle for milk and more importantly dung that, when composted with leaves, forms the main nutrient input for mountain agriculture. The use of this dung in biogas plants will generate a waste product (slurry) that is a better fertiliser than raw cowdung (as the seeds of weeds and pathogens are destroyed and nutrients are more available) and biogas slurry fertiliser has good market values. The biogas digester converts the carbon of the dung into methane gas which then provides a clean and high calorific fuel – far superior to traditional chulhas or wood cookstoves. This reduces or can even completely do away with the need for fuelwood. Not only does this greatly benefit the environment and greatly reduce one of the biggest causes of forest degradation, but clean biogas has none of the deleterious health effects of traditional woodstoves. Biogas can thus help preserve forests while taking away the single largest cause of ill health – the smoky chulha that causes severe respiratory and eye problems. The lack of black carbon emissions from biogas can also help cut down one of the important causative agents of glacier melt. Compared with direct combustion of dung, biogas stoves produce only 1% of the greenhouse gas impacts.

Building of biogas plants, pioneered by NGOs such as Chirag in the 1990's and later by Grassroots and promoted under various Government schemes, have demonstrated the success of this technology at altitudes of upto 1500m and often higher. Small biogas plants, of 1-2 cu.m. capacity, fed by 2-4 cattle can reduce the fuelwood consumptions of a family of 6 by 30-60%. A biogas plant has an operational life of well over ten years and biogas units over 15-20 years old can be found operational in Uttarakhand.

Yet the spread of this technology has been slow and it remains restricted to a few clusters in the state. A high upfront cost of about Rs 15,000 and uncertain and erratic subsidies are one issue. The lack of sufficient numbers of skilled masons and repair technicians are perhaps a bigger issue. However, the biggest issue remains a lack of awareness of this technology rather than any inherent weakness in it.

Issues that limit its use include the acute water shortages in the summer in some areas which make it difficult to even make the slurry (cowdung plus water) that needs to be fed into a biogas plant, small technical problems such as a blockage of the outlet pipe due to water or scum formation in the digestor and a lack of technicians to deal with these issues. While biogas can greatly reduce the drudgery of fuelwood collection, collecting and transporting cattle dung to the biogas plant (which also implies stall feeding and not open grazing of cattle) and the effort of mixing the slurry are also deterrents. Nonetheless, biogas is a very appropriate technology which needs efforts to spread awareness. Biogas plants are clean and green with huge benefits to forests and towards global warming mitigation. Providing subsidies for their building and maintenance would be well worth the money, and have very leveraged benefits in terms of forest preservation, reduction in black carbon in addition to significant health benefits, and the costs could be met in part through benefits through mechanisms such as REDD+ and CDM.

5.6 BIOMASS GASIFICATION

Gassifiers convert various kinds of biomass into energy. In the Himalayas the abundance of pine needles, can provide a potential source of fuel. Biomass gassifiers can convert 1.5 kg of biomass into approx 1 KW of electricity. About 4 kg of woody biomass can be converted into a liter equivalent of diesel or similar fuel. A single hectare of forest can thus yield 3000 KW of energy per annum in terms of leaf litter and waste wood alone. This biomass collection would not in any way adversely impact growing stocks (carbon sequestration rates) or timber value which would continue to increase. This energy can be fed into the grid during times of peak demand (evenings) thereby fetching premium prices.

Recently, AVANI a Pithoragarh based NGO set up gasification based power plant using pine (*Pinus roxburghii*) needles as feed stock for generation of electricity and cooking charcoal. The electricity thus generated is used for rural cottage industry or fed to the grid. Residue is converted to charcoal which is briquetted for cooking in rural kitchens. The idea of using pine needles for electricity generation and briquetting is a promising as the villagers get an economic reason to remove pine litter. Accumulation of pine needles in the forest floor act as a fuel for forest fires in the summer months and bring about huge ecological and economic losses from forests. Moreover clean electricity and cooking charcoal generated from the process of gasification has the potential to improve rural lifestyles and reduce carbon emissions from burning of fuel wood extracted from the forest. This reduces women drudgery and forest degradation in Uttarakhand.

AVANI plans to create 100-150KW capacity village level power plants bundled to create employment generation, biodiversity conservation, and carbon mitigation. AVANI estimates that

pine needles litter from each hectare of land generates 8 MWh of electricity; cooking fuel for one family and; employment for one person in one year. This technology can provide smoke free indoors which will positively impact health of women and children; restore eco-services over 2-4 hectares of land reduce drudgery for women[14]. In addition to this planting fast growing species of fodder i.e. *Napier and Thysolenea* on the forest floor of pine forest would not only fulfill the fodder demands but also conserve the forest.

Prima facie, evidences on Pine needle gasification provided by AVANI are astounding. Nevertheless, it is imperative to understand the economic viability of such initiatives and also that the ecological implications of removing pine litter from the forest floor are yet to be fully understood. Moreover, the burning of pine litter in summer months releases nutrients which helps initiate the growth of fodder grasses in the lean period. Scientific studies are required to access the sustainable quantity of litter removal for pine needle gasification in the state.

High capital costs (a 10KW gassifier suitable for a 2-3 ha forest costs almost Rs 5 lakh) and operating costs (salary of a technician) put some questions on the economic viability of this operations which are still being evaluated. Carbon credits could help increase the benefits.

5.7 BIOMASS BRIQUETTING

Biomass briquetting is an area of potential both from the CDM point of view and also for enhancing rural livelihoods. The abundant availability of pine needles offers a good raw material for briquette making in Uttarakhand.

[14] http://www.avani-kumaon.org.

Several private players have introduced innovations in the sector. For example, Dehradun based company (Doon Biomass Energy, Uttarakhand) has devised a new and low cost, easy to operate machine for biomass briquetting. This would enable the rural populations of plains and mountainous areas of Uttarakhand to convert the biomass into briquettes in the villages itself, thus removing the hurdle of transportation and problems associated with high technology dependent machines. Moreover this would enhance rural livelihoods by providing incomes through the sale of briquettes.

Collected at around Rs 1 per kg, this cheap and abundant raw material provides daily wages comparable and often superior to those of MGNREGA while reducing the fuel load of forests (many pine forests burn on an almost annual basis). Ordinary compressed briquettes have calorific values and properties similar to coal and can be sold for commercial operations (such as to run boilers in industry) at similar prices to coal. Biochar briquettes, which are almost indistinguishable in properties to wood coal and command similar prices, have huge potential for domestic heating and cooking.

Assuming a dry mass of chir needles and twigs of 4 tonnes/ha, a single hectare of pine forest can in theory yield about Rs 20,000 worth of biochar (at Rs 20/kg) or Rs 25,000 of compressed briquettes (at Rs 6-7/kg) thereby offering returns not much lower than traditional agriculture. This figure does not take into consideration the increase in value of timber from such forests or the value of carbon sequestered or replaced through this alternate fuel. To claim CDM benefits from the activity, complex bundling requirements and similar hurdles would need to be dealt with. However, the activity holds promise keeping in view the commercial uses of biomass briquettes and enhancing rural livelihoods.

Small scale applications using biomass have as yet now seen wide success. Most activities are implemented by big industries in the region (sugar mills and paper industry) while the returns to the local people are negligible. In the mountainous areas the CDM activities based on biomass are absent.

Box 8. General challenges and risks for project activities

Challenges:

- *Frequent changes in Guidelines and formats*
- *Difficulty in setting the baseline*
- *Low CERs price rate*
- *Cost and Time consuming*
- *Lack of Knowledge like intimation of the proposed project to UNFCCC before six months*
- *Selection of right consultant and valuator*

Risks

Registration risk

- *The non approval of a new methodology*
- *The unsuccessful validation of a methodology for calculating emissions reduction*
- *The non-approval by the host country*
- *A request of review by the CDM EB at either the registration or CER issuance step*

Counterparty risk

Resides in the fact that CER's are usually sold in the form of forward contracts. There is always the risk that one of the parties defaults on its contractual obligation.

Market risk: *Is directly linked to the fluctuations in the price of CER's*

Country risk

Reflects the importance of host country regulations, CER ownership rights may differ from country to country

5.8 CHALLENGES OF GETTING CDM OR REDD+ CREDITS FOR SOLAR POWER BIOGAS AND MICROHYDELS

While biogas plants, watermills, microhydels and solar power are eligible for CDM credits, there remain huge challenges in getting these credits due to the very small and diffuse nature of these interventions. Problems include:

- High upfront cost including the cost of external consultants to negotiate a rather difficult set of formalities related to having a project registered and accepted
- Challenges of bundling, i.e. taking together dozens or hundreds of small projects / plants to create a viable fundable unit, including setting up of institutional mechanism
- Tedious monitoring: To give the example of biogas, also applicable to other forms of energy discussed above, such monitoring would include:
    - Metering the energy produced by a sample of the biogas plants
    - Monitoring and recording the number of biogas plants operating;
    - Estimating the annual hours of operation of an average system, using survey methods. Annual hours of operation can be estimated from total output (e.g. cubic m of biogas generated) and output per hour.
- Need for trained technical work force to maintain operations

5.9 REDD+: SCOPE FOR UTTARAKHAND

The **Cancun Agreement of 2010** imported essential elements of the **Copenhagen Accord, 2009** into the UNFCCC. The agreements also took initial steps to implement the operational elements of the accord including a new green climate fund for developing countries and a system of international consultants and analysis (ICA) to help verify countries actions. With almost

65% of forest area (FSI, 2009) Uttarakhand has huge potential to generate revenue from REDD+ mechanisms. The state is a good example of low deforestation (due to the ban on green felling in the Himalayan states of India since 1982) but high degradation rates (due to dependence on forests for subsistence). Of the five activities listed in paragraph 70 of the AWG/LCA (Ad hoc Working group on Longterm Cooperative Action) Uttarakhand is eligible for four activities[15], one under REDD *(b)* and three under the 'plus' *(c, d and e)*.

Owing to its high forest area and strong social capital Uttarakhand has vast potential to contribute to the cause of activities listed in paragraph 70 of AWG/LCA, and also generate revenue through REDD+ mechanism, however the ***devil lies in the details***.

The major challenges in implementation:

(1) Correctly measuring net emissions from '**Degradation**'.

(2) The permanence and 'leakage' of carbon emissions from other forest activities;

(3) Ensuring economic incentives and payment distribution for REDD

These are explained below:

5.9.1 Correctly measuring net emissions from 'Degradation

Extraction of wood by local populations through the process of lopping (or branch pruning) continues at a heavy rate lowering the carbon content without bringing about loss in the forest area. Millions of people in the mountainous region of Uttarakhand are

[15]*(b) Reducing emissions from forest degradation;*
(c) Conservation of forest carbon stocks;
(d) Sustainable management of forest;
(e) Enhancement of forest carbon stocks;

directly dependent on forests for their day-to-day living. The traditional agriculture in this region is heavily reliant on forests and needs a considerable amount of input from it. Up to 10 units of energy from forest ecosystems are required to obtain 1 unit of grain energy from Himalayan agro-ecosystem (Pandey and Singh, 1984; Singh and Singh, 1992). Data on forest degradation is hardly available for the state because its measurement is labour intensive. The data of Forest Survey of India shows the forest cover in Uttarakhand, and other states of India is either increasing or stable, but almost nothing is known about carbon density inside forests as affected by degradation.

5.9.2 Methodology Development and lack of expertise

One of the major challenges in implementing projects under REDD+ in Uttarakhand is the lack of information and processes for collecting data in relation to GHG emissions from forest degradation. The established process to obtain information on deforestation is through field based inventories and remote sensing; however assessing degradation is much more complicated. Degradation cannot be assessed by optical remote sensing techniques, even with high resolution images. While such techniques can provide data on selective logging in rainforests, which is not representative of degradation as it occurs in the Himalayas and the dry tropics (Skutch pers. comm.). These techniques can detect where degradation is taking place but cannot measure the loss of biomass below canopy. It is therefore essential to collect ground level data on changes in forest stock which can only be obtained through regular and repeated preparation of forest inventories. It is also important to develop a methodology consistent with IPCC rules to assess degradation in the Indian Himalayan region. The other constraint is the lack of efficient manpower to prepare such inventories for monitoring and verification purposes. Since monitoring and verification are costly and often complex, a trade off takes place

between accuracy and cost of measuring and monitoring carbon sequestration (Dargusch *et al.*,2010).

5.9.3 Permanence and leakage of carbon emissions from other forest activities

One of the major implications for implementing REDD+program in Uttarakhand would be tackling the issues related to **'permanence and leakages'**. The UNFCCC defines permanence as "the longevity of a carbon pool and the stability of its stocks". Non-permanence of carbon stocks in forestry terms is usually used to describe a situation in which a forest has sequestered carbon but where that absorption of such carbon has later been reversed because the forest has been removed again (Skutsch and Trines, 2010). For example carbon saved by a forest in Uttarakhand is released after getting payments for reduction of CO_2 levels in the atmosphere. It is essential to ensure that the forest area remains intact and free from degradation permanently or for a duration of emission reduction agreement (Parker *et al.* 2009: Dutschkeand Angelsen, 2008) until the peak in atmospheric levels of CO_2 is reversed which is likely to be in next 100 or 200 years (Dutschke 2005).

Due to small scale chronic disturbances such as people's dependence on forests, forest carbon in Uttarakhand is inherently vulnerable to reversal and degradation might set in once the project period is over. Furthermore, lack of resources to implement and monitor policies and high degree of political instability may increase the risk that the project will not be permanent.

Leakage is simply defined as "displacement of emissions" (Wunder, 2008). In simpler words the criteria of leakage requires that a reduction in carbon emissions does not result in increased emissions in another area. Due to high dependence on forests 'leakage' outside the project boundary may occur which will only

displace degradation rather than reduce it (Aukland, *et al*. 2003; Persson and Azar, 2007). Projects in the Indian Himalayan region would be particularly prone to leakages if no alternative strategy or livelihood option is provided; there may simply be a direct displacement of forest degrading activities to another location. For example a community managed forest in Uttarakhand may be rewarded for reducing degradation in the community forest. However the community's reliance on forest may have shifted to other forest areas to meet its demands for firewood, fodder, and other forest produce. In such circumstances emission reduction achieved by conservation of the community forest is balanced or exceeded by degradation in other forest area(s).

5.9.4. Ensuring economic incentives and involvement of communities

One of the major challenges is how to ensure that sufficient economic incentives for reducing emission are paid to populations adjacent to or dependent on forested land who often act as agents of forest degradation (Persson and Azar 2007). If REDD+ projects restrict access to these forests, the projects must incorporate payments to local communities or create alternative means for these communities to address their livelihood needs over the term of the REDD+project. A lack of success in designing and implementing such projects will substantially increase the risk of lack of permanence and of leakage (Brown *et al.* 2000).

5.10 INSTITUTION STRUCTURES: THE VAN PANCHAYATS

Uttarakhand has strong social capital in the form of 12,089 Van Panchayats (VP) or community managed forests covering more than 0.5 million ha. Community forestry is seen as a cost effective means of dealing with forest degradation and management in the Himalayas (Tewari *et al.* 2008) Communities in India and Nepal have been highly successful in terms of forest conservation at local level. However, appropriate design and planning will

be required to take advantage of REDD+ to protect vulnerable communities and their forest To elaborate further on this point, most of the success stories highlighted are from VPs which are well managed and of adequate size (> 50ha) whereas 84% of the VP's smaller (<50ha) (Tewari and Phartiyal, 2008) in size (Fig 12) and would require enormous upfront cost and time to undertake any REDD+ activity. Involving local people in the measurements of carbon could be one way to lower the costs involved and make the communities self reliant by giving them access to economic returns through engagement in carbon measurement.

Box 9. Carbon and community forestry Uttarakhand

At present the entire forest area of Uttarakhand has about 0.5billion t carbon in biomass and soil, which is nearly 25% of the annual carbon emission of India's 1.2 billion population through fossil fuel combustion. The Uttarakhand forests sequester C at the rate of about 7Mt/yr, which is roughly worth Rs. 3.5 billion. Some Van Panchayats, e.g., villages in Lamgarha block, Almora sequester Carbon at the rate of 3.7t $ha^{-1}yr^{-1}$ in addition to meeting people's daily needs of biomass: firewood, livestock, fodder and litter (source of nutrients to agricultural fields). If people fail to maintain their existing forests because of the lack of any economic support, the soil carbon pool would also be lost. Proper policies, therefore, need to be framed and implemented to reap the maximum benefit from the forest carbon stocks of Himalayan states like Uttarakhand.

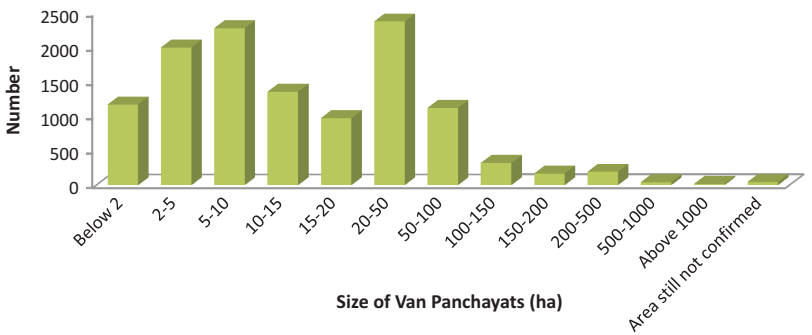


Fig. 12 Van Panchayat status of Uttarakhand

Although, the local people have limited formal education, it is possible to train them and collect reliable data (Skutsch. 2011).

5.11 SWOT ANALYSIS FOR REDD+ IN UTTARAKHAND

Strengths:	Weakness:
• Well established institutional set up • Existence of Van Panchayats • Close to 65% geographical area under forest • Ministry of Environment promotes REDD process • Wealth of information on Natural Resources, land uses and communities	• Level of local awareness – low • No capacity in government (Forest • department to support REDD+ • Safeguards not considered in forestry programs • Complexity (many indicators) • No coordination between indigenous people and forest department.
• Supportive programs (NAPCC) • Existence of many Institutions, INGO's and RNGO's	• Lack of upfront funds for REDD plus
Opportunities:	**Threats:**
• CAMPA and MGNREGAS funds available for dovetailing • Synchronization with other development initiatives • Funding by different sources • Expert institutions, INGO's and RNGO's can help build expertise and safe guards • High international interest in the region • Long term research on CC and Carbon forestry	• REDD+ may lead to State control over community owned forests • May lead to conflicts between government and indigenous people • Unfavorable policies • Enhanced leakages from forests • Large chunk of credits owned by State forest department • Issues of permanence after the completion of project

5.12 LINKAGES WITH ONGOING PROGRAMMES

We advocate that, to be sustainable REDD programmes in Uttarakhand must not be stand alone but instead in line with existing and ongoing programmes as far as possible. An example of this kind of linkage would be the fodder programme coordinated by Dehradun based Himmotthan. Fodder shortage is one of the main issues affecting the development of rural areas in Uttarakhand. It leads to both poor quality milch animals, and the degradation of forests. Given the reality of fodder scarcity in Uttarakhand, Himmotthan initiated the Integrated Livelihood and fodder Development Programme (IFLDP) in the state in 2007, in collaboration with the state government, through the National Rural Employment Guarantee Scheme (NREGS), and leading Non-Profit Organisations (NPO) of Uttarakhand. In 125 villages, spread over seven districts, a total of 133 hectares of land was taken up for fodder promotion. Over 6,300 people participated in the project. 748 tonnes of fodder was produced from community-managed plots. Grass production in planted plots increased from 1.2 tonnes to 6.9 tonnes per hectare. The IFLDP has increased fodder availability to over 3,000 households over a three-year period. Given that extraction for fodder is a major cause for the degradation of Himalayan forest this intervention and associated NREGA could be linked with REDD+

5.12.1 MNREGA

The Mahatama Gandhi National Rural Employment Guarantee Act, 2005 was enacted by Ministry of Rural Development (Govt. of India) to guarantee 100 days of employment in a financial year to any rural household whose adult members are willing to do unskilled manual work. The act came into force initially in 200 districts of the country to be gradually extended to other areas to be notified by the Central Government. The basic objective of the Act is to enhance livelihood security in rural areas by providing atleast 100 days of guaranteed wage employment in a financial

year to every household whose adult members volunteer to do unskilled manual work.

In Uttarakhand Phase I only three districts, namely Tehri, Chamoli and Champawat were taken up under MGNREGA where the scheme started from Feb. 02, 2006. The remaining districts were taken up under MGNREGA in two successive phases in 2007 and 2008.

Forest Panchayat being an important body in the majority of Gram Panchayats in Uttarakhand, the State Government has included these institutions in the list of implementing Agencies vide Govt. order no. 279/8(3)NREGA/ 2006 dated 7.12.2007 for forestry, pasture development and water conservation works to be implemented under National Rural Employment Guarantee Scheme of the State Government. This offers an opportunity to link REDD+ schemes with MGNREGA.

5.12.2 NAP

National Afforestation Programme (NAP) is being implemented by MoEF, Government of India in pursuit of India's commitment to bring one third of the land area of the country under forest and tree plantation as envisaged in the National Forest Policy, 1988. NAP is being operated as a 100% Central Sector Scheme. The overall objective of the scheme is to develop the forest resources with people's participation, with focus on improvement in livelihoods of the forest –fringe communities, especially the poor. NAP scheme aims to support and accelerate the ongoing process of devolving Joint Forest Management Committee (JFMC) at the village level and Forest Development Agency (FDA) at the forest division level. Financial support under NAP Scheme is meant for afforestation. For its success, ancillary activities are supported as well. The financial support is available for:

- Afforestation
  - Aided Natural Regeneration
  - Artificial Regeneration
  - Bamboo Plantation
  - Cane Plantation
  - Mixed Plantation of tree having MFP and medicinal value
  - Regeneration of perennial herbs and shrubs of medicine value
  - Pasture Development/Silvipasture
- Mobilization of village JFMC and Micro-planning in project villages
- Soil and Moisture Conservation
- Entry Point Activity (for village development; average assistance Rs.4000 per ha of afforestation)
- Fencing, Monitoring and Evaluation, Training, Awareness raising

Operational guidelines of NAP also suggest co-ordination with rural development programmes so that the forest fringe areas and community/privately owned forests can be developed on watershed approach in a holistic manner[16].

Schemes such as NAP and MGNREGA provide considerable funds and often include priorities which overlap with those envisaged under REDD+. Leveraging these schemes through alignment of REDD+ funds would enable the flow of additional resources while strengthening monitoring mechanisms and the sustainability of these projects.

[16] GOI: Forest Works Manual and Schedule of Rates for Forest Related Works in Uttarakhand

CHAPTER 6

Conclusion and Recommendations

Uttarakhand has much strength that is favorable to effectively tap into the CDM credits market. Indeed many initiatives, both public and private have attempted, to tap into this sector. Small Hydro Projects are better suited for CDM in part because they are simpler to monitor and offer concentrated carbon savings than other alternative energy generation schemes and there are several success stores in the state.

Small Hydro Projects generate 25 MW of power or less. These are mostly in the ambit of the private sector where operating enterprises normally have the resources to bear the upfront cost involved in preparing a case for CDM credits. They may, nevertheless, benefit from a simplified procedural handbook. UREDA has done some work in this area. There is an estimated unidentified potential of about 5000 MW for small hydro projects in the Himalaya, a fair bit of which would be in Uttarakhand. 'Unidentified potential' is when potential is known to exist, but the scoping and definitive identification of sites has not been carried out.

Very small or microhydel power projects (defined as projects that generate upto 100 KW), family sized biogas plants, water mills, and solar energy units while collectively worth a fair amount of CDM credits require complicated bundling, tricky monitoring, institutional arrangement to oversee operations, and the provision of trained manpower to keep the operations going.

However given the strength of civil society institutions and NGO's as well as the presence of nodal organizations such as

Himmotthan society in Uttarakhand, such bundling could well be attempted and successfully achieved. NGOs can typically monitor such bundled projects more efficiently and at a much lower cost than commercial organizations.

Recommendations

- Make accessible in easy to understand and use language the guidelines and procedures related to CDM. UREDA has already done some work in this area which should be built upon
- Disseminate information related to CDM to small hydro power and sugar mills. Explore with them possibility of tapping the CDM market
- Map government schemes that provide subsidy on developing alternative energy. Explore possibilities of dove tailing CDM benefits into these schemes to leverage the funds available and enhance monitoring and sustainability of interventions.
- Provide training to NGOs on CDM and possibilities of bundling projects for credits. Biogas plants, watermills (*gharats*), solar projects and biomass gasifies among examples of suitable projects. Mature farmer federations or even SHGs may also be able to take on these tasks and develop an added revenue model for themselves.
- Greater Govt support or donor support for alternate energy projects should be lobbied for. While CDM credits get attention and often are more easily supported, there is a huge need in the Himalaya in general, and Uttarakhand in particular, for enhancing and upgrading household energy sources. The traditional *chulha* or woodstove is not just inefficient and fraught with problems such as adverse health impacts, but also has severe environmental implications. These emit black carbon which is an important cause of

glacial melt and also lead to forest degradation, in addition to condemning the local women to a rather primitive practice of climbing high trees to lop off branches. Currently several interventions –through the government, based out of NGO's and piloted by universities and research institutions are underway. Scaling up these interventions and subsequently linking them to carbon credit mechanism is recommended.

- Support for training biogas technicians, barefoot solar technicians and good masons can provide huge impetus to alternate energy programmes and provide sufficient numbers to make CDM economically viable.

Uttarakhand is also well placed to be engaged in the international REDD+ mechanism, especially with the help of Van Panchayats (VP's). However a supportive legal policy framework is required along with linkages with governmental and nongovernmental programs if the full potential in REDD+ is to be attained. The success of REDD+ will also greatly depend on developments in the international arena.

Awareness at both national and local level is essential for generating interest and participation in the REDD+ design process. Uttarakhand does not have the resources to implement REDD+ programs immediately. Upfront financing would be essential to initiate the programs. Certain countries like Nepal have already been funded by World Bank under FCPF (The Forest Carbon Partnership Facility) program. The state needs to identify, train and support organisations/individuals to take a lead in such programmes in the state. Strengthening local institutions such as Van Panchayats and building the capacity of rural youth will enable Uttarakhand to implement REDD+ program. This will not only ensure that part ownership of programs rests with the rural population but also provide employment opportunities to the youth of the villages.

The mountainous regions of Uttarakhand are characterised by an agricultural economy with heavy dependence on forests for subsistence. Therefore any REDD+ mechanism should be aimed to be attractive and advantageous to the rural population of the state. REDD and CDM must not lead to a loss in the rights of local people or their alienation from the forests but provide them with an incentive to protect forests. An effective, competent and clearly defined governance structure is required to ensure maximum benefits from REDD+ (Manandhar, 2009). The governance structure should be able to address associated risks while ensuring mechanisms for reduction in CO_2 emissions.

Poverty and outmigration are among the prime development concerns of the state. To address these, resilience of vulnerable people and ecosystems should be improved to reduce risks associated with climate change. Creating jobs at the village level will improve the lifestyles and mitigate outmigration of youth from the villages. How can REDD+ play a role in this? It is clearly observed and documented that rural people are more prone to natural disasters. As both natural disasters and poverty are high in the Himalayas, the focus should be on maintaining and enhancing the resilience and capacity of local people under the REDD+ mechanism.

Conclusion

- The rural population of Uttarakhand is heavily dependent on fuelwoods, from forests for their energy needs. Changing this by the introduction of biogas, LPG and fuel efficient stoves will reduce forest degradation and emissions of black carbon. Additionally, it will reduce women's drudgery and improving health, particularly reducing respiratory and eye ailments. While monitoring programmes is a challenge, such efforts that change energy use patterns are eligible for benefits under REDD+.

- A state level body should be constituted for development, monitoring and guiding REDD+ programs in the state. This should comprise senior government officials, academicians, and non government and civil society representatives, in addition to experts from private sector organizations.
- Awareness of climate change, carbon emission, CDM and REDD+ is needed. Developing information and awareness materials of different levels of complexity is required. Policy briefings for decision makers, simple awareness materials for CBOs and village institutions and Government support to one or a few groups working in the field is the need of the hour.
- There is an urgent need to develop methodology to assess degradation of forests in a relatively accurate, rapid and cost effective manner. At present, measuring forest degradation is inaccurate and expensive. Use of ecophysiological tools, such as Leaf Area Index measurements may hold some promise.
- Forests in Uttarakhand have high leakage rates which will make the MRV process difficult and involve high transaction costs. This needs to be considered in the planning process of the mechanism.
- Any carbon mitigation activity under REDD+ mechanism would require linkages with development programs in state. Mapping of government programmes, especially the flagship programmes of central and state government to look for likely convergence and synergy. NREGA and NAP are two good examples of programmes for linkages and convergence.
- Knowledge on REDD + is limited to certain pockets of the world. Uttarakhand could benefit from building upon the understanding of REDD+ and the dissemination of this understanding. This process could involve multiple stakeholders such as specific consultants (often private

agencies) in the field, those who work on building a knowledge base (institutions such as FRI, CEDAR, etc.), those who disseminate it to policy makers and practitioners (Himmotthan Pariyojana, GIZ, etc.), and those that turn knowledge into action (NGOs, PRI and other village institutions, local communities).

SELECT BIBLIOGRAPHY

Angelsen, A. (ed.) (2008). Moving Ahead with REDD Issues, Options and Implications. CIFOR, Bogor, Indonesia.

Asner GP, Knapp DE, Broadbent EN, Oliviera MK and Silva JN (2005). Selective logging in the Brazilian Amazon. Science 310, 480-481

Aukland L, Costa PM, Brown S (2003) A conceptual framework and its application for addressingleakage on avoided deforestation projects.*Clim Policy* 3(2):123–136

BRI (1976)."A Study of the Feasibility of Establishing a Rural Energy Centre for Demonstration Purposes in Senegal". Brace Research Institute. Report No. I.116.

Brown S, Burnham M, Delaney M, Powell M, Vaca R, Moreno A (2000) Issues and challenges for forestbasedcarbon-offset projects: a case study of the Noel Kempff Climate Action Project in Bolivia. *Mitigation Adapt Strategies Glob Change* 5:99–121

CBD (2011). 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-plus) http://www.cbd.int/forest/redd/

Dargusch, P., Lawrence, K., Herbohn, J. and Medrilzam. (2010). A Small-Scale Forestry Perspective on Constraints to Including REDD in International Carbon Markets. http://www.greenera.eu/pdfs/Small-Scale-Forestry-Perspective.pdf

Disch, D., K. Rai and S. Maheshwari. (2010). *Carbon finance: A guide for sustainable energy enterprises and NGOs*. GVEP International. http://www.gvepinternational.org/en/business/guides

Dutschke, M. with Angelsen, A. (2008) How do we ensure permanence and assign liability? In Angelsen, A (ed*) Moving ahead with REDD: Issues, options and implications.* CIFOR, Bogor Indonesia.

Dyurgerov MD and Meier, MF. (2005). *Glaciers and changingearth system: A 2004 snapshot.* Boulder (USA): Instituteof Arctic and Alpine Research, University of Colorado.

Ecosystem Marketplace (2009). New Energy Finance, State of the Voluntary Carbon Markets 2009.http://www.ecosystemmarketplace.com/documents/cms_documents/StateOfTheVoluntaryCarbonMarkets_2009.pdf

Erokoro, E.E. (2007). Small Hydro Power Projects and CDM BenefitsA Case Study of Obudu Plateau 1 MW Small Hydro Project,Nigeria. *International Conference on Small Hydropower - Hydro Sri Lanka, 22-24 October 2007.*

FSI (2009).*India State of Forest Report.* MoEF, Govt. of India. Green Clean Guide (2011). http://greencleanguide.com/2011/01/24/what-is-cdm/

Henson, R. (2006), *The Rough Guide to Climate Change,* London, Rough Guides.

Houghton, J.T. (1997).*Global warming: the complete briefing.* Cambridge University Press.

IGES (2011).*Current Status of CDM in India.* http://www.iges.or.jp/en/cdm/report.html

IPCC (1995).*Climate Change 1995: The Science of Climate Change: Summary for Policymakers and Technical Summary of the Working Group I Report.*

IPCC (1995).*Second Assessment Report: Climate Change*

IPCC (2001).*Third Assessment Report: Climate Change*

IPCC (2007).*Fourth Assessment Report: Climate Change*

IUCN (2011). http://www.iucn.org/about/work/programmes/forest/fp_our_work/fp_our_work_thematic/redd/redd_plus_explained/

James-Smith, E. (2005). *Using the CDM into energy planning – A case study from South Africa*, Masters thesis, Department of Environment, Technology and Social Studies, Roskilde University.

Kollmuss, A., Zink, H. and Polycarp, C. (2008).*Making Sense of the Voluntary CarbonMarket: A Comparison of Carbon Offset Standards.* Frankfurt/Main.

Manandhar, U.,(2009). *REDD, REDD+ and Co- Benefits.* In Acharaya*, et.al* Ready for REDD? Taking stock of Experiences, Opportunities and challenges in Nepal.

MoEF,(2010).India's Forests and Redd+.Government Of India

NASA GISS (2009).http://www.nasa.gov/topics/earth/features/2008_temps.html

NCDMA (2011).http://www.cdmindia.in

Pandey, U. and Singh, J.S. (1984).Energy-flow Relationships Between Agro- and Forest Ecosystems in Central Himalaya. Environmental Conservation 11 (1): 45-53

Parker, C. Mitchell, A, Trevedi, M and Mardas, N. (2009) The little REDD book. Global Canopy Foundation, Oxford.

Parker, Sybil P.(ed.) (1997).*Encyclopedia of science & technology*.McGraw-Hill. New York.

Persson, U. M. and Azar, C. 2007. Tropical deforestation in a future internationalclimate policy regime - Lessons from the Brazilian Amazon. *Mitig Adapt Strat GlobChange* 12:1277-1304.

Singh, J.S., and Singh, S.P. (1992).*Forests of Himalaya: Structure, Functioning and Impact of Man*, GyanodayaPrakashan, Nainital, India.

Singh, S.P., Singh, V., and Skutsch, M., (2010) .*Rapid warming in Himalayas, Ecosystem responses and development options.* Climate and Development, Volume 2, Number 3, pp. 221-232(12)

Singh, V. (2009) *Biomass Stock and Carbon Sequestration Rates in Banj Oak (Quercusleucotrichophora, (A. Camus) Forests Under Different Disturbance Regimes in Central Himalaya".* Ph.D. thesis, Department of Forestry, Kuman University Nainital

Skutsch, M and Trines, E. (2010). Understanding Permanence in REDD. K: TGAL Policy Paper no. 6, Community Carbon Forestry

Skutsch, M, (2011). Community Forest monitoring for the carbon market Opportunities under REDD, Earthscan, London

Souza, C, Firestone L, Moreira Silva L, and Roberts D. (2003). Mappingforest degradation in the Eastern Amazon from SPOT 4 through spectralmixture models. *Remote Sensing of Environment* 87: 494-506.

Tewari P., and Phartiyal,P. Strengthening of Community Managed Institutes (Van Panchayats) through Public Private Partnership in Uttarakhand, India *Use of Carbon Sequestration Data for Resource Mobilization and Monitoring http://www.forestrynepal.org/images/02%20Presented%20Papers%20and%20Powerpoints/Theme%201/Paper/02-%20Tiwari%20et%20al_India.pdf*

Tewari, A., Singh, V. and Phartiyal, P. (2008). The potential of community managed forests for carbon trade. LEISA: 24 (4). pp. 32-33

The Forest Conservation Act, (1980)

The Forest Rights Act, (2006)

Uttarakhand Jal Vidyut Nigam Limited (2006) http://www.uttarakhandjalvidyut.com/small_hydroplants.htm

UNFCCC (2008). The Little REDD+ Book. http://www.theredddesk.org/redd_book

UNFCCC (2011). http://cdm.unfccc.int/Statistics/Registration/NumOfRegisteredProjByHostPartiesPieChart.html

UNFCCC (2011).*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).* http://unfccc.int/meetings/ad_hoc_working_groups/lca/items/4578.php

World Bank (2007).State and Trends of the Carbon Market.http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:21319781~pagePK:64257043~piPK:437376~theSitePK:4607,00.html

World Bank (2008).State and Trends of the Carbon Market. http://siteresources.worldbank.org/NEWS/Resources/State&Trendsformatted06May10pm.pdf

Wunder, S. (2008). *Moving ahead with REDD: Issues, options and implications*, chapter How do we deal with leakage?, page 65. CIFOR.