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Synergies between Climate Mitigation and Adaptation in Forest Landscape Restoration

GLOBAL FOREST AND CLIMATE CHANGE PROGRAMME

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Introduction

Forests have always been cleared to provide land uses necessary for human existence. This trend has naturally increased over time and now global estimates suggest, "*that 30% of original forest cover has been converted for other uses and an additional 20% has been degraded*."[i]

Humans also benefit from resources from forests. The rural poor, in particular, benefit extensively from forest goods and services (such people are approximately 1.6 billion in number).[ii] IUCN has estimated the economic benefits of forests at USD 130 million per year.[iii] On the other side, The Economics of Ecosystems and Biodiversity (TEEB) calculate the costs in lost value from forest destruction to be between USD 2-5 trillion per year.[iv]

Forests have many unique properties, related to their high rates of primary productivity and biodiversity, which distinguish them ecologically from other ecosystems. Such properties include biological structures that develop in vertical and horizontal layers of live and dead plants, complex processes at multiple vertical levels from within soil layers up to the canopy, the capacity for self-renewal in the face of constant small and large disturbances, co-evolved plant-animal and plant-plant interactions, and the influence forest landscapes can have on micro- and regional climates, especially in closed-canopy tropical forests. Forests are comprised of multiple ecosystems that are associated with variable edaphic and microclimate conditions across broad landscapes.

Thompson, I., Mackey, B., McNulty, S., Mosseler, A. (2009). Forest Resilience, Biodiversity, and Climate Change. A synthesis of the biodiversity/resilience/stability relationship in forest ecosystems. Secretariat of the Convention on Biological Diversity, Montreal.

Forest Landscape Restoration

Forest Landscape Restoration (FLR) is a process that aims to regain ecological integrity and enhance human well-being in deforested or degraded forest landscapes. It involves people coming together to restore the function and productivity of degraded forest lands - through a variety of place-based interventions, including new tree plantings, managed natural regeneration, or improved land management. The idea is to restore forest ecosystems as part of larger, negotiated landscape management changes, rather than through isolated restoration projects or piecemeal land use alterations. In light of the immense benefits provided by forests, FLR provides a great opportunity to address pressing global challenges. Indeed, more than two billion hectares of land offer opportunities for restoration across the world, in both tropical and temperate countries.[v]

The Bonn Challenge, established at the invitation of the Government of Germany and IUCN in 2011, calls for the restoration of 150 million hectares (m/ha) of deforested and degraded lands by 2020. This approach is aimed at facilitating the implementation of various international commitments including the UNFCCC REDD+ goal. This could also help to sequester an additional 1 GtCO2e per year, reducing the current emissions gap by 11-17%.[vi] The Challenge is supported by the Global Partnership on Forest Landscape Restoration (GPFLR), with IUCN as its secretariat. This is a voluntary partnership between governments, international and non-governmental organizations and others, which "*facilitates exchange and learning, generates new knowledge and tools, acts as vehicle to mobilize capacity and expert support to address the practicalities of in-situ landscape restoration*."[vii]

Currently, nearly 60 m/ha of land have been pledged from countries like Ethiopia, Rwanda, Uganda, the Democratic Republic of Congo, Colombia, Peru, Mexico, Costa Rica, El Salvador, Guatemala and the United States and the Altantic Forest Restoration Pact in Brazil, with several million further hectares in contributions expected in 2015.[viii]

Forest Landscape Restoration has the potential to provide immense benefits for climate change mitigation and, if carried out in a climate smart manner, provide equally large adaptation benefits. Previously forests were mainly considered for mitigation purposes and largely ignored for adaptation. Now, recent studies suggest their importance in linking both mitigation and adaptation.[ix]

Box 1 Important Aspects of Forest Landscape Restoration

- It focuses restoration decisions on how best to restore forest functionality (that is, the goods, services and processes that forests deliver), rather than on simply maximizing new forest cover. In other words, FLR is much more than just tree-planting;
- It encourages landscape managers to take site-based decisions within a landscape context, ensuring, at the very least, that such decisions do not reduce the quality or quantity of forest-related functionality at a landscape level and, ideally, that the decisions contribute towards improving landscape-level functionality;
- It requires that local needs are addressed and balanced alongside with national-level priorities and requirements for reforestation, thus making local stakeholder involvement in planning and management decisions an essential component;
- While promoting the need for site-level specialization, it discourages actions that would result in human well-being being traded off against ecological integrity at the landscape level, or vice versa. Such trade-offs are unsustainable and tend to be counterproductive in the medium to long term. Rather such tradeoffs should be part of landscape level negotiations;
- It recognizes that neither the solutions to complex land-use problems nor the outcomes of a particular course of action can be predicted accurately, especially as ecosystems and land-use patterns change over time. FLR is therefore built on adaptive management and requires that necessary provision is made for monitoring and learning;
- Given the complex challenge of restoration, FLR normally requires a package of tools. Silver bullet type-solutions or approaches seldom provide the practitioner with sufficient flexibility; and
- Over the longer term, FLR cannot be driven solely by good technical interventions alone but will require supportive local and national policy frameworks. In many situations it is likely that policy change will follow on from good innovative practice. Therefore, practitioners need to familiarize themselves with how other land- use policies impact the restoration and management of forests.

Source: IUCN 2005

The Study

The purpose of this study is to understand the current discourse and practice on climate change mitigation and adaptation in FLR, as well as to analyze the implications for a better understanding the complementarities and synergies between mitigation and adaptation, specifically in the context of FLR. Both mitigation and adaptation are considered equally important to address with climate change. Developing countries, least developed countries (LDCs) and island states all now agree on instituting mitigation efforts as well as adaptation.

The results of the study will help develop and implement IUCN's strategies and actions to establish linkages between climate mitigation and adaptation in forest landscapes. As compared to other sectors, there is potentially more opportunity to demonstrate these linkages in the broad forest sector. The involvement of local communities in mitigation efforts through forest restoration provides an ideal opportunity to enhance the adaptive capacity of those communities.

It is thus critical to appraise and better understand the links between mitigation and adaptation in the context of both policy relevance and field implementation. This would help develop a joint mitigation and adaptation conceptual

model and strategy to optimize investment on FLR projects and initiatives based on empirical knowledge and experience, even though it may still be politically necessary to separate mitigation and adaptation at a policy level, or at least see one as a co-benefit of the other, and vice versa

The idea is to synthesise the rich learning, evidence and expertise for integrated adaptation-mitigation options in FLR and make this available for policy makers, such that it can be used to inform policy and on-ground practice. This will help to ensure that the success stories of mitigation-adaptation integration in forest landscapes can be replicated in other sectors also. It will also help in bringing technical expertise from international and national arenas to the local field levels.

Methodology

The study entailed extensive literature review of linkages between adaptation and mitigation at the global policy level, through analysis of relevant policies and protocols in the context of climate change in general and FLR in particular. Initially, results of UNFCCC Conference of Parties were assessed to summarise the various decisions that have been taken over the years.

This was followed by literature review regarding the current discourse and understanding of adaptation and mitigation options and the synergies between the two, specifically in the context of FLR.

An important aspect of the study was to develop case studies to explore linkages between national policies on mitigation and adaptation in 7 priority countries (India, Kenya, Uganda, Rwanda, Vietnam, El Salvador and Mexico). In addition, the case studies also highlighted FLR related mitigation and adaptation options in the countries, their role in UNFCCC, and the way forward for them in promoting synergetic mitigation and adaptation options for forest landscapes.

The final section provides recommendations for integrated mitigation-adaptation options at international and national policy levels after reviewing the current thinking on this aspect.

Box 2 UNEP has specified that forests have four major roles in climate change:

1. They currently contribute about **one-sixth of global carbon emissions** when cleared, overused or degraded;
2. They react sensitively to a changing climate;
3. When managed sustainably, they **produce woodfuels as a benign alternative to fossil fuels**;
4. And finally, they have the potential to **absorb about one-tenth of global carbon emissions** projected for the first half of this century into their biomass, soils and products and store them - in principle in perpetuity

Source: http://www.fao.org/forestry/climatechange/53459/en/

Climate Change and Forest Landscapes

Over the past two decades it has become increasingly clear that climate is changing across the globe. The Intergovermental Panel on Climate Change (IPCC) published its first assessment report in 1990, highlighting this aspect. Since then, its subsequent reports have continued to provide further and increasingly stronger evidence that human induced climate change has immense effects on humans societies and ecosystems.

Forests are important ecosystems and provide countless goods and services to people across the globe. These goods and services are in the form of food, fuel, medicine, employment and income. Wood and NTFP (non-timber forest products) are used for various purposes by local communities as well as at the national and global levels. Forests also support extensive biodiversity; providing habitat and food sources for various species. The impact of climate change, can therefore, be felt across the board in forest ecosystems, affecting human societies in a multitude of ways. Climate change impacts humans directly, and can affect both humans and biodiversity indirectly through its influence on forest landscapes. Since local communities are also dependent on biodiversity, they are again affected when species are affected. Furthermore, forests - like other ecosystems across the globe, are not

only being affected by climate change (Box 2) associated disturbances such as flooding, droughts, wildfires and insects but also by other drivers of change such as land use, pollution and overexploitation[x].

Global vegetation patterns are heavily dependent on climate and human influence, which specifically influences the distribution, structure and ecology of forests.[xi] This fact has been repeatedly proven by various studies, showing that particular climate regimes are associated with particular plant communities or functional types [xii] and as such it can be assumed that climate change would therefore have extensive impacts on the configuration of forests.[xiii] This was also highlighted in the Third Assessment Report of IPCC, which showed that forest ecosystems are likely to be seriously impacted by future climate change[xiv] and this may happen even if global warming is less than projected in this century, with the result still being changes in species composition, productivity and biodiversity.[xv]

According to the Food and Agriculture Organization of the UN (FAO), the increase in the concentration of atmospheric CO_2 due to change in climate, will directly affect forest growth and production. On the other hand changes in temperature and precipitation will result in indirect impacts through complex interactions in the forest ecosystems. Although warmer temperatures in temperate and boreal zones will have a positive effect, a decline in precipitation and an increase in decomposition rates will nullify this.[xvi] Furthermore, the increase in productivity in some tropical zones will be temporary and in drylands the increase in temperature will lead to increased plant stress decreasing their productivity.[xvii]

It is clear that changes in forest productivity are likely to have a multitude of impacts on natural and human systems. It will impact the production of wood and wood products thus leading to losses in income for forest communities and the timber industry. Forest biodiversity will also be impacted as forests shift towards the poles and vulnerable species could be lost.[xviii] Not only this, the higher predicted incidences of extreme events will also have a devastating effect on the forest flora and fauna as will the increase in forest fires due to droughts.[xix] Changes in precipitation and runoff patterns will result in decrease in the availability of water in many parts of the worlds forested watersheds, thus decreasing the goods and services they provide.[xx] Incidences of pest outbreaks are also expected to rise as the defenses of host species change with a changing climate, as well as with the change in the abundance of parasites and predators. FAO cites examples where insect and pathogen lifecycles or habits have been altered by local or larger-scale climate change (e.g. mountain pine beetles in North America and pine and oak caterpillars in Europe).[xxi]

It is therefore, necessary to implement strategies and approaches in forest ecosystems to increase their resilience and adaptive capacity, thus decreasing the vulnerability of the human societies dependent on them. As such, adaptive and sustainable forest management is crucial to reduce vulnerabilities of forests and the human populations dependent on them.

Importantly, approaches such as afforestation, reforestation, restoration, and avoided deforestation (REDD+) are essential approaches to ensure the continuation of carbon sequestration for mitigation of GHGs. FAO recommends 10% forest cover per a country's land area.[xxii] Forest landscape restoration provides extensive opportunities for the implementation of these climate related options.

Current Strategies to Deal with Climate Change: Definitions

Mitigation and adaptation are the two main strategies that are used effectively to address climate change and its impacts, especially on forest ecosystems.

Adaptation

IPCC defines adaptation "*as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*." [xxiii] According to the UNFCCC "*Adaptation refers to adjustments in ecological, social, or economic systems in response to actual or expected climatic stimuli and their effects or impacts. It refers to changes in processes, practices, and structures to moderate*

potential damages or to benefit from opportunities associated with climate change." IPCC also defines the types of adaptation: anticipatory or proactive adaptation ("that takes place before impacts of climate change are observed"), reactive adaptation ("that takes place after impacts of climate change have been observed"), autonomous or spontaneous adaptation ("that does not constitute a conscious response to climatic stimuli but is triggered by ecological changes in natural systems and by market or welfare changes in human systems") and planned adaptation ("that is the result of a deliberate policy decision, based on an awareness that conditions have changed or are about to change and that action is required to return to, maintain, or achieve a desired state"). [xxiv]

In forest landscapes, adaptation means changing management practices in order to decrease the vulnerability of forests to climate change as well as implementing activities to reduce the vulnerability of the forest dependent populations, and adopting climate smart restoration and management approaches, for example restoration with species appropriate to the evolving changes in climate.

Vulnerability is central to adaptation[xxv] and the IPCC defines vulnerability as "*the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity*". It elaborates on the components of vulnerability, which are: exposure, sensitivity, and adaptive capacity.[xxvi]

Using the IPCC definitions *"exposure is the nature and degree to which a system is exposed to significant climatic variations*". Forests are exposed to different aspects of climate change (and other factors such as land use and pollution that may exacerbate climate change impacts). [xxvii]

Sensitivity means the "*degree to which a system is affected, either adversely or beneficially, by climate-related stimuli*." This indicates that forests are impacted by climate change by varying degrees and these impacts may be positive or negative and may be through changes in tree level processes, species distribution or disturbance regimes.[xxviii]

Finally, the IPCC definition refers to adaptive capacity that is "*the ability to adjust to climate change (including climate variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences*." In terms of forests the extent of their adaptive capacity to climate change is not clear and therefore we do not know how well forest landscapes would be able to adjust to climate change. [xxix] This needs to be considered when developing adaptation strategies for forests.

The success of adaptation strategies depends on governments and other stakeholders including civil society, communities, international organizations and the private sector.[xxx]

Box 3 UNFCCC Requirements

- Requires all Parties, taking into account their responsibilities and capabilities, to formulate and implement programmes containing measures to mitigate climate change
- Also requires all Parties to develop and periodically update national inventories of GHG emissions and removals
- Commits all Parties to promote, and cooperate in, the development, application and diffusion of climate friendly technologies
- Requires developed countries to adopt national policies and measures to limit GHG emissions and protect and enhance sinks and reservoirs
- States that the extent to which developing countries will implement their commitments will depend on financial resources and transfer of technology

Mitigation

The IPCC defines mitigation as "*an anthropogenic intervention to reduce the emissions sources or enhance the sinks of greenhouse gases*." The Fourth Assessment Report of the International Panel for Climate Change highlights that global greenhouse gas (GHG) emissions have grown since pre-industrial times. [xxxi] Approximately 70% of this increase occurred between 1970 and 2004. According to the

United Nations Framework Convention on Climate Change (UNFCCC) these emissions will continue to grow over the next few decades even with the current level of climate change mitigation policies and sustainable development practices.[xxxii] Both the UNFCCC and IPCC maintain that societies can respond to climate change by reducing GHG emissions and enhancing sinks and reservoirs, depending on governments' capacity to do so, and based on socioeconomic and environmental situations and the availability of information and technology. A wide variety of policies and climate change mitigation instruments are available to encourage and assist governments to provide incentives for mitigation activities.[xxxiii] The convention also lays down requirements for the parties (Box 3).

Carbon is one of the main contributors to climate change and is mainly stored in fossil fuel reserves, atmosphere, oceans, ocean sediment and terrestrial ecosystems.[xxxiv] According to the IPCC, terrestrial ecosystems store approximately 2,400 Gt C with a gross carbon exchange with the atmosphere at approximately 200 Gt C per year.[xxxv] It is important to note that almost 50% of terrestrial carbon stocks are in forest ecosystems in the form of biomass and soil carbon.[xxxvi]

Since almost half the world's forests have been converted to agriculture and other land uses [xxxvii] and extensive degradation has also taken place in the remainder, this means that "*the current terrestrial stock of ~2,400 Gt is possibly about 40% below the natural reservoir when at equilibrium with current climate*." [xxxviii]

According to the FAO, mitigation strategies in the forest sector can be grouped into four main categories:

- Reducing emissions from deforestation;
- Reducing emissions from forest degradation;
- Enhancing forest carbon sinks; and
- Product substitution (use of wood instead of fossil fuels for energy and the use of wood fiber in place of materials such as cement, steel and aluminum that involve the emission of larger quantities of GHGs). [xxxix]

Countries are being encouraged, especially through REDD+, to undertake mitigation actions in forest landscapes, by incorporating the above strategies. A variety of policies and instruments have effectively reduced GHG emissions in many countries and according to the Fourth IPCC there is significant potential in the coming decades also.[xl]

Both mitigation and adaptation are crucial strategies if this planet is to deal with climate change and is impacts. As a result, countries have come together to increase their own understanding of climate change and its impacts, to build their capacities and to implement mitigation and adaptation activities. The next section (Section 2) outlines this global response to climate change.

Global Response to Climate Change

"*Climate change is a complex problem, which, although environmental in nature, has consequences for all spheres of existence on our planet. It either impacts on-- or is impacted by-- global issues, including poverty, economic development, population growth, sustainable development and resource management. It is not surprising, then, that solutions come from all disciplines and fields of research and development*." UNFCCC [xli]

It was this global understanding that led to the establishment of various responses to climate change. The crucial need was to reduce emissions and in 2010 governments agreed that emissions need to be reduced such that global temperature increases are limited to below 2^0C. In this context, various political, technical and economic actions were taken. Organizations such as the IPCC and the World Bank provide the technical and socioeconomic information (and funding for projects also, in the case of The World Bank) regarding climate change, which assists countries in implementing actions for mitigation and adaptation. While the UNFCCC is a framework where national parties influence decisions on actions on the political and economic climate change agenda. Therefore, to understand global actions it is necessary to briefly review these organizations and frameworks to assess how they influence climate change mitigation and adaptation strategies.

The Intergovernmental Panel on Climate Change (IPCC) was established by the United Nations Environment Programme and the World Meteorological Organisation in 1988, as the leading international body for the scientific and socioeconomic impact assessment of climate change. [xlii] It is responsible for reviewing and assessing the most recent global scientific, technical and socioeconomic information.

The scientific aspects of climate are assessed by the IPCC Working Group I (WG I). It looks at changes in greenhouse gases and aerosols in the atmosphere; observed changes in air, land and ocean temperatures, rainfall, glaciers and ice sheets, oceans and sea level; historical and paleoclimatic perspective on climate change; biogeochemistry, carbon cycle, gases and aerosols; satellite data and other data; climate models; climate projections, causes and attribution of climate change. Adaptation, impacts and vulnerability are assessed by the IPCC Working Group II (WG II), which also takes into consideration the interrelationship between vulnerability, adaptation and sustainable development. Mitigation options are assessed by the IPCC Working Group III (WG III).[xliii]

The Task Force on National Greenhouse Gas Inventories (TFI) was established by the IPCC to oversee the IPCC National Greenhouse Gas Inventories Programme (IPCC-NGGIP) and a Technical Support Unit (TSU) has been established to support the IPCC Chair in preparing the Synthesis Report for the Fifth Assessment Report.[xliv]

Box 4 IPCC Climate Activities 2014

The Working Group II (WGII) contribution to the Fifth Assessment Report on impacts, adaptation and vulnerability will be considered in Yokohama, Japan, on 25-29 March 2014.

The Working Group III (WGIII) contribution to the Fifth Assessment Report on mitigation of climate change) will be considered in Berlin, Germany, on 7-11 April 2014,

The Synthesis Report (SYR) of the Fifth Assessment Report will be considered in Copenhagen, Denmark, on 27-31 October 2014.

Source: http://www.ipcc.ch/index.htm#.UsfatfQW0v4

Responding to climate change in 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), to work together to limit average global temperature increases and the resulting climate change and to adapt to its impacts that were already taking place. Subsequently, the Kyoto Protocol was launched to strengthen the global response to climate change. At the COP 17 in Durban an agreement was made to move to a commitment phase beyond 2013 for the Protocol, the first phase of which ended in 2012.[xlv]

> *The ultimate objective of the Convention is the "...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system..."*
>
> Source: http://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveng.pdf

The Bali Road Map was adopted at the 13th Conference of the Parties (COP 13) in December 2007 in Bali, and is a comprehensive process to enable the full, effective and sustained implementation of the Convention through long-term cooperative action, now, up to and beyond 2012. The Bali Action Plan is divided into five main categories: shared vision, mitigation, adaptation, technology and financing. The long term vision of plan includes a long term goal for emission reductions.[xlvi] It is particularly important as it also aims towards forest conservation, sustainable forest management and enhancement of carbon stock and identified REDD+ as a potential mitigation initiative.

This was followed by the Cancun Agreements in 2010which, in addition to mitigation, gave equal importance to adaptation and included finance, technology and capacity building support to assist developing countries adapt to climate change, as well as to lower emissions.[xlvii] These Agreements specifically included forests, and governments agreed to protect the world's forests by launching concrete action in developing nations.

Climate change affects human societies and ecosystems, and this is especially exacerbated in developing countries. Even with mitigation actions being undertaken worldwide there is still a need to ensure that adaptation to climate change also takes place so that people and ecosystems are less vulnerable to climate change impacts.[xlviii] Of equal importance is the mainstreaming of adaptation into national development policies.[xlix] This fact was internationally recognized and the National Adaptation Plans of Action were established at COP 7 in 2002, through which the Least Developed Countries (LDCs) identify and communicate their most urgent adaptation needs and also prioritize actions. As at November 2013, 50 countries had completed and submitted their NAPAs to the secretariat.[l]

At the 2012 UN Climate Change Conference in Doha, Qatar, strategies to implement National Adaptation Plans of Action (NAPAs) in LDCs were agreed upon. In addition, governments further clarified ways to measure deforestation, and to ensure that efforts to fight deforestation are supported.[li] The Nairobi Work Programme (NWP) undertaken under the Subsidiary Body for Scientific and Technological Advice (SBSTA) of the UNFCCC, aims to assist all Parties, in particular developing countries, including the least developed countries and small island developing States, to" *improve their understanding and assessment of impacts, vulnerability and adaptation to climate change*"; and "*make informed decisions on practical adaptation actions and measures to respond to climate change on a sound scientific, technical and socio-economic basis, taking into account current and future climate change and variability*".[lii]

To specifically target mitigation and encourage mitigation action, the Conference of Parties (COP), at its sixteenth session, decided to set up a registry to record Nationally Appropriate Mitigation Actions (NAMAs). The idea was to facilitate the matching of finance, technology and capacity building with these actions. [liii]

Box 5 Climate Change Timeline of Actions

2012—The Doha Amendment to the Kyoto Protocol is adopted by the CMP at CMP8. More on the Doha Amendment.

2011—The Durban Platform for Enhanced Action drafted and accepted by the COP, at COP17. More on the Durban outcomes.

2010—Cancun Agreements drafted and largely accepted by the COP, at COP16. More on the Cancun Agreements.

2009 — Copenhagen Accord drafted at COP15 in Copenhagen. This was taken note of by the COP. Countries later submitted emissions reductions pledges or mitigation action pledges, all non-binding.

2007—IPCC's Fourth Assessment Report released. Climate science entered into popular consciousness. At COP13, Parties agreed on the Bali Road Map, which charted the way towards a post-2012 outcome in two work streams: the AWG-KP, and another under the Convention, known as the Ad-Hoc Working Group on Long-Term Cooperative Action Under the Convention. More about the Bali Road Map.

2005 — Entry into force of the Kyoto Protocol. The first Meeting of the Parties to the Kyoto Protocol (MOP 1) takes place in Montreal. In accordance with Kyoto Protocol requirements, Parties launched negotiations on the next phase of the KP under the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP). What was to become the Nairobi Work Programme on Adaptation (it would receive its name in 2006, one year later) is accepted and agreed on. More about the Nairobi Work Programme.

2001—Release of IPCC's Third Assessment Report. Bonn Agreements adopted, based on the Buenos Aires Plan of Action of 1998. Marrakesh Accords adopted at COP7, detailing rules for implementation of Kyoto Protocol, setting up new funding and and planning instruments for adaptation, and establishing a technology transfer framework.

1997—Kyoto Protocol formally adopted in December at COP3. More about the Kyoto Protocol.

1996—The UNFCCC Secretariat is set up to support action under the Convention. More on the Secretariat.

1995—The first Conference of the Parties (COP 1) takes place in Berlin.

1994—UNFCCC enters into force. An introduction to the United Nations Framework Convention on Climate Change.

1992—The INC adopts UNFCCC text. At the Earth Summit in Rio, the UNFCCC is opened for signature along with its sister Rio Conventions, UNCBD and UNCCD. More about the two other Rio Conventions: UNCBD and UNCCD.

1991—First meeting of the Intergovernmental Negotiating Committee (INC) takes place.

1990—IPCC's first assessment report released. IPCC and second World Climate Conference call for a global treaty on climate change. United Nations General Assembly negotiations on a framework convention begin.

1988—The Intergovernmental Panel on Climate Change is set up. More about the science of climate change.

1979—The first World Climate Conference (WCC) takes place.

Box 6: COP 19 Warsaw 2013. Some decisions taken to further the Action Agenda.

Decision -/CP. 19 "Further advancing the Durban Platform" including mitigation benefits, costs, co-benefits, barriers to their implementation and strategies to overcome those barriers, including finance, technology and capacity-building support for mitigation action in developing country Parties. (FCCC/ADP/2013/L.4).

The Warsaw International Mechanism for Loss and Damage was also discussed. Warsaw International Mechanism for Loss and Damage associated with climate change impacts.

Another decision was in the context of forests whereby monitoring and reporting of activities was agreed upon based on information provided by IPCC. Modalities for national forest monitoring systems, and Addressing the drivers of deforestation and forest degradation.

It was also decided to continue the Nairobi work programme on impacts, vulnerability and adaptation to climate change. Nairobi Work Programme on impacts, vulnerability and adaptation to climate change.

Importantly the arrangement between the Green Climate Fund and parties was also agreed. Report of the Green Climate Fund to the Conference of the Parties and guidance to the Green Climate Fund and Arrangements between the Conference of the Parties and the Green Climate Fund.

The most recent Conference of the Parties (COP 19) took place in Warsaw in 2013. One of the breakthrough achievements here was that the rulebook on Reducing Emissions from Deforestation and Forest Degradation (REDD+) was agreed upon. This time it includes safeguards for people's rights and access to forest ecosystems as well as for biodiversity. [liv] Initial pledges of USD 280 million were made to support protection of forests, to be provided as result based payments.[lv] Furthermore, measures to strengthen forest conservation as well as payment systems for forest protection were also decided. The Green Climate Fund will also be ready for utilization by mid-2014.[lvi] The Climate Technology Center and Network (CTCN) which was established at COP 16 in Cancun, and which aims to transfer technology to developing countries, was officially opened in Warsaw. [lvii] Adaptation was also given a wider reach and a workshop outlining adaptation achievements was organized. Parties have always questioned whether adaptation was worth it due to the fact that it can tend to be expensive. At COP 19 there was concurrence that it is, considering that emergency responses to disasters such as Typhoon Haiyan can be extensively more expensive.[lviii] Other outcomes included developed countries meeting the target capitalization of USD 100 million for the Adaptation Fund, which can now continue funding priority projects.[lix] Governments also agreed on a mechanism to address loss and damage caused by long-term climate change. This would help countries to improve risk reduction and deal with both extreme and slow onset events.[lx]

In 2008, the United Nations created the United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN-REDD). The aim of the programme is to build developing countries' capacity to reduce emissions and to participate in future REDD+ mechanisms. (REDD+ refers to reducing emissions from deforestation and forest degradation in developing countries; and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks in developing countries). The programme provides support to governments to prepare national REDD+ strategies, build monitoring systems, engage stakeholders and assess multiple benefits.[lxi] The Programme supports the UNFCCC partnerships on REDD+ and provides support to countries implementing REDD+ decisions taken during COP 16.[lxii]

The UN REDD+ activities have the following three phases:[lxiii]

- **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.

As mentioned earlier, the IPCC provides technical and socioeconomic climate change data and the UNFCCC provides a platform to bring countries together to implement policies at the political and economic levels. Other global organizations such as UNEP and The World Bank have their own climate change adaptation and mitigation projects, where developing countries are supported for both approaches. The FAO specifically works globally in the forestry and climate change sector in order to increase food security.

In spite of these efforts global emissions are still rising. According to the World Bank a 4^0C temperature rise is on the cards, because the current level of action is inadequate.[lxiv] The World Economic Forum's Global Risk Report of 2013, highlights GHG emissions as one of the five major risks that the global economy faces. It points out that global economic and environmental systems are simultaneously under stress and the impacts of climate change on them is more and more evident.[lxv] There is therefore clearly a need to scale up climate efforts and synthesizing mitigation and adaptation efforts are perhaps the best ways of doing so, especially in the context of landscape restoration.

Mitigation and Adaptation in Forest Landscapes

The Fourth Assessment Report of the IPCC highlights the fact that mitigation efforts need to continue to control the rate and magnitude of climate change - a change that would have very high social, environmental and economic costs.[lxvi] From the previous chapter we can see that extensive global efforts have been made to mitigate changes in climate, however, even with current mitigation efforts the climate does and will continue to change. Therefore adaptation has become a necessary strategy for both human societies and ecosystems to "*adjust human and natural systems so that communities are more resilient and can cope with the harmful effects of climate variability*." [lxvii] As such, adaptation interventions have taken place to ensure that human and natural systems both adapt to already occurring climate variability, by reducing their vulnerability. The bottom line is that no matter how strong mitigation efforts are, there would still be impacts from climate change and adaptation to these impacts is necessary for humans (adaptive capacities) as well as ecosystems (changes in ecosystem structure and function). Conversely, adaptation alone will not be enough as the magnitude of change increases and therefore mitigation is also essential.

Mitigation and adaptation are different from each other in that they have different objectives. While mitigation addresses the causes of climate change such as greenhouse gas emissions, adaptation addresses its impacts. Other differences between the two are in terms of spatial and temporal scales. While adaptation usually provides benefits at the local level, mitigation is a global effort. Both work across different time scales with mitigation being long term and adaptation short term, and the economic sectors that both are a priority in, are also different. [lxviii]

While the two approaches have generally been implemented separately, current discourse is slowly moving towards finding synergies between mitigation and adaptation to ensure integrated and holistic solutions to the larger climate problem, especially in the context of forest ecosystems, i.e. that there are mitigation co-benefits for adaptation, and adaptation co-benefits for mitigation – in this way attribution can be stronger. In August 2012 Bolivia presented a proposal to the UNFCCC making the case for a joint mitigation and adaptation mechanism for forests.[lxix] The report points out the dual role of forests for both mitigation and adaptation. The Fourth IPCC Report also strongly promoted the need to explore synergies between the two (Box 7). The reason for this is that integration can maximize the effectiveness of investment as well as enhance institutional capacity to cope with a changing climate.[lxx] The Report also points out that integrated actions for both mitigation and adaptation can include technological, institutional and behavioral options, implementation of economic and policy instruments as incentives and research & development to make them more effective and efficient.[lxxi]

The FAO promotes Sustainable Forest Management (SFM) as an approach consistent with both mitigation and adaptation, which can be useful in finding synergies between the two. It maintains that *"using SFM as an overall framework helps ensure that adaptation and mitigation measures are synergistic and balanced with other forest management objectives and take into consideration the economic, social and environmental values of forests*".[lxxii] This is analogous with Sustainable Land Management, which is advocated for by UN CCD

Box 7 Four levels of adaptation-mitigation interrelationship:

- Adaptation actions that have consequences for mitigation,
- Mitigation actions that have consequences for adaptation,
- Decisions that include trade-offs or synergies between adaptation and mitigation,
- Processes that have consequences for both adaptation and mitigation.

Source: IPCC AR4

The following are some strategies and areas where there is an extensive potential for integrated mitigation-adaptation options in forest landscapes.

> "Climate change mitigation measures, including in forests, are urgently needed to help reduce anthropogenic human-induced interference with the climate system, but such measures will only begin to have an effect on global mean surface temperature decades from now. For this reason, adaptation measures in forests to secure the continued delivery of forest goods and ecosystem services will be required for many years to come."
>
> Source: FAO 2013. Climate change guidelines for forest managers. FAO Forestry Paper No. 172. Rome, Food and Agriculture Organization of the United Nations.

Forest Landscapes, Mitigation and Adaptation

Forests contain a quantity of terrestrial carbon stored in trees and soil, representing a significant global carbon stock. According to UNFCCC's LULUCF (Land Use, Land Use Change and Forestry) Programme, in terms of total carbon storage, global forests store 283 Gt of carbon in biomass, 38 Gt in deadwood and 317 Gt in soils (top 30 cm) and litter. For 2005, the total carbon content of forest ecosystems was estimated at 638 Gt, which is more than the amount of carbon in the entire atmosphere. Human activities on terrestrial systems such as forests, therefore change carbon stocks in the ecosystems themselves and in the atmosphere.[lxxiii] During the 1990s, tropical deforestation and re-growth of forests in temperate and boreal zones were the major factors in contributing to emissions and removal of greenhouse gases respectively.[lxxiv] Deforestation and forest degradation for other land uses (agriculture, pastures, and infrastructure) and through extensive logging and fires account for nearly 20% of global greenhouse gas emissions. [lxxv]

Forest landscapes are one sector where both mitigation and adaptation approaches are or can be applied. Forests provide ecosystem goods and services and therefore reduce the vulnerability of local communities and support economic sectors thus contributing to adaptation. For example, they provide non-timber forest products (NTFPs) and firewood during times of crop failure due to drought; they regulate water flow during high rainfall and protect coastal areas from storms and sea level rise. Similarly, they contribute to mitigation by removing carbon from the atmosphere. [lxxvi] It is therefore clear that forests have a role to play in the application of strategies and interventions that look at integrating mitigation and adaptation. For climate smart forest management and restoration, it will be important to better understand how forest ecosystems will change with climate change, and how these changes can be mediated through improved management (more resilient species, different species, different management approaches for example).

Based on this, it is now important for forest landscape restoration to be included in national adaptation strategies. In addition, forest based mitigation activities such as REDD+ need to explicitly include adaptation,[lxxvii] which would ensure that they fall within the purview of FLR. If this is not done, then FLR may well not deliver to its expectations, or even fail

Mitigation can contribute to adaptation

An important mechanism to mitigate climate change through controlling the release of carbon into the atmosphere through deforestation and forest degradation is REDD+. The Reducing Emissions from Deforestation and Forest Degradation in Developing Countries Programme was launched in 2008. It is a collaborative programme between and building on the expertise of Food and Agriculture Organization of the United Nations (FAO), the United Nations Development Programme (UNDP) and the United Nations Environment Programme (UNEP). REDD+ refers to reducing emissions from deforestation and forest degradation in developing countries, and highlights the role of conservation, sustainable management of forests and enhancement of forest carbon stocks, by providing financial incentives.[lxxviii]

Forests contribute through their capacity to remove carbon from the atmosphere by storing it. Mitigation efforts such as the Clean Development Mechanism promote afforestation and reforestation projects, while REDD+ is based on

providing financial incentives to conserve forests, which would result in maintaining and increasing carbon stocks. REDD+ proposes the financing of not only forest conservation and preservation, but also reforestation and sustainable forest management (which can have strong linkages with adaptation*). But such mitigation efforts need to be smart in what sorts of species are used for restoration and how the management approaches take into account the different climate scenarios.*

Mitigation through REDD+ is based on forests, while many adaptation strategies including Ecosystems Based Adaptation (EbA) are related to forests. Therefore it makes sense to understand and promote the linkages between mitigation and adaptation in FLR. Importantly, REDD+ offers opportunities to enhance the outcomes of both, and to help reduce vulnerabilities of local communities.[lxxix] A REDD+ project will be more effective and sustainable if it integrates adaptation measures for both communities and ecosystems. Mitigation needs adaptation to be able to achieve this in a climate proof manner. Furthermore, integrating adaptation into mitigation legitimizes the project amongst local communities, due to its emphasis on local needs. [lxxx] Therefore we need to assess national and international policies for integration, assess community vulnerability and analyze the results of FLR and REDD+ approaches, in the context of both adaptation and mitigation.

Forests need adaptation to maintain ecosystem functionality (adaptation for forests). Such ecosystem functions provide local ecosystem services that reduce the vulnerability of communities to climate change (forests for people's adaptation). [lxxxi] Mitigation projects such as CDM and REDD+ have a huge potential to facilitate adaptation of forests by reducing pressure and conserving biodiversity hotspots.[lxxxii] In terms of the adaptive capacities of people, mitigation projects can facilitate the increase of services on which local people rely. This can result in diversifying incomes, developing economic activities and infrastructure, increase social services and strengthen local institutions.[lxxxiii]

Adaptation can contribute to mitigation

Forest adaptation measures help to ensure the continuation of, and/or an increase in ecosystem services and carbon stocks, thereby contributing to mitigation efforts.[lxxxiv] Again, FLR related projectsare a clear example of this since they can contribute to increasing or maintaining carbon stock. For example, projects such as planting mangroves in coastal areas will contribute to people's adaptation by protecting coastal areas; and will contribute to mitigation by storing carbon. Other mechanisms such as sustainable forest management, agroforestry and community based forestry can also contribute to mitigation by increasing carbon stocks in biomass and soil.

Adaptation also needs mitigation. First of all adaptation alone is not enough to deal with the impacts of climate change and mitigation is required to reduce its magnitude. Secondly, a well-developed and sustainable adaptation project that includes mitigation can benefit from carbon funding and capacity building from international instruments such as REDD+. [lxxxv]

However, caution must be applied when considering such integration. Previously concerns have been raised about the possibility of REDD+ projects restricting the access to and rights of communities to forest resources. Therefore, it is necessary that local livelihoods, access and rights of communities, governance and participation make essential components of any integrated project. [lxxxvi]

FLR and REDD+

Ecosystem degradation - especially forest degradation - can give rise to a whole range of issues including emission of carbon into the atmosphere, reduced options for local livelihoods, and conversion. FLR provides a framework for situations where forest loss has led to the degradation of forest ecosystem services and its aim is to increase the resilience of forest landscapes and to support forest communities. [lxxxvii] It uses a "double filter", suggesting that any FLR related project should include improving the ecological functionality of the landscape *and* human well-being.[lxxxviii] Because it takes a landscape view, FLR requires that project site-level decisions incorporate landscape-

level objectives and impacts. The process should be participatory, involve stakeholders at all levels, and be empowering. Thus, it is a framework that aims to manage the interactions between people, natural resources and land use. [lxxxix]

FLR is therefore a promising option for integrating mitigation and adaptation, through promoting REDD+ activities in forests; while ensuring sustainable management of forest goods and services across an entire landscape; and with active engagement and collaboration amongst all the stakeholders.[xc] The main property of FLR is that it encompasses a host of principles and approaches and cuts across sectors and disciplines, resulting in a holistic approach. This makes it environmentally and socially beneficial, resulting in increased resistance and resilience to climate change, by providing a secure source of biomass and biofuel energy, through carbon sequestration,[xci] and by being climate change smart

Successful FLR needs and contributes to greater transparency and accountability and better governance practices. Experience is showing that FLR can promote forest governance arrangements that improve livelihoods and promote sustainable forest management, complementing initiatives that address forest law enforcement and governance.[xcii] Forest landscape restoration provides an effective basis to implement REDD+ activities, which in turn helps to achieve the goals of both adaptation and mitigation together.

Currently, REDD+ negotiations and national preparations have mainly focused on MRV (monitoring, reporting and verification) systems, in addition to forest governance and national policies/ strategies for REDD+.[xciii] However, effective forest management practices are essential, if the objective of curbing emissions is to be achieved and if carbon stocks are to be enhanced.[xciv] Forest management interventions such as FLR, which sustainably manage these forest services could be beneficial for REDD+. Some forest landscapes have a higher potential for REDD+ than others. However, landscapes with potentially low benefit from REDD+ incentives must also be supported.[xcv] In a nutshell, managing the functions of forests (i.e the provision of their goods and services which include carbon sequestration and increase in carbon stock) is essential for success for REDD+ [xcvi] and is thus a crucial area to achieving synergies between adaptation and mitigation goals.

Ecosystem-Based Adaptation (EbA)

It is clear that healthy, well-functioning ecosystems are more resilient to the effects of climate change and as such reduce the vulnerability of people to its impacts. Ecosystem Based Adaptation (EbA) is an approach that uses biodiversity and ecosystem services as part of a holistic adaptation strategy to assist human beings to adapt to climate change. According to the CBD 2002 it "*integrates the use of biodiversity and ecosystem services into an overall adaptation strategy, can be cost-effective and generate social, economic and cultural co-benefits and contribute to the conservation of biodiversity.*" [xcvii] It works from the local to the global levels. It can also contribute to mitigation by reducing carbon emissions from degradation and increasing carbon stocks especially in the contest of forests.[xcviii] As such many organizations - especially biodiversity and conservation based ones - use this approach to help communities adapt to climate change, by integrating EbA into national and regional strategies and national plans. This is especially where biodiversity and ecosystems services are considered a part of climate adaptation strategies. These include UNEP, WWF, IUCN, WRI, CI, and CARE International. The terminologies may differ among the organizations but the bottom line is that ecosystems and biodiversity must be an integral part of adaptation strategies.

EbA is one approach that can be utilized to underline the linkages between mitigation and adaptation in forest landscapes. Since EbA aims at reducing human vulnerabilities through the provision of ecosystem services, it is clear that well managed and conserved forest ecosystems can help people to both adapt to climate change, and enhance their benefit flows. It can be an effective means of using mitigation tools such as CDM and REDD+ and incorporating adaptation strategies within them. Afforestation, reforestation, conservation, preservation and sustainable management of forests (mitigation measures through CDM and REDD+) can all provide ecosystem

services that help communities to adapt to the impacts of climate change by reducing vulnerabilities and increasing resilience.

EbA is a people centered approach and incorporating it as an adaptation measure into REDD+ ensures that the rights and access of people to forests are not restricted or increase their dependence on external funding.[xcix] Legal rights to access, manage and benefit from rehabilitated and conserved forests are key to long-term sustainability.[c] Therefore, non-financial benefits of mitigation projects such as tenure rights need to become a necessary aspect of REDD+ projects in order to increase adaptive capacity and resilience. [ci] REDD+ discussions also need to look at food security in the context of forest projects such as through the provision of NTFPS another necessary component of EbA.

Agroforestry

One of the impacts of climate change is the reduction in crop yields. For example, it was projected that within a one to two decades, crop yields could be reduced by 20 - 30% in southern Africa by 2030. [cii]. This will in turn increase the vulnerability of famers.

In addition, the IPCC highlights that agriculture, deforestation, and land-use change together account for about 31% of total global anthropogenic GHG emissions.[ciii] In Africa for example, carbon is being released from topsoil due to degradation of croplands, rangelands, and forest degradation. [civ]

Agricultural mitigation potential is estimated to be 5,500-6,000 million tons of CO_2-equivlent per year globally[cv] and approximately 70% of this potential is in developing countries.[cvi] According to the IPCC Fourth Assessment Report, in Sub Saharan Africa, this potential is estimated to be 924Mt CO_2-equivalent per year, in South America it 707 Mt CO_2-equivalent per year and 374 Mt CO_2-equivalent per year for North America.[cvii]

Agroforestry is potentially an important sector where it makes sense to link mitigation and adaptation. It is an integrated scientific and technical approach that garners benefits from using a combination of trees and shrubs with crops. The emphasis is on using improved crop and pasture land management with an emphasis on intercropping with trees, with the aim of managing forest goods and services. As such it constitutes an important technical component for FLR. [cviii]

"Agroforestry is a collective name for land-use systems and technologies where woody perennials (trees, shrubs, palms, bamboos, etc.) are deliberately used on the same land-management units as agricultural crops and/or animals, in some form of spatial arrangement or temporal sequence. In agroforestry systems there are both ecological and economical interactions between the different components."[cix]

Recently poor farmers are turning to agroforestry in order to adapt to climate change impacts. A study conducted by the CGIAR research programme on Climate Change, Agriculture and Food Security (CCAFS) surveyed over 700 households in East Africa and discovered that at least 50% of them had started planting trees on their farms, which decreased the effects of climate change by decreasing erosion and improving water and soil quality (forest services that FLR aims to manage). In addition, this activity helps decrease farmers' vulnerability by providing consumable products in addition to their regular harvest (forest goods that FLR aims to manage).[cx] Although

> *"Agroforestry is the single land use that can combine food production with environmental services provided by tree cover in dense populated countries. In a people-centred approach, agroforestry in its 1000 modalities is much more successful in combining diversified food production, fuel for cooking (and heating), building materials, environmental services and resilience both of income, fodder for cattle and disasters including climate change"*
>
> Source: Assistant Director-General of FAO and Chair of the Collaborative Partnershio on Forests. Eduardo Roias-Briales. New Delhi. Februarv 2014

mitigation was not studied, it is clear that such plantation would also help in carbon sequestration (another forest service).

In particular, including diverse and well managed shade canopy in, for example perennial cropping systems, can provide mitigation and adaptation benefits (by improving the overall adaptive capacity of the system and enhancing carbon storage).[cxi] 'Multifunctional trees' contribute to adaptation by their capacity to maintain soil organic matter and fertility, stabilize production, diversify livelihoods and provide ecosystem services in the landscape. They also produce plant biomass and store carbon in foliage and help to store it in the soil.[cxii] This is a clear linkage between mitigation and adaptation in the context of FLR i.e by looking at the whole landscape, instead of just farms or just forests. Conservation and management of trees within farms and in the surrounding landscape not only improves connectivity but also conserves biodiversity, provides ecosystem goods and services and maintains carbon stocks.[cxiii] An important implication of this, for mitigation approaches like REDD+, is the potential for decreased deforestation. [cxiv] Recent figures from FAO show that agriculture is expanding in 70% of the countries, so it is likely that agroforestry systems will serve as an important component of FLR.[cxv]

Community-Based Forestry

Community forestry is that branch of forestry in which the local communities play a crucial role in managing forests as well as in land use decision making, with support and facilitation provided by the government. Since it involves the participation of various stakeholders, it is a more administrative aspect of forestry, as compared to agro-forestry, which is more of a technical approach. FAO defines community forestry as "any situation that intimately involves local people in forestry activity".[cxvi]

Because forests play a major role in generating livelihoods for local communities, it is crucial to understand the relationships between mitigation, adaptation and forest-based communities.[cxvii] In the context of FLR, forest landscapes can be thought of as a mosaic, which includes components such as land use, tenure, drainage patterns and human settlements.[cxviii] Community forestry can assist in drawing linkages between mitigation and adaptation. Since it considers sustainable forest management, biodiversity conservation and local livelihoods it is an important site level FLR option. It can not only incorporate adaptation but also mitigation options such as REDD+.[cxix]

A publication from RECOFT presented case studies from Cambodia, Indonesia, Nepal, Thailand and Vietnam, and highlighted the importance of community based forestry projects for both mitigation and adaptation. The case studies show that while there are tradeoffs, it is clear that there is a strong potential for linkages between mitigation and adaptation in sustainably managed community forestry projects.[cxx]

Another study conducted in Shinyanga in Tanzania demonstrated that farmers undertake restoration activities if the incentives are right. In the case of the study, the need for dry season forage for livestock and for timber and NTFPs were two of the main drivers for the FLR in Shinyanga. Similarly, climate change can prove to be another important driver, which will increase the need for similar products and services.[cxxi]

These are just some of the options that can be beneficial for synergies between mitigation and adaptation in FLR. Section 4 will provide more context after reviewing case studies from different countries, regarding mitigation and adaptation in forest landscapes and will look at examples of integration and gaps wherever they exist.

Case Studies

This section looks at mitigation and adaptation strategies in the context of FLR in India, Vietnam, Mexico, El Salvador, Rwanda, Kenya, and Uganda. Examples of synergies are highlighted wherever possible. However, since integrated mitigation-adaptation options are only just being discussed, these examples are few.

India

Background and Climate Scenarios

According to the National Communication submitted to the UNFCCC in 2012, approximately 46% of India's area is under agriculture, while about 24% is classified as forests. Other estimations suggest that about 20% (64 million ha) of the geographical area is under forest cover,[cxxii] with almost 200,000 villages classified as forest villages.[cxxiii] The availability of forestland per capita is the lowest in the world at 0.08 ha, compared to 0.5 ha in developing countries and 0.64 ha globally. Urbanization, availability of irrigation facilities, conversion of forest land to alternative uses, law of inheritance and natural disasters all have had an impact on land use patterns in the country[cxxiv] and pest, diseases and forest fires (approximately 35 m/ha of forests, some 55 percent of the forest area, are affected by fires annually) contribute extensively to forest degradation.[cxxv]

The forests in India can be can be divided into 16 major types ranging from wet evergreen forests in the northeast and the southwest, to tropical dry thorn forests in central and western India. The National Communication also highlights that forest cover in 1994 was 6,83,100 km^2, while it was 6,90,899 km^2 in 2007. The increase is attributed to various environmentally friendly policies of the government. A comparison of the years 2000 to 2007 shows a net increase in forest cover by 57,502 km^2. However, dense forest cover (>40% tree canopy cover) decreased by 14,287 km^2 and the area under mangroves declined by 157 km^2 during this period.[cxxvi]

According to 2004 Government of India figures[cxxvii] India's CO_2 emissions are well below the global average at 1.02 Mt compared to 19.73 Mt for USA, 8.46 Mt for the EU, and 9.52 Mt for Japan[cxxviii](the world average was 4.25 Mt). This is down from 1.5 Mt in 2000. Climate modeling projections carried out for the period 1961 - 2098 indicate that while there may not be a significant decrease in monsoon rainfall, the mean annual surface air temperature rise by the end of the century ranges from 3.5^0C to 4.3^0C.[cxxix] Climate scenarios were also undertaken, which showed that Net Primary Productivity (NPP) increases by over 30% by 2035 and 56% by 2085. The increase is higher for northeastern India due to warmer wetter climate predictions. Soil Organic Carbon is also expected to increase but at a lower rate. The assessments show that climate change is expected to increase species loss and the habitat of many species is expected to move either northward or upwards in altitude. In addition, ecosystems will not only be "*slow in showing evidence of change but also slow to recover from stresses*." [cxxx]

Two regional studies pertaining to potential climate change impacts on forests in the northern state of Himachal Pradesh, and the Western Ghats respectively show evidence of shifts in vegetation types, which will have implications for forest depletion and their biodiversity.[cxxxi] A recent study also suggests variation in the magnitude of change for both temperature and rainfall, with Northwestern India likely to be drier and Northeastern India likely to be wetter. In addition, temperature is bound to increase more in Northwestern India than in the Northeast. Southern and Southeastern India are also expected to experience moderate increases in temperature.[cxxxii]

The same study shows that the mean rainfall and temperature in areas under forest cover is somewhat higher than that in the non-forested areas; and the expected increase in rainfall due to climate change is also larger for forested

areas (367 mm compared to the overall average of 235mm). On the other hand the mean change in temperature is not different from the non-forested regions.[cxxxiii] Of course climate change is not uniform across the forest types and studies show a large increase of rainfall of more than 550mm/year for hardwood and bamboo forests and 220mm for fir/blue pine forests.[cxxxiv]

One scenario shows a national average warming of 2.9^{0}C, in colder forests by 3^{0}C and in Western Ghat evergreen forests by 2.4^{0}C, which is similar to another scenario where the national average increase is 4^{0}C , the northern temperate forests at 4.6^{0}C and the Western Ghat evergreen forests at 3.3^{0}C.[cxxxv]

Even with all the modeling studies undertaken, experts claim that there are still data limitations on area, biomass and carbon stock as well as data on forest degradation. There is also a lack of periodic forest inventory studies, land use change matrix for 6 categories is not available, carbon pools data is unavailable for varying land categories. Furthermore, wood extraction, commercial timber and fuelwood extraction data is also not officially available.[cxxxvi] However, according to a FAO working paper, biomass from forests and trees has remained the principal source of domestic energy in India and the First National Communication did estimate it to account for less than 2% of national net emissions in 1994.[cxxxvii]

Adaptation and Mitigation Actions

It is important to note that forests in India are depended upon by humans for goods and services, and are already impacted by a multitude of other stresses such as over extraction, pest outbreaks, overgrazing, fires, conversion, and human related pressures. Climate change will have further and additional exacerbating adverse effects.[cxxxviii]

This makes it necessary for India to implement adaptation measures that decrease the vulnerability of populations during adverse climate events as well as to increase their adaptive capacity to deal with climate change in the long run. Although, currently none of the schemes being implemented to deal with climate change explicitly refer to adaptation, they do contain objectives that relate to adaptation. For example, the National Forest Policy (1988) focuses on increasing the coping capacities of forest dependent communities. In addition, the Participatory Forest Management Programme has been introduced. In 2002 the Biological Diversity Act was adopted to conserve biodiversity as a whole and as such a National Biodiversity Authority (NBA) was established to regulate access to genetic resources and traditional knowledge.[cxxxix]

Even though, India's current levels of GHG emissions are well below global averages, the UNFCCC recognizes that "*emissions originating in developing countries will inevitably increase as a result of economic and social development*."[cxl] Therefore, measures need to be taken that will ensure that climate change mitigation is implemented in forest landscapes. While the Forest Conservation Act of 1980 was helpful in accelerating the afforestation process, more needs to be done in terms of explicit mitigation efforts.

The National Forest Policy clearly states forest conservation and enhancements as stated objectives and according to the National Communication various policy measures have resulted in not only an increase in forest cover but also a decrease in deforestation.[cxli] These include the Forest Conservation Act, 1980, the Wildlife Act, Joint Forest Management, Social Forestry, banning of timber extraction in reserve forests, improved cook- stove programme, and use of biogas to conserve fuelwood; as well as conservation strategies for mangroves coral reefs and lakes.

India recognizes that forests have an important role as carbon sinks and therefore, it is promoting afforestation at a large scale. It has one fifth of its area under forests and is increasing its forest cover by 0.8 m/ha/year, so as to account for 11% of India's annual GHG emissions. The budget for forestry had more than doubled by 2009/10 (Rs. 83 bn or 8300 crore) and this increase is expected to be sustained. In addition, the 13th Finance Commission has

recommended an additional Rs. 50 billion for the period 2010-2015 for the forestry sector; earmarked for the sustainable management and conservation of forests landscapes.[cxlii]

The National Communication highlights the needs to develop and implement adaptation measures and promotes "no regrets" adaptation approaches. These include (i) Modifying the forest working plan preparation process and incorporating the projected climate change and likely impacts, (ii) Initiating research on adaptation practices, covering both conservation and forest regeneration practices, (iii) Linking Protected Areas and forest fragments, (iv) Anticipatory planting of species along the altitudinal and latitudinal gradient, (v) In situ conservation, (vi) Adopting mixed species forestry in all afforestation programmes, (vii) Incorporating fi re protection and management practices and implementing advance fi re-warning systems.[cxliii]

A recent study assessed the integration of national forestry initiatives with international climate change policy.[cxliv] As part of this the Social Forestry Programme and the Joint Forest Management were reviewed. Both of these had been implemented for their co-benefits such as forest protection, employment opportunities and increased livelihood opportunities. The study highlighted India's effective position to benefit from climate change mitigation efforts due its history in forest management. The study argued for the need to align India's forest policies particularly those concerned with land tenure and resource rights, with international mechanisms such as CDM and REDD+. In addition, it underscored the need to actively involve rural communities into the implementation of any international approaches such as CDM and REDD+ so that they can assist in sustainable forest management and retain rights to forests and their resources.[cxlv]

The Government of India, through the office of the Prime Minister, has therefore developed a National Action Plan for Climate Change, which focuses on "*promoting understanding of climate change, adaptation and mitigation, energy efficiency and natural resource conservation*." As part of this a National Mission for a Green India is also proposed, which aims to enhance ecosystems services especially carbon sinks. As such a Green India campaign is proposed, which aims at afforestation of 5 m/ha across India.[cxlvi] The implementation of the Mission is spread over ten years till 2016-2017. The Green India Programme is expected to be implemented on degraded forestland with community participation and through joint forest committees under the aegis of the Department of Forests. The programme has an initial budget of Rs. 60 billion. [cxlvii] Another mission under the National Action Plan for Climate Change is the National Mission for Sustainable Agriculture, which seeks to adopt adaptation and mitigation measures, with dryland agriculture receiving major importance.[cxlviii]

Box 8 The National Mission for a Green India aims at :

1. Enhancing carbon sinks in sustai nably managed forests and other ecosy stems,
2. Enhancing the resilience and abili ty of vulnerable species/ ecosy stems to adapt to the changing climate,
3. Enabling adaptation of forest-dependent local communities in t he face of climatic variability.

Source: Climate Change & Forests; Status of Science, Policy and Research. Prof. Ravindranath, Indian Institute of Science, Bangalore.

There are other smaller scale projects specifically implementing adaptation interventions in India. For example the Climate Change Adaptation in Rural Areas of India (CCA RAI) is an Indo-German development project, financed by the German Federal Ministry for Economic Cooperation and Development (BMZ). It aims to enhance the adaptive capacities of vulnerable rural communities in India so that they are better equipped to cope with climate variability and change. It is implemented by the Ministry of Environment and Forest and the German Development Organization (GIZ) GmbH.[cxlix] Under this larger project a number of smaller projects were implemented:

In the coastal zones of Tamil Nadu communities are feeling the impacts of climate change through erratic rainfall and increased temperatures. As a result, there has been a decrease in crop productivity, and storm surges have become more frequent as it is expected that sea level rise will further affect coastal areas through salinization. To respond to this, a joint project between the MS Swaminathan Research Foundation and the Climate Change

Adaptation in Rural Areas of India has been implemented, which ended in December 2013. The aim of the project was to establish integrated mangrove fishery farming systems to convert saline areas into productive land. This was done by planting salt tolerant plants, including mangroves, and promoting fish farming in other areas. [cl]

Another project, also in Tamil Nadu, was implemented to increase water availability and land fertility, through water harvesting, the application of nutrient-rich silt on farms, and the promotion of agroforestry. This project was a joint undertaking of the project Climate Change Adaptation in Rural Areas of India (CCA RAI) and the Development of Humane Action (DHAN) Foundation, which ended in October 2013. [cli]

A joint undertaking of Climate Change Adaptation in Rural Areas of India and the Foundation for Ecological Security was aimed at restoring the ecology of degraded forest landscapes in Madhya Pradesh. This was done by enhancing forest biodiversity, reducing soil erosion and strengthening institutions and ended in 2013.[clii]

The Watershed Organization Trust is implementing a Climate Change Adaptation project in Maharashtra, Andhra Pradesh and Madhya Pradesh, benefiting 52,000 people and 9,800 households. The project objectives include watershed development and ecosystems management in addition to sustainable agriculture, other mitigation measures and disaster risk reduction. The project is funded by Swiss Development Cooperation, the National Bank for Rural Development, India (NABARD) and the Government of Maharshtra.[cliii]

India and the UNFCCC

India is a non-Annex 1 Party, which signed the UNFCCC on 10 June 1992 and ratified it on 1 November 1993. The country's commitments under the framework are the same as other developing countries, which do not have binding GHG mitigation commitments. This is due to their minor contribution to GHG emissions and their low financial and technical capacities. The Ministry of Environment and Forests represents India at the UNFCCC and has constituted Working Groups on the UNFCCC.[cliv]

In terms of UNFCCC commitments, while India has endorsed the convention and its many agreements, it has made some of its reservations clear also. For example, in its submission to the Durban Platform, India has strongly voiced its belief that post 2020 arrangements should resemble Kyoto, which means that while developed countries have binding emissions cuts, developing countries would do so on a voluntary basis. The responsibilities/ obligations of developing countries should be based on the principles of equity and cannot be binding until the principle of differentiation based on equity is defined through negotiations. Unilateral measures also should not be taken by any country in the post 2020 scenario, and furthermore developed countries must provide financing, technology and support to developing countries. Finally, the arrangements should also ensure access to intellectual property rights and transfer of climate friendly technologies.[clv]

In light of the above, as part of the Nationally Appropriate Mitigation Action (NAMA), India, through its Ministry of Environment and Forests, in 2010, agreed to endeavor to reduce emissions intensity of its GDP by 20-25% by 2020, in comparison to 2005 levels. It added, India has stated that emissions from the agriculture sector would not form part of the assessment of its emissions intensity. It specified that these actions will be voluntary and not be legally binding.[clvi] A comprehensive mitigation action plan has not been submitted yet.

Way forward for India's adaptation and mitigation actions

There are still gaps in the implementation of adaptation and mitigation approaches in India. The missions articulated in the National Action Plan do not seem to have any strategy, which would ensure that they work in an integrated manner. It is also not clear which department has jurisdiction over them. There is also no indication of a clear strategy for the outreach and awareness raising effort needed to promote and implement such a programme over such a vast area.[clvii] Overall, while the plan is a good first step, it is vague in concrete implementation strategies for each of its missions. A much more cohesive and concerted effort needs to be made to ensure successful climate change mitigation and adaptation interventions.

An important implication of these gaps in the National Action Plan can be the opportunity for integrated mitigation and adaptation interventions, especially as part of the Green India Mission, which being relatively new, provides a good platform for effectively implementing synergetic mitigation and adaptation actions in forest landscapes. Incorporating an integrated strategy within the Green India Mission will not only ensure that GHG emissions are targeted through afforestation activities (thus achieving mitigation goals) but also that forest goods and services are maintained and managed ensuring that both the forests and the human communities dependent on them adapt to climate change.

To be able to achieve this however, there is a need to ensure the collection of current data on all aspects of forest systems as well as impacts of climate change on their ecology. Based on this data, the next step would involve a diversity of stakeholders to raise awareness and build capacity on the links between mitigation and adaptation. Stakeholder involvement however, needs to be locale specific, as different forest ecosystems will have different functions and thus will need specific interventions for management. This is a good time to analyze the National Action Plan on Climate Change and ensure that a strategic action plan is developed for its implementation incorporating synergies between climate mitigation and adaptation in forest ecosystems.

For this purpose, the Ministry of Environment and Forests, India, donor organizations, international climate change organizations and local stakeholders need to get together and analyze the National Action Plan, assess to see its alignment with the UNFCCC protocols and then ensure that explicit and integrated mitigation-adaptation actions are incorporated into it, especially in the context of forest landscapes. This will take India forward in playing its important role in addressing climate change implications.

Would be good if you could suggest a few simple and concrete actions, based on the national analysis to explore the linkages between mitigation and adaptation, and then with forests and FLR.

Viet Nam

Background and Climate Scenarios

Viet Nam is situated in Southeast Asia bordering China in the north, Laos and Cambodia in the west and the East Sea to east, south and southwest.[clviii] It extends 1,662 km from north to south and has a land area of 331,051.4 km^2. Its climate is monsoon tropical with average annual temperatures ranging between 12.8^0C to 27.7^0C, while rainfall ranges from 1,400 to 2,400 mm. The country is impacted by between 6 - 8 typhoons annually.[clix] The total area under forests was about 11.6 m/ha in 2000, making up 35.2% of the national land area. This showed an increase in December of 2008, when the forest area was 13.1 m/ha, making 38.7% of the national land area.

The country's National Communication to the UNFCCC provided data regarding the GHG inventory for the year 2000, for the energy, industrial processes, agriculture, land use, land-use change and forestry (LULUCF), and waste sectors. This inventory showed that total greenhouse gas emissions in 2000 amounted to 150.9 million $MtCO_2e$, of which 65.1million $MtCO_2e$ came from agriculture (largest source), 52.8 million $MtCO_2e$ from energy (35%), 15.1 million $MtCO_2e$ from LULUCF (10%), 10.0 million $MtCO_2e$ from industrial processes(5.6%), and 7.9 million $MtCO_2e$ from waste(5.3%).[clx]

The impact of climate change has been such that over the 50 years between 1958 and 2007 annual average temperatures saw a rise of 0.5 - 0.7^0C. In addition, temperatures for winters and northern climate zones rose at higher rates than those for summers and southern climate zones. In terms of annual average precipitation, northern climate zones saw a decrease in rainfall as compared to southern zones. Nationally, average rainfall saw a decline of 2% between the period of 1958 - 2007. [clxi] Typhoons tended to occur more frequently and with higher intensity and storm seasons tend to end later. Sea levels rose at a rate of 3 mm annually during 1993 - 2008 and sea levels at Hon Dau Oceanographical Station rose by approximately 20 cm over 50 years.[clxii]

Climate change scenarios published in 2009, indicate that annual rivers flow are likely to increase in the North and the northern part of the North Central Coast. On the other hand annual river flows in southern part of the North Central Coast are likely to decrease. In addition, flood flows are also predicted to increase in most of the rivers although flows during the dry season are shown to decline. Furthermore, annual potential evapo-transpiration also showed rapid increases (highest levels of increases) in the South Central Coast and the Mekong Delta regions, indicating that after 2020 the ground water levels are likely to drop drastically. The scenarios also predicted that by the end of the 21st century, temperatures would rise by 2.3^0C, relative to the average in 1980-1999 and the increase in temperature would be in the range of 1.6 - 2.8^0C in different zones.[clxiii]

Sea level rise is predicted to increase by about 30 cm by mid-21st century and by 75 cm by the end of the century. As such, the annual flood-ridden area will expand with the Mekong River being the most impacted, as it contains about 90% of the national floodplain area. The rise in sea levels will also lead to saltwater intrusion in rivers and underground water resources. This is likely to cause extensive social and economic losses throughout the country. Climate impacts are expected to be quite serious on coastal ecosystems such as mangrove forests. An example of this is the mangrove forests east of Ca Mau, where many species lost their natural habitat.[clxiv]

Climate change scenarios for 2020, 2050 and 2100 show that forest area is likely to decrease 2.3 m/ha (6.7%), 1.3 m/ha (3.9%) and 1.2 m/ha (3.5%) respectively, mostly concentrated in the Central Highlands and South Central Coast.

Future scenarios show that by 2100 climate change will have affected over 4% of Viet Nam's population, causing the loss of 5,469 km^2 of arable land and resulting in the submerging 168 km^2 of aquaculture area and 320 km^2 of forest land. Forests are likely to be impacted in diverse ways. Forest cover of closed tropical moist semi-deciduous, as well as evergreen forests, will decrease by 2100. According to the scenarios highlighted in the National Communication "*in 2100, Chukrasia tabularis forests are projected to cover only 0.3 million ha, a decrease of 70% decrease. Pinus merkusii forests, are projected to cover approximately 2.3 million ha, equivalent to a fall of 58%.*"[clxv]

Added to all of the above, the risk of forest fires is predicted to increase in all regions during the dry-hot season and the warmer conditions will encourage the spread of forest pests, thus affecting the whole ecosystem.

Adaptation and Mitigation Actions

Viet Nam assessed GHG mitigation options for agriculture, energy and LULUCF, as a result of which 28 mitigation options were developed for GHG sources and sinks. These include 15 options for energy and transportation, 5 for agriculture and 8 for LULUCF and the total mitigation potential for these options amounted to 3,270.7 million MtCO2e, to which energy contributes 192.2 million MtCO2e, agriculture 56.5 million MtCO2e and LULUCF 3,022 million MtCO2e. The uncertainty levels for these are in order of increasing magnitude, from energy followed by agriculture and finally LULUCF. Costs were also calculated which showed that GHG decrease and carbon sink expansion costs in the energy sector range from USD 24.9/tCO_2 to USD 23.8/tCO2, in agriculture sector from USD-10.9/tCO2 and USD 9.7/tCO2, and in LULUCF sector, between USD0.4/tCO2 and USD 1.4/tCO2, showing that LULUCF will have the least amount of costs per ton of CO2.[clxvi]

Viet Nam classifies its adaptation strategies as full protection, adaptation and withdrawal. Measures for forestry focus on promoting the sustainable management and development of forests by "*research, selecting and expanding coverage of drought and pest resistant species, and establishing a forest fire management and prevention program*."[clxvii] Forest policies have focused on social forestry, sustainable management and utilization of forest resources and market-oriented forestry. The policies also emphasize community participation in the development and protection of forests, and forestland has been allocated to households, individuals and organizations. State forest entities are meant to serve as intermediaries and to provide guidance and technical services. In addition, the

policies focus on protection and conservation of environmental services and forest related biodiversity. Since 1990 the State has issued up to 150 forest related policies.[clxviii]

It approved its National Strategy on Climate Change in December 2011, which aimed to "*lower GHG emissions in parallel with adaptation for effective response to climate change*." It also adopted a Green Growth Strategy in September 2012; the objective of which is to reduce GHG emissions and increase carbon sinks.[clxix]

Viet Nam has been one of the most active countries in the world in undertaking adaptation actions as compared to other East Asian and South Asian countries.[clxx] The following actions are related to forests only, however there are a host of other adaptation activities that are being implemented in the country.

The National Target Programme for Climate Change Adaptation was implemented between 2009 - 2013 with the support of UNDP and DANIDA, by the Ministry of Natural Resources and Environment and Ministry of Industry and Trade. It had both adaptation and mitigation components. However, these were not integrated and were implemented by different ministries.[clxxi]

A pilot project on Payment for Environmental Services (PFES) was implemented in 2011- 2012 in Lam Dong and Son La provinces. It was the first fully self-reliant programme for forest management and poverty reduction via PFES, generating approximately USD 4m (89% of which was from hydropower). This resulted is the protection of 209,705 ha of forests, engaging over 7000 households (of which over 6000 were ethnic minorities) in forest protection and allocation. The total income of the households increased by 30% and lifted about 50% of the households over the poverty line. In addition, the area of forest invaded or encroached was reduced and cases of illegal logging wildlife poaching decreased by 50%.[clxxii]

Viet Nam launched its UN-REDD National Programme in 2009 and started a few key activities - one of them being the establishment of a national network for REDD.[clxxiii] A REDD+ project aimed to undertake Research on Integrating Community Based Participatory Carbon Measurement and Monitoring with Satellite Remote Sensing and GIS in Measurement, Reporting and Verification (MRV) System for REDD+. The project supported the participation of local communities in the measurement and monitoring of forest carbon, by building their capacity in using MRV/ MRE. The project specifically looks at adaptation challenges in REDD+ projects, such as including community experiences and strengths in REDD+ activities, training and capacity building. The project highlighted, that identifying land tenure and resources use rights will determine the likelihood of the success of REDD+ activities, as will implementation in project areas, where forest laws are well defined, understood by communities and implemented effectively. Finally, the integration of local knowledge, tools and methods with modern scientific knowledge, tools and methods should be promoted in REDD+.[clxxiv]

A Mangrove Management Information System (MMIS) project is being implemented since 2007, in which training is provided to use the MMIS to help manage dykes (specifically mangroves) in Northern Viet Nam. The project is funded by the Government of Denmark.[clxxv]

UNEP also provides support through its Asia Pacific Office to Viet Nam among other SE Asian countries. It has established a South Asian Network of Climate Change Focal Points, which aims at building capacities and improving readiness for technology transfer both in mitigation and adaptation.[clxxvi]

Typhoon Damrey hit the Da Loc commune of Viet Nam in 2005 and CARE International, observing the buffering capabilities of mangrove forests, started the Community Based Mangrove Reforestation project. More than 700 people (from 3 villages) took part in the project. While initially thought of as a disaster risk reduction project, it has also contributed to both mitigation (through carbon sequestration) and adaptation (increasing adaptive capacity by diversifying livelihoods sources). Although there are many downsides associated with it in terms of inequitable

benefit sharing and destruction of mangroves through collection of high value products, there is a huge potential for success with effective mechanisms to counter these issues.[clxxvii]

IUCN implements its Mangroves for the Future Programme in Asia with the support of the UNDP. This project is a partnership led initiative to promote investments in coastal ecosystems. Through its Small Grants Facility the project will support local communities in coastal vegetation - especially mangrove management - in Viet Nam, for climate change mitigation and adaptation.[clxxviii]

IUCN implements another project in Thailand, Cambodia and Vietnam called Building Resilience to Climate Change Impacts in Coastal Southeast Asia, funded by the European Union (2011 - 2014). In Viet Nam, recently, 10 pilot projects were launched to build community resilience to climate change impacts. In collaboration with Mangroves for the Future, approximately USD 350,000 is being invested into these projects. Importantly, mangrove reforestation and mangrove eco-tourism development for communities are some of the pilot activities that consider forests and climate adaptation.[clxxix]

A new project is being implemented by IUCN and the Netherlands Development Organization in Ngoc Hien District Ca Mau Province in Viet Nam. This area is home to half of Viet Nam's mangrove forest area and half of its shrimp farming area. Shrimp farming is one of the country's major exports and is also the leading cause of its mangrove loss. The project is funded by German Federal Ministry of the Environment, Nature Conservation, and Nuclear Safety (BMU). It focuses on a group of 2,600 shrimp farmers, who are using an integrated model of farming shrimp among mangrove forests, in which each household must reserve 60% of their land for mangroves.[clxxx]

Viet Nam and the UNFCCC

The country is a non-Annex 1 Party, which signed and ratified the UNFCCC in 1992 and ratified it in 1994. It signed the Kyoto Protocol in 1998 and ratified it in 2002. It has submitted both the first (2003) and second (in 2010) National Communication on Climate Change to the UNFCCC. Viet Nam has also communicated with regard to the Copenhagen Accord in 2010, in which it highlighted that a National Target Programme to respond to Climate Change had been developed and was being implemented. Similar to India, Viet Nam, while endorsing the need for a new legally binding agreement post 2020, highlighted the need to consider the principles of equity; common but differentiated capacities and responsibilities; and urged developed countries to take a more committed role in combating climate change.[clxxxi]

Way forward for Viet Nam's adaptation and mitigation actions

Gaps exist in data collection related to Viet Nam's mitigation and adaptation actions generally, and in forest landscapes in particular. The data for impact assessments and adaptation measures, in particular the data that was used in cost benefit analyses is incomplete. There is a need to undertake in-depth analysis to assess impacts from other natural phenomena, exacerbated or induced by climate change.[clxxxii]

In addition, sufficient information for cross-sectoral or inter-regional assessments is not provided by adaptation assessment, models and tools; there is a lack of capacity to assess the adaptation technology needs; zoning maps are not available that show areas prone to natural disasters and there is a crucial need for improved local knowledge regarding the impacts of climate change.[clxxxiii]

Viet Nam's adaptation options need to be integrated with its mitigation activities more specifically. In particular, since it is actively implementing REDD+ activities, there is a need to incorporate sustainable forest management into it.[clxxxiv] Resilient plant and tree species must be identified and planted while introducing afforestation and reforestation programmes as part of REDD+[clxxxv] and as part of a larger FLR scheme. There is a need to improve timber use efficiency and processing technologies.[clxxxvi] These activities will contribute to both mitigation (through carbon sequestration) and adaptation (adaptation of forests). In addition, adaptive capacity of upland and coastal

forest communities, as well as their resilience need to be enhanced through agroforestry and community forestry. Adaptations options for populations vulnerable to climate change due to their livelihoods need to be specified (these include among others those dependent on forest based livelihoods).[clxxxvii] EbA measures such as supporting forest and mangrove plantations can also be used to address extreme weather events and sea level rise.

In summary, there is a lot of opportunity to find synergies in mitigation and adaptation activities and to implement them in the context of the vulnerable upland and coastal forest landscapes in Viet Nam.

Mexico

Background and Climate Scenarios

Mexico is situated in North America and covers a total surface area of 1,964,375 km^2. The northern and central parts of the country are very arid, arid and semi-arid and occupy 56% of the territory, while 37% of the area is sub-humid and is found in mountains and coastal plains of the Pacific, the Gulf of Mexico and the northeastern part of the Yucatan. Humid areas are located in the remaining 7% of the territory. Rainfall in the north and northeast has an annual average of barely 100mm, while in the southeast and part of the southern pacific coast it goes up to 2000 to 4000 mm. The average rainfall from 1941 to 2004 was 773 mm and the total mean water availability is 475 km^3 per year. [clxxxviii]

The country has designated 12% of its territory as protected areas (over 25 m/ha) and has over 7,000 km^2 of mangrove forests.[clxxxix] It is known as a "mega-diverse" country - home to 60 - 70% of all known biological diversity on earth as well as representing 12% of the world total. In addition, Mexico has the 12th largest forest area worldwide. [cxc]

The National Inventory of GHG emissions was undertaken for the period 1990 - 2010. In 2010 emissions amounted to 748,252,200 MtCO2e overall, which was an increase of over 33% from 1990 with an annual average growth rate of 1.5%. From 2001 - 2010 the annual average growth rate was at 2.6%.[cxci] Out of this energy contributed over 67% (at 504 million $MtCO_2e$), agriculture over 12% (at 92,184,400 MtCO2e), Industrial processes over 8% (at 61,226,900 MtCO2e), LULUCF over 6% (at 46,892,400 MtCO2e) and waste at 5.9% (44,130,800 MtCO2e). Specifically in the LULUCF sector, forest and grassland conversion contributed over 71% (at 46,547,900 MtCO2e), soils over 19% (12,593,000 MtCO2e), and biomass changes and other timber biomass reservoirs 9% (at 5,860,600 MtCO2e). Emissions in this last category declined by over 54% with a negative annual average growth rate of almost -4%.[cxcii]

The rate of deforestation between 1990 and 2000 was 347,000 ha/yr . Projections for 2000 - 2005 were made in the Third National Communication, which assumed that although the rate would remain constant, it would be moderated by several government programmes. Therefore, the deforestation rate was 260,000 ha/yr (at 0.4% annually and a total of over 1 mill ha of forests was lost from 2000–2005). This has resulted in a degraded, converted, and underused forest base, which is exacerbated by the conversion of forest (and other natural ecosystems) for agriculture and livestock use. For this reason Mexico fell from 9th to 12th place globally, in net annual loss of forest area during 2000 - 2005. Rural areas are highly dependent on wood based energy (90% of rural household consumption). Varying degrees of forest fires occur all over the country during the dry season (December to August). There were over 9,000 forest fires in 2005, showing an increase of over 13% as compared to the year 2000. The annual average for 2000–2005 was over 7000 fires affecting 208,533 ha annually. In the first 6 months of 2006 over 8000 forest fires were recorded affecting 234,745 ha.[cxciii]

In the coastal ecosystems, mangroves comprised 880,000 ha in 2000, however estimates by the former National Institute of Ecology (now the National Institute of Ecology and Climate Change) suggest that they are being lost at an average annual rate of 2.5%. The projections for 2020, again conducted by the National Institute of Ecology, show a loss of 50% mangrove forest cover.[cxciv]

All these causes of forest loss are now being exacerbated by climate change, such as those experienced during the El Nino event between 1997 - 1998, which led to drought conditions and record numbers of forest fires. Climate change modeling scenarios show increases in temperature and humidity by 2020, which could be beneficial for rainforests. However, temperate climates will decease and warm dry ones will increase. By 2050 more than 20% of the country area will change to warmer drier climates resulting in water stress and between 50 - 60% of plant communities will be affected by conditions different from current ones.[cxcv]

The climate around 2020 is projected to be between 1.5 and 2.5^{0}C warmer, and changes are also expected in precipitation with a slight decrease in a large part of the country resulting in droughts. Furthermore, the intensity of hurricanes will increase. Deforestation and climate change together will have devastating effects on biodiversity in the country's forests.[cxcvi]

Adaptation and Mitigation Actions

Mexico's forest policy aims towards sustainable development of forest resources, through conservation, protection, restoration combined with support and production actions. The long-term vision is the Strategic Forest Programme 2025.[cxcvii] While agrarian reforms were successful in creating a large community forestry sector, forest laws have been unstable over the years. They have passed through multiple policy cycles and regimes.[cxcviii]

The National Climate Change Strategy was published in 2013[cxcix], which clearly outlines mitigation and adaptation options across various sectors, including for forestry. The strategy is expected to guide Mexico's climate change policy for the next 40 years. It highlights 14 lines of action that aim to guide policies and instruments specifically for the sustainable management and conservation of ecosystems, including forests.[cc]

In June 2012, Mexico published its General Law on Climate Change (GCLC), which made its climate change policy legally binding. The policy included the goal of 30% reduction in emissions by 2020 and 50% by 2050 as compared to the year 2000.[cci]

The GCLC links adaptation and mitigation measures to sustainable development, taking into account the need to create a green fund, a national register of carbon emissions, as well as a national carbon market. Among all these needs, the GLCC establishes a Climate Change Fund, to be comprised of a number of sources, including certified emissions reductions, and to be used for different adaptation and mitigation actions, including REDD+. The law also provides recommendations for policies, strategies and goals for climate change mitigation and adaptation, and processes for evaluation and follow-up of actions and their impact.[ccii] In particular, the GLCC included the goal of 30% reduction in emissions by 2020 and 50% by 2050 as compared to the year 2000.[cciii] It also created the National Climate Change System, Special Climate Change Commission and Climate Change Council.[cciv]

The Special Climate Change Programme was implemented between 2009 - 2012, which included actions in the forest sector to achieve annual emissions reductions of 51 MtCO2e in relation to the baseline (what baseline) by the end of the project period. From the year 2008 to 2012, the programme achieved reductions of 129 MtCO2e, exceeding the target annual emission reduction by 4%.[ccv] A study conducted by the Mexican Institute of Competitiveness to estimate the potential of the Programme goals by 2020, showed that by that year, it will be possible to reduce 195 MtCO2e by implementing various measures including REDD+. The study also highlighted that achieving the goals for 2020 and 2050 would require additional actions as well as a combination of NAMAs.[ccvi]

Mexico has developed a National Strategy for REDD+, as well as the Project of Forest and Climate Change. In 2010, The Vision of Mexico for REDD+: Towards a National Strategy was also published. Importantly, a Climate Change Strategy for Natural Protected Areas was prepared, which aimed at enhancing the adaptation capacities of ecosystems and human populations by mitigating emissions. This strategy is a good example of an integrated mitigation-adaptation activity.

Mitigation options from the forestry sector predict emission reductions of 57 MtCO2e, and various programmes are underway, which point to a significant reduction potential by 2020: Sustainable Forestry Management Programme 6.7 MtCO2eq, Forestry Cultivation Programme in Temperate Forests 3.8 MtCO2e, Wildlife Conservation Units 3.6 MtCO2e, 8 REDD+ pilot projects 10.1 MtCO2e and others 7.8 MtCO2e.[ccvii]

Overall, timber production declined 38% between 2000 and 2009, and it was estimated that over 2 m/ha were reforested between 2007 - 2012 (almost 1.9 million trees were planted).[ccviii]

A project was supported by UNDP-GEF in Tlaxcala, to build capacity for climate change adaptation in Mexico (as well as Cuba and Central America). Through interactions with and participation of various stakeholders, the project identified the main threats to forest production and conservation. The project modeled adaptation scenarios, according to which, a reduction in deforestation rate of 0.64% in Tlaxcala would mean that just under 60% of the forest area as compared to 1980 would be present by 2050. By reducing forest fires by 0.01% however, deforestation and plant loss could diminish even more and a 2% increase in reforestation could be even more beneficial.[ccix]

The National Forestry Commission developed and implemented a number of mitigation actions according to the National Communication presented in 2006. For example, the National Forestry Programme between 2001 and 2006 helped owners of forest land manage over 9 m/ha, benefiting 20,376 producers. Ecotourism was also promoted through this programme (350 projects).[ccx]

The Commercial Forestry Plantation Programme has focus on reclaiming forest lands, restoring wooded areas and creating projects oriented towards timber production. Funds were allocated to over 3,000 commercial forest plantation projects over an area of 351,000 ha between 2001 and 2006.[ccxi]

The Community Forest Development Programme assisted communities in high priority regions to sustainably manage forest resources. The World Bank contributed 74% of the 26.3 million cost of this project; the rest was contributed by the Government of Mexico and other beneficiaries.[ccxii]

The Hydrological Environmental Services Payment Programme implemented from 2003, paid owners of forests to conserve and preserve them. Official statistics stated that approximately 480,000 ha were incorporated within this programme during 2003 to 2005.[ccxiii]

Each of the above are officially mandated as mitigation projects, however, there is clearly an adaptation element to all of them as well, that has not been made explicit. They show the implementation of effective linkages between mitigation and adaptation options in the context of forest landscapes.

The Forest Ecosystem Conservation and Reforestation Programme was aimed specifically at restoring plant cover in strategic areas, with the objective to increase biomass for carbon sequestration. During 2001 - 2005, 1.8 m/ha were reforested and plantation survival increased from 20% in 1990 to almost 50% in 2005. Between 2001-2006 forest protection, restoration and conservation measures were implemented on another 2.8 m/ha and health treatment was expanded to 32,000 ha in 2005 (from 21,000 ha in 2002).

The Programme to Develop Environmental Service Market for Carbon Capture, Services Derived from Biodiversity and to Promote the Establishment and Improvement of Agroforestry Systems aims to promote access to national and international markets for carbon sequestration, biodiversity and agroforestry systems.

As a result of a combination of programmes such as those highlighted above, forest cover loss between 2000 and 2010 was reduced by 50%.

A project entitled Cooperation Programme for Adapting to Climate Change in Sierra Madre/ Chiappas, funded by BMU is supporting Mexico in developing and implementing a strategy for effective ecosystem-based adaptation measures in watersheds in coastal regions. The project is implemented by The Nature Conservancy and for the period 2011-2014. Project partners assess the region's vulnerability and then plan adaptation measures such as reforestation and restoration of ecosystems. The aim is to finance these measures sustainably through the global carbon market as well as through a regional public investment strategy, which is to be set up over the course of the project.[ccxiv]

The Mexican - German Climate Change Alliance also funded by BMU (from 2010 - 2014), is helping to develop and implement a medium to long-term climate change policy for Mexico and includes both mitigation and adaptation measures.[ccxv]

IUCN works in Mexico through its members, and in 2013, with USD 6.2 million in funding from Norway's Agency for Development Cooperation (NORAD), initiated the Advancing REDD+ project, which focuses on mobilizing private investment for community-based, carbon-intensive landscape restoration. The project will last 3 years and aims to establish examples of partnerships between communities and the private sector in order to scale up landscape restoration activities.[ccxvi]

IUCN also implemented the project Building Regionally Appropriate EbA in Mesoamerica in Costa Rica, El Salvador, Mexico and Panama. The project was funded by BMU and ended in 2013. EbA measures were implemented in 6 demonstration sites.[ccxvii] An ongoing BMU funded project is the Transforming Evidence into Change: A Holistic Approach to Governance for EbA in Costa Rica, El Salvador, Guatemala, Honduras, Mexico and Panama. The project "*collects and presents information on the advantages associated with EbA in terms, for example, of sustaining biodiversity, reducing disaster risks or promoting food security*".[ccxviii]

Mexico and the UNFCCC

Mexico is a non Annex 1 party, which became a signatory to the UNFCCC in 1992 and ratified it in 1993. It has committed that the Special Climate Change Programme, adopted in 2009 will achieve a reduction in total annual emissions of 51 MtCO2e by 2012. It has also committed to reduce emissions by 30% by 2020,as part of its initial NAMA, provided financial and technological support was provided by developed countries.[ccxix]

Way forward for Mexico's adaptation and mitigation actions

Mexico is planning a number of REDD+ projects as a UN - REDD partner country. It is also a member of the Forest Carbon Partnership Facility. Moreover, some priority areas for 'early actions' have been located in the states of Oaxaca, Jalisco, Michoacan, State of Mexico, Chiapas, Yucatan, Campeche, and Quintana Roo. Although these are not full REDD+ demonstration projects, they do aim to assess various environmental, social and cultural conditions as part of which institutional arrangements, governance structures, monitoring and financial mechanisms can be tested.[ccxx]

The development of State Level Action Programmes on Climate Change is ongoing. In addition, a number of activities are being implemented at the local level by non-governmental organizations. Some forest carbon projects are already working in the voluntary carbon market.[ccxxi]

Under the REDD+ framework, the integration between adaptation and mitigation is particularly evident in the implementation of FLR programmes. IUCN funded a study, which shows that Mexico has a potential area of 302,124 km^2 to implement FLR initiatives. Out of this 9% is considered high priority, 17% medium priority and 74% low priority, representing approximately 13% of the of the total national area.[ccxxii] This represents a clear path for the way forward for the country's integrated mitigation-adaptation actions. This information provides an opportunity to implement integrated actions as per the National Climate Change Strategy, climate policies and as part of the country's commitment to reduce emissions and create carbon sinks.

It is one of the first developing countries to set a specific target for carbon reduction through its National Strategy and Action Plan and the Special Programme for Climate Change. It has also committed to reduce its GHG by half by 2050 (compared to 2000 levels).[ccxxiii] As such it has a huge potential for FLR related and community based forestry actions.

The Mexican government is willing to commit resources for adaptation to climate change. However, institutional capacity, efficiency and governance at federal, state and local levels remain weak. Additionally, the broad scope of the General Law on Climate Change does not provide strategies for local implementation, and there is a need for accurate and updated vulnerability atlases.

Although Mexico is well on the way to implement various actions, many of which show clear linkages between mitigation and adaptation, there is still room to articulate a clear synthesis between the two. A factor that could increase the synergies between adaptation and mitigation is knowledge. Forestry policymakers and practitioners tend to be divided between adaptation and mitigation, with a mutual lack of knowledge between the two communities. In Mexico, very few mitigation projects explicitly integrate adaptation measures. Most of these projects mention positive impacts on livelihoods but do not highlight any explicit connections to community adaptation. [ccxxiv]

Therefore, the National Climate Change Strategy needs to be reviewed, and an integrated plan of action needs to be developed for its forest related activities, that incorporate both mitigation and adaptation together. Since the National Strategy has only recently been published, the timing to do so is perfect. Financial and technological mechanisms are needed for all of this to become a reality, as well as the development and strengthening of human and institutional capacities at all levels.

The inclusion of climate change in public policy making will ensure that the co-benefits derived from climate change adaptation and mitigation activities would contribute to improved standards of living in rural areas. They would also contribute to poverty reduction, decreasing social inequity and increasing access to basic resources.

> *"There is no doubt that the deforestation has left El Salvador even more vulnerable to climate change and the storms it is increasingly bringing."*
>
> Ricardo Navarro, director of CESTA, the national branch of Friends of the Earth.
> *http://www.independent.co.uk/environment/climate-change/el-salvador-in-battle-against-tide-of-climate-change-8145210.html*

El Salvador

Background and Climate Scenarios

El Salvador is situated in Central America, north of the equator and to the west of the Greenwich meridian. It has an area of 20,740 km^2 and approximately 86% of its area is classified as subtropical humid forests, 8% as sub-tropical very humid forests and 4% as tropical humid forestland. The annual rainfall ranges between 1,525.8 mm and 2,127.2 mm, with an average of 1,823.6 mm, and annual temperatures range between 24.2^{0}C and 25.9^{0}C, with an average of 24.8^{0}C.[ccxxv]

The country is already susceptible to various natural phenomena such as hurricanes, earthquakes and volcanic eruptions. Poverty, inequality and lack of preparedness have brought much destruction to the country. Added to this is its extremely vulnerability to climate change,[ccxxvi] the impacts of which are becoming increasingly clear. El Salvador has a dry season (November to April) and a rainy season (May to October). Since 2009, the country has experienced several incidences of historical records in rainfall, some occurring in months that have never before experienced such extreme precipitation. Furthermore, rainfall records were broken in some dry season months as well. Extreme rainfall events have increased from one per decade in the 1960s to 8 in the current century. Three extreme events that had devastating impacts occurred between November 2009 and October 2011 and caused loss and damage of USD 1.3 m (6% of the GDP in 2011).[ccxxvii]

El Salvador is the second most deforested country in Latin America, after Haiti. It has lost almost 85% of its forested area since 1960s and less than 6,000 ha are primary forests. Loss between 1990 and 2005 was over 20% of forest cover.[ccxxviii] Excessive deforestation and soil erosion have meant an increased landslides and forest fires, resulting in further economic losses. For example losses to agriculture from flooding were over USD 100 m in 2010, while those resulting from drought were USD 38 m.[ccxxix] A study conducted in the coastal plains, by the Ministry of Environment and Natural Resources and the National Service of Territorial Studies, concluded a loss between 10 - 19% of the territory due to sea level rise of 13 -55 cm, in particular in the mangrove swamp areas; increase in forest fires and diseases; increase in soil erosion and a decrease in the productivity of corn due to drought.[ccxxx]

Annual cumulative rainfall ranged from a minimum of 1,274 mm to a maximum of 2,310 mm between 1950 and 2006. Average temperatures increased by 1.3^0C in 2006, when compared to the 1950s. Sea levels rose by 7.8 cm (at an average rate of 1.3 mm per year).[ccxxxi] Modeling scenarios show that temperatures are likely to range from 0.8^0C to 1.1^0C in 2020, up to 2.5 - 3.7^0C in 2100[ccxxxii]; precipitation changes of between -11.3% to 3.5% are predicted for 2020 and between -36.6% to 11.1% by 2100; and sea level rise is likely to be 20 cm by 2030, 40 cm by 2040 and 70 cm by 2100.[ccxxxiii]

In terms of GHG emission, in 1994 the sectors with the highest level of emissions were energy (50.4%), and the Land Use Change and Forestry Sector (42%).[ccxxxiv] GHG emission in 2005 increased by over 3% as compared to 2000 (14MtCO_2e,) mainly from energy, agriculture and waste. LULUCF emissions show a decrease from 30% (4,277,670 MtCO2e) to 23% (3,380,190 MtCO2e). This makes energy the highest emitter of emission followed by LULUCF,[ccxxxv] which is 0.04% of global emissions.

Adaptation and Mitigation Actions

El Salvador has the carbon capturing potential of 53m MtCO2, if 415,424 ha are reforested according to a study conducted by the Ministry of Environment and Natural Resources between 2002 and 2006.[ccxxxvi]

A National Environmental Policy was adopted in 2012 to reverse environmental degradation and reduce vulnerability to climate change. A programme was formulated and implemented to restore ecosystems and rural landscapes as part of El Salvador's climate change adaptation efforts.[ccxxxvii] A National Environmental Strategy was developed in 2013, also incorporating climate change goals.[ccxxxviii]

Importantly a REDD+ programme is being formulated, which is looking at 'adaptation-based mitigation' as its main objective. Moreover, a National Climate Change Strategy is also being formulated.[ccxxxix]

A National Climate Change Plan is being developed by the Ministry of Environment and Natural Resources that will include the National Action Programme on Adaptation (NAPAs) and the National Appropriate Mitigations Actions (NAMAs) among other actions. Forests have been identified as one of the priority areas for adaptation together with agriculture, water and coasts.[ccxl]

The National Program for Ecosystem and Landscape Restoration (PREP) is being implemented by the Ministry of Environment and Natural Resources.[ccxli] El Salvador's government has explicitly included climate adaptation as one of the major concerns in developing the national budget. A national priority confirmed by the Ministry of Finance in the 2013 Budget Policy is: "*Halting environmental degradation and promoting climate change adaptation*".[ccxlii]

The country has been involved in REDD+ through its incorporation into The World Bank's Forest Carbon Partnership Facility (FCPF), created to purchase and trade carbon credits.[ccxliii]

A project entitled Avoided Deforestation in the Coffee Forest project (or the Coffee and Environment Initiative) is a 16 year project that aims to curtail the deforestation of coffee forests, which lose area every year due to the economic challenges faced by coffee growers. It covers 53,560 hectares of privately owned land. Two trust funds

were set up by the BMI (the Multisectoral Investment Bank) to help producers. These funds collect and organize the commercial loans that the country's private banks had issued to coffee growers up until 2001. An additional trust fund was set up, the FIDECAM, which gives growers economic incentives of reducing their yearly debt costs by up to 30 percent if they avoided cutting forests and maintain their coffee activity, halt deforestation rates and changes in land use, avoid greenhouse gas emissions and maintain their carbon stocks.[ccxliv]

Women of the Association of Communities for Development and Villages, have banded together to work towards food security in the forest near San Julian in El Salvador. The people in the area relied on subsistence agriculture and were severely impacted by climate change, which resulted in frequent losses of the family harvest. In response, the women in Los Lagartos began to plant a forest (to be used as fuelwood). The project benefits about 50 families (approximately 300 people) and is expected to be expanded to other areas.[ccxlv]

Since 2010, IUCN is also implemented the project Building Regionally Appropriate EbA in Mesoamerica in Costa Rica, El Salvador, Mexico and Panama. The project was funded by BMU and ended in 2013. EbA measures were implemented in 6 demonstration sites.[ccxlvi] In El Salvador the project set up two demonstration sites, one being transboundary in Trifinio (Binational Sumpul river basin) and the other one in Garita Palmera mangroves (Paz river basin). Local communities in Trifinio (from El Salvador and Honduras) rely on intensive agriculture and the production of cabbage, but there are also coffee growers. They are affected by climate change due *to* frost damage. Climate change scenarios for the area show an increase in drought periods. In response, communities established a local forest nursery, which produced trees for green wind barriers. Another BMU funded project is the Transforming Evidence into Change: A Holistic Approach to Governance for EbA in Costa Rica, El Salvador, Guatemala, Honduras, Mexico and Panama. The project "*collects and presents information on the advantages associated with EbA in terms, for example, of sustaining biodiversity, reducing disaster risks or promoting food security"*.[ccxlvii]

El Salvador and the UNFCCC

El Salvador is a non-Annex 1 party, which signed the UNFCCC in 1992 and ratified it in 1995. El Salvador adopted the Durban Platform as well as the Cancun Agreements, according to which NAPAs and NAMAs are to be developed. However, the country has not submitted these to the UNFCCC yet.

Way forward for El Salvador's adaptation and mitigation actions

El Salvador is one of the poorest countries in the Western Hemisphere, which has already been impacted drastically by gang warfare. [ccxlviii] It faces acute vulnerability to climate related disasters and according to the Global Facility for Disaster Reduction and Recovery, approximately 90% of its area is affected by climate related disasters. Furthermore, 95% of its population lives in risk zones and 96% of its GDP is also produced in these risk zones.[ccxlix]

Due to these factors its climate changes related strategies have primarily been concentrated on loss and damage, especially in the context of adaptation. Most of the adaptation strategies have been in the agriculture, water and coastal areas.[ccl]

A lot of work needs to be undertaken for mitigation and adaptation in El Salvador and moreover there is a crucial need for assessments and data collection, which will assist in formulating effective strategies in forest landscapes. These can include community based forestry and agroforestry in the coffee growing areas. The REDD+ programme being formulated, linking both options, provides a place to start for FLR related options. In the case of El Salvador, mitigation- adaptation linkages would have to be sensitive to the large rural base in the country, that is going to be impacted by climate change, and also consider the loss and damage that is likely to occur due to extreme events. In addition, sound methodologies need to be incorporated specifically to address adaptation.[ccli] Lack of financial resources, technology and knowledge/ skills are important issues that also need to be addressed.[cclii]

Kenya

Background and Climate Scenarios

The Republic of Kenya has an area of approximately 580,370 km^2, 2% of which is occupied by lakes, 18% by high potential areas (as defined by the government) and 80% by arid and semi-arid lands. Kenya also has a 400 km long coastline. National parks are found on 7% of the country's total area. Highland moist forests are 2%, rainforests 0.1%, highland dry forests 0.4%, evergreen and semi-evergreen bush land 1.4%, arid thorn bush land & woodland 41.7%, coastal forests and woodland 0.1%, riverine forests 1.5%, coastal evergreen bush land 0.4%, coastal palm stands 0.1%, and mangroves 0.2% of the total area.[ccliii] In 1963, the forest cover was 11%, which has been reduced to 6% (a loss of about 12,000 ha annually).[ccliv] According to other estimates it is less than 2%.[cclv] Forests are estimated to contribute approximately 1% to overall GDP (not including household wood energy and NTFPs).[cclvi]

Climate patterns show that long rains occur in March - May and short rains occur between October - December. Maximum and minimum temperatures range from below 0^{0}C on Mount Kenya to 40^{0}C in the northwestern, northern and northeastern parts and extreme events such as droughts and floods are common.[cclvii] The country has two main rainy seasons followed by long dry periods. The wettest month is usually April, having 266 mm of rainfall. The driest month is August with 24 mm of rainfall. February is the hottest month with temperatures between 13^{0}C to 28^{0}C and July is the coolest ranging between 11^{0}C to 23^{0}C.[cclviii]

Data shows an increase in average annual temperatures by 1^{0}C between 1960 and 2003 and moreover there have been prolonged droughts and intense flooding since the year 2000. Glaciers around Mount Kenya have also disappeared resulting in the drying of streams in the watershed. Sea levels also rose by approximately 1mm annually, in the Mombassa and Lamu areas between 1986 and 2004 while climate change is now considered the main cause of coral loss in the Western Kenyan Ocean.[cclix]

Heavy reliance on fuel-wood and population growth have led to deforestation, as forests have been converted into farmlands. In addition, Kenya is considered a water scarce country[**cclx**] and diminishing water resources and decreasing (and erratic) rainfall are likely to exacerbate this problem. In addition, changes due to a climate impacts have led to harvest losses and food shortages, loss of biodiversity, increase in landslides, soil degradation, increase in pests and an increase in the range of malaria.[**cclxi**]

The UNDP country profile indicates an increase in average annual temperatures by 1°C and 5°C by the 2090s (comparatively global temperatures are expected to rise by 2°C rise by 2100).[cclxii] During the same timeframe, rainfall periods for both short and long seasons are likely to remain the same, however, each season (particularly the short season) will become wetter and more intense, resulting in an increase in floods. Droughts will also be more severe due to a rise in temperatures. According to UNEP "*Kenya's high dependence on natural resources, its poverty levels and low capacity to adapt, and the existence of other significant environmental stress make it highly vulnerable to climate change*."[cclxiii] A study by the Stockholm Environment Institute (SEI) estimated that climate change related costs might be equal to almost 3% of the GDP annually by 2030.[cclxiv]

As in other parts of the world, the forestry sector in Kenya is also vulnerable to climate change. It is reported in the National Climate Change Response Strategy that the increase in desertification and forest degradation, due to climate change, will impact economic benefits and livelihoods, as well as biodiversity and other environmental services. Kenya's forestry sector is vulnerable to climate change, which is expected to have important effects on the composition, growth rates and regenerative capacity.[cclxv] This will result in the spread of invasive species, and temperature increases will also lead to an increase in forest fires, as well as pests.[cclxvi]

GHG emissions from energy sector were 4.5 million $MtC0_2$ (primarily from fossil fuel combustion) in 1994.[cclxvii] According to the Climate Change Action Plan, emissions in the forestry sector rose from 16.3 MtCO2e in 2000 to 19.6 MtCO2e in 2010 (32% of total national emissions in 2010), mainly due to deforestation.[cclxviii]

Adaptation and Mitigation Actions

Kenya was a net absorber or sink of carbon in 1994, absorbing about 22,751,000 MtCO2.[cclxix] According to the Climate Change Action Plan there is a potential of abating 32 MtCO2 per year by 2030 with the restoration of forests on degraded land. Emissions are expected to decline to 17 MtCO2e in 2020 and to 12.9 MtCO2 in 2030 due to a reduction in deforestation and increases in the number and sizes of trees.[cclxx]

The large potential for restoration of forests on degraded lands is driven by the scale of implementation; almost 1 m/ha of forests could be restored on degraded lands between 2015 and 2030 in the mitigation scenario. This compares to 240,000 ha of reforestation of degraded forests and a decrease in deforestation and forest degradation of 63,000 ha by 2030. The total abatement potential in the forestry sector in 2030 exceeds 41 Mt CO2 per year.[cclxxi]

The Forest Policy first published in 1957, was later revised and the new policy came into force in 2007, while the Forest Act was passed in 2005.[cclxxii] Kenya's Vision 2030, which is its long terms development strategy, aims at attaining at least 10% forest cover by 2030 through reforestation, farm and dryland management and restoration of degraded forests, all through community involvement in the management of public forests. Thus the Vision looks at integrating adaptation and mitigation. The Forest Services Strategic Plan has the goal of increasing forest cover by 4% between 2010 and 2014. [cclxxiii]

The first national initiative to comprehensively address climate change, was the National Climate Change Response Strategy (2009) and it explicitly recognizes the forest sector as the main one to contribute to mitigation. It focuses on ensuring that both adaptation and mitigation options are integrated in all national plans and development options. The Strategy also lays out policies and legislation for mitigation and adaptation measures.[cclxxiv]

A National Climate Change Action Plan was also developed in 2012, which has a special focus on forests and clearly identifies adaptation and mitigation as priority areas together with sustainable development.[cclxxv] The plan highlights low-carbon development actions in the forestry sector, that have the potential to abate emissions of 40 MtCO2e per year in 2030. This would mean restoring 960,000 ha of degraded forests between 2015 and 2030. To this end a REDD+ Readiness Preparation Proposal has been developed, outlining a roadmap of REDD+ preparation activities and also has informed the country's REDD+ strategy and implementation framework. A grant of USD 3.4 m, provided by Forest Carbon Partnership Facility is supporting elements of the REDD+ plan.[cclxxvi]

The Green Belt Movement has a climate change programme and is working with the Government of Kenya for climate change programmes and REDD+ activities, such as carbon projects in Aberdare forest, Mt. Kenya forest and Mau forest. The organization has also been working on REDD+ mitigation and adaptation activities at the community level.[cclxxvii]

The Rockefeller Foundation has funded the Adaptation of People to Climate Change in East Africa (Uganda and Kenya) project, which aims to analyze the potential of EbA to address climate change. The project is being implemented by ICRAF, Makerere University and Kenya Forestry Research Institute and is from 2011 - 2015.[cclxxviii]

Kenya and the UNFCCC

Kenya is a non-Annex 1 party, which signed the UNFCCC in 1992 and ratified it in 2010. The government has established National Climate Change Activities Coordination Committee to translate the objectives of the UNFCCC and other protocols into national development priorities.[cclxxix]Although the Nationally Appropriate Mitigation Actions (NAMA) have not been developed, they are in the offing under the Nation Climate Change Action Plan. [cclxxx] National Adaptation Plans are also part of the Action Plan agenda (both NAMA and NAP are part of the commitments under

the Durban Platform and the Cancun Agreement).[cclxxxi] The government also associated itself with the Copenhagen Accord in 2010.[cclxxxii]

Way forward for Kenya's adaptation and mitigation actions

Data availability is a big issue in Kenya. However, the country is well on its way to increasing its understanding of its climate change needs and implementing adaptation and mitigation actions. It especially recognizes the forestry sector as extremely important and has developed action plans for it, specifically in the context of REDD+. Although it has not yet developed its NAMA and its adaptation activities are also ad hoc, there is progress. This provides a good time to consolidate mitigation-adaptation actions, especially as part of the REDD+ action plan in the country.

The Green Belt Movement and other forestry projects are areas where FLR options can be investigated. The Vision 2030 also highlights community involvement and therefore, community based forestry and agroforestry programmes that link both mitigation and adaptation can be developed as part of it.

Before any of this can take place however, data collection and further analyses are required to ensure that planning and implementation of projects is effective and efficient.

Rwanda

Background and Climate Scenarios

Rwanda is located in Central Africa, has a total area of 26,338km^2. The Nile River to the west covers 67% of the drainage area and delivers 90% of water, while the Congo covers 33%.[cclxxxiii]

Natural rainforests make 33% of its forest cover, followed by eucalyptus plantations at 26% and degraded forests at 15.7%. Most rainforests are protected, while the degraded forests are used for domestic purposes. Temperature variation is between 15^{0}C to 17^{0}C and annual average rainfall is 1,400 mm in the mountainous region of the Congo-Nile crest. The Central Plateau has temperatures ranging from 19 - 20^{0}C, with 1200 mm of average annual rainfall. The Eastern Low Plateau has temperatures between 21 to 22^{0}C and average rainfall of around 950 mm. A small dry region in Bugarama has annual temperatures of up to 24^{0}C, with annual average rainfall at 800 mm.

There has been a clear downward trend in average annual rainfall at Kigali Airport station between 1961 - 1990. Average annual temperatures indicate an upward trend of 0.9^{0}C in the same period, as well as during 1971 - 2007 where the increase has been recorded as 1.2^{0}C. In addition, while average rainfall has decreased in April (the month that usually has the highest precipitation) as compared to the average of 1961 - 1990; the months of July, September, November and December have seen higher precipitation than normal. This high rate has not been equally distributed and has resulted in floods and landslides. Average annual temperatures are expected to increase from 0.75 to 3.25^{0}C (December to February) and from 1 to 3.25^{0}C (June to August) in the 21st century.

Agriculture is the highest emitter of GHG in 2005 with approximately 3,909,900 MtCO2e (78% of total), followed by energy at 891,300 MtCO2e (17.8%), industrial processes 150,520 MtCO2e (3%), waste 47,250 MtCO2e (0.9%) and LULUCF 10,900 MtCO2e (0.2%). Total national emissions for 2005 show a negative balance with emissions at 5,010,000 MtCO2e and absorption at 8,545,000 MtCO2e.

Climate change has had an impact on the country during the past 30 years and the frequency, intensity and persistence of extreme weather events have been changed accordingly. As a result there have been heavy rains, heat waves, droughts and events such as El Nino and La Nina. Temperature projections show an increase in average annual temperature for 2020 (increase of 0.4 to 0.6^{0}C), 2050 (increase of 1.2 to 1.9^{0}C) and 2100 (increase of 2.3 to 3.3^{0}C).

These climate changes have impacted water resources, causing floods as well as droughts. The result is that water levels have declined due to decreases in river discharges, decline in water levels in water bodies, drying up of sinks, loss of aquatic biodiversity (and other biodiversity) and reduction in power generation. Groundwater resources were also affected.

In September 12, 2007, 15 people died and 2 went missing, due to torrential rains in Bigogwe (Nyabihu district) and Kanzenze (Rubavu district) respectively in the Northern and Western Provinces. Furthermore, 456 houses and hundreds of hectares of plantations of potatoes were also destroyed, and 2403 people from 438 families were displaced. Heavy rains and winds affected eight of the 12 sectors of Rubavu District: Gisenyi, Rubavu, Rugerero, Nyamyumba, Nyundo, Cyanzarwe, Nyakiriba and Kanama, in September 2008, 500 homes and approximately 2000 ha of crops were submerged. In addition, bridges, roads and schools were severely damaged.

Agricultural production was affected due to decrease in rainfall during periods of drought in the east and southeast regions, especially in the Bugesera region. It is predicted that forests may be impacted further due to diseases, forest fires and increase in pests due to climate change as well as continued anthropogenic stresses such as deforestation.

Adaptation and Mitigation Actions

Mitigation options considered in the Second National Communication show that 18,862,500 MtCO2e can potentially be sequestered by forests. In addition, reduction in fuelwood and charcoal use will also be beneficial and will lead to a decline in emissions from 2015. Various options if considered will reduce total emissions of 8,6663,000 MtCO2e by between 2005 to 2030.[cclxxxiv]

The First National Forest Policy was established in 2004 (16 years after the Forest Law). This was revised in 2011 and set clear targets to increase forest cover and for the forestry sector to play a role in the economy. The policy aims to sustainably manage and use the country's forests and contribute to the forestry sector as outlined in the Vision 2020.[cclxxxv] In 2011, Rwanda won a UN backed gold award for its forest promotion policies. At that time it was reported that forest cover had increased 37% since 1990 due to these policies, which also consider biodiversity consider, green jobs and ecotourism.[cclxxxvi]

The East African Community Climate Change Policy is applied in Rwanda, the objective of which is to provide guidance to partner states to implement measures climate change, while working towards sustainable development.[cclxxxvii]

The National Green Growth and Climate Resilient Strategy was developed in 2011 and aims to guide the mainstreaming of climate resilience and low carbon development into key sectors. The strategy includes a vision for 2050 and various programmes of action (including sustainable forestry and agroforestry).[cclxxxviii]

Since Rwanda is categorized as a LDC (least developed country), it is required to submit National Adaptation Plans of Actions (NAPA)[cclxxxix] to the UNFCCC. This was formulated in 2006 and outlines adaptation strategies, approaches and projects. Forestry is part of the key adaptation options identified in the NAPA (Preparation and implementation of Forestry Development Plan, Development of energy sources alternative to wood and Introduction of drought resistant species in arid and semi-arid areas). After a multi-criteria analysis however, the only one that formed a part of 6 priority options was Development of Energy Sources Alternative to Firewood. The aim of this project is to reduce the overexploitation of forests by reducing reliance on firewood. Projects identified under this priority area include:

a) Land conservation and protection against erosion and floods at districts level of vulnerable regions to climate change. This has the objective of sustainable management of ecosystems (including forests) as well as reforestation of non-agricultural spaces.

b) Preparation and implementation of woody combustible substitution national strategy to combat the deforestation and put a brake on erosion due to climate change.

A project entitled Reducing the Vulnerability of the Energy Sector to the Impacts of Climate Change was implemented between June 2005 -June 2010, in the Burera and Musanze districts in the Northern Province. This project had a watershed component, which aimed at *Promoting ecologically sensitive livelihood activities within the watershed region supplying the Ntaruka and Mukungwa power stations*. The project was implemented in select villages, and activities included the establishment of nurseries in which climate-resilient trees would be grown; associated tree planting; construction of erosion-control structures; provision of technical and financial support for beekeeping and livestock operations; and training and provision of energy-efficient cook stoves and alternative energy sources. It was implemented by Kigali Institute of Science and Technology and was funded by GEF, Government of The Netherlands and Government of Norway.[ccxc]

The project Reducing Vulnerability to Climate Change by Establishing Early Warning and Disaster Preparedness Systems and Support for Integrated Watershed Management in Flood Prone Areas is being implemented by UNDP and UNEP and funded by, GEF through its Least Developed Countries Fund (LDCF). The project is implemented in the Gishwati ecosystem in Western Rwanda and the associated Nile-Congo crest watersheds. Forests are an important cross cutting theme and the project aims to decrease the vulnerability of the people living and deriving their livelihoods from these areas (Box 9).[ccxci]

UNEP and UNDP started implementing the Rwandan Climate Change and Development Project - Adapting by Reducing Vulnerability (CC DARE). The project relocates communities from the Gishwati Forest, which has suffered extensive environmental degradation and has become dangerous due to extreme weather events, to safer areas. According to UNEP, the efforts to rehabilitate people will maximize the chances of establishing new carbon sinks in Gishwati.[ccxcii]

The project Reducing Vulnerability to Climate Change by Establishing Early Warning and Disaster Preparedness Systems and Support for Integrated Watershed Management in flood prone areas is being implemented in 10 districts by UNEP, UNDP Rwanda Agriculture Board and African Adaptation Programme. Adaptation activities include, but are not limited to, decreasing soil erosion impacts, conservation of river banks, planting of water-entrapment trees, agroforestry and forest and land rehabilitation. The project is funded by GEF through its Least Developed Countries Fund and is expected to be completed by 2014.[ccxciii]

Box 9 Gishwati Area Conservation Programme

One hundred years ago, Gishwati was Rwanda's second largest indigenous forest. It extended 1,000 square kilometers or approximately a quarter million acres (100,000 hectares). The Gishwati Forest was reduced to about one fourth that size by the late 1980s due to human encroachment, deforestation and small-scale farming. The aftermath of the civil war and genocide in the mid-90s resulted in the resettlement of refugees to the area and further encroachment. Today, Gishwati has about 2,500 acres of forest and a small population of 14 chimpanzees.

But for Gishwati, like the people of Rwanda, there is a bright future. In the fall of 2007, Rwanda President Paul Kagame and Ted Townsend, founder of Great Ape Trust of Iowa and Earthpark, unveiled at the Clinton Global Initiative, Rwanda's first national conservation park. In December, Gishwati was selected as the site for the project – setting into motion one of Africa's most ambitious forest restoration and ecological research efforts.

Developing a chimpanzee field study site at Gishwati and restoring the forest are two significant goals of the Gishwati Area Conservation Program. But the effort goes well beyond great apes and reforestation. It is about the people of Rwanda and improving their lives and livelihoods. This collaborative effort will reduce poverty's threat to conservation by improving water quality, controlling floods, promoting ecotourism and enhancing local employment.

Source: taken entirely from http://www.earthpark.net/programs/gishwati/

Rwanda and the UNFCCC

Rwanda is a non Annex 1 party, which became a signatory to the UNFCCC in 1992 and ratified it in 1998. It is classified as and Least Developed Country and as such has developed a NAPA as per the requirements. The Programme of Action however, concentrates on water resource management, disaster management and agro-pastoral activities. Forests are only considered through development of alternative sources of energy.[ccxciv] Rwanda has not submitted a NAMA to the UNFCCC.

Way forward for Rwanda's adaptation and mitigation actions

Rwanda has low energy emissions and basically provides a net sink for carbon emissions. It has started implementing a number of adaptation projects funded by various donors. Most of projects deal with securing people's livelihoods and with decreasing vulnerability to extreme weather events such as floods and droughts. Many of these projects do have mitigation components as they look to decreasing deforestation, thus increasing carbon sinks. Its National Adaptation Plan of Action however, does not explicitly consider forest landscapes and this is a major gap that needs to be addressed.

There is also no explicit strategy integrating the two options and this means an opportunity exists to ensure that synergies can be promoted and implemented. The country's forestry policy looks at incorporating forests into the national economy and therefore it is crucial that this be undertaken in a sustainable manner. Rwanda is on its way in this regard with its clear targets to increase forest cover and its forest promotion policies.

There is still a need however, for data collection regarding the impacts of climate change on forest landscapes, and to implement forest based mitigation projects that incorporate adaptation of forests and adaptation of forest communities.

Uganda

Background and Climate Scenarios

Uganda is an equatorial country and has 241,038 km^2 of land, of which open water and swamps constitute 43,941 km^2. The climate is moderate humid and hot throughout the year. The country's two annual rainy seasons merge into one long rainy season towards the north of the equator. The average rainfall ranges from 400–2200 mm per year. The temperature is moderate and mean daily temperature is 28^0C.

Forests play a very important role in Uganda's economy and provide goods and services that contribute 6.1% to the GDP. Rural communities are especially dependent on forests and over 99% of the national energy demand is met by wood products. The tropical forest in Congo influences the climate in Uganda (in western and northwestern Uganda). Uganda also has a large area of degraded and deforested lands. About 70% of its forests are privately owned and provide a source of employment. Deforestation is without doubt the main environmental issue in Uganda. The available data suggests that at the beginning of the 20th century, coverage of forests and woodlands was over 50% while it was 24% in 2007 primarily due to extensive use of firewood and charcoal. Approximately 33% of local forest reserves have been completely deforested compared to 6% of central forest reserves. Furthermore, only 1.2% of local forest reserves are intact as compared to 16.8% of central forest reserves. It is predicted that Uganda may lose its natural forests by the end of this century if the current high rate of deforestation and forest degradation continues. The consequences of this are desertification, loss of biodiversity, erosion of gene pools, increase vulnerability of local communities to climate extremes, and reduction of livelihood assets for rural communities. Dry weather and the increasing droughts also result in forest fires. Encroachment is also one of the major issues in forest reserves leading to further degradation.

The wetter areas of the country (eastern and northwestern parts) are experiencing heavier and more violent rainfall, and the dry regions (western, northern and northeastern) are experiencing long droughts. The erratic rainfall and long drought periods have made Uganda very susceptible to climate change impacts. The onset of frequent droughts has resulted in the water table being lowered. For example, in 1999/2000 there was a severe drought, which led to negative impacts on the economy by causing severe water shortage, leading to loss of animals, low production of milk, food insecurity and increased food prices. Prior to this, 1998 was an El Nino year, which experienced heavy rainfalls and resultant floods. Temperature rises have led to the increase in malaria in the highlands, where the people have not developed immunity for it. Temperature increases have also led to increase in pest outbreaks and crop diseases. The Rwenzori mountain range has a permanent ice-cap that is vulnerable to climate change.[ccxcv]

> *In Mt Elgon, Uganda – vulnerability Analysis suggests that there will be a 0.5 to 1.0C raise (I can get the exact figures later) in Temperature. Therefore the temperature gradient will move up altitude by approx.500m. To cope with this, it will be important to restore forests that are best suited to the changing temperature regimes"*
>
> *Ed Barrow, IUCN Global Ecosystem Management Programme*

The GHG inventory shows that using 1994 data an estimated total of 708,610 MtCO2 of CO2 were emitted from petroleum products. The total CO2 emission from wood-fuel, charcoal, and from wood to charcoal respectively was 11,605.42 KT, 773.67 KT and 1,384.64 KT. Uganda has a low industrial base and emitted a total of 15,400 MtCO2e of CO2 from cement production, while lime and foam emitted 28,000 MtCO2 and 100 MtCO2 of CO2 respectively. Agriculture is the biggest contributor to GHG at 579,749,900 MtCO2e. LULUCF contributed 10,858,738 MtCO2.[ccxcvi]

Adaptation and Mitigation Actions

Various policies have been put into place to deal with climate change, such as the Disaster Management and Preparedness Policy, Forest Policy (2001), Environment Policy, National Water Policy, Energy Policy and Climate Monitoring among others.[ccxcvii]

The country wrote its first forestry policy in 1929, which has gone through various reviews. The latest iteration was in 2001, when the Ministry of Water, Lands and Environment drafted a new one. The Policy aims to promote forests as part of the economy, sustainable use and management of forests, as well as conservation of biodiversity and environmental services. It also aims to promote urban forestry, and improve land & tree tenure.[ccxcviii]

Uganda prepared its National Adaptation Programmes of Action (NAPA) in 2007, as its requirement for the UNFCCC. It highlighted the importance of the forestry sector and priority interventions included agroforestry and integration of climate change issues into sectoral planning and implementation.[ccxcix] A Climate Change Unit has been established in the Ministry of Water and Environment.[ccc] In December 2013, the National Climate Change Policy was approved.[ccci] The National Strategy to Strengthen Human Resources and Skills to Advance Green Low Emission and Climate Resilient Development 2013–2022 was launched on 28 June 2013.[cccii]

The Rockefeller Foundation has funded the Adaptation of People to Climate Change in East Africa (Uganda and Kenya), which aims to analyze the potential of EbA to address climate change. The project is being implemented by ICRAF, Makerere University and Kenya Forestry Research Institute and is from 2011–2015.[cccciii]

UNDP, UNEP, IUCN and the Ministry of Water and Environment, Uganda are implementing EbA in Mountain Elgon Ecosystem from 2012–2014.[ccciv]

Uganda and the UNFCCC

Uganda is a non-Annex 1 party, which signed the UNFCCC in 1992 and ratified it in 1993. Uganda is classified as a Least Developed Country and as such has developed its NAPA in 2007. After extensive PRA exercises and

multicriteria analyses, nine priority projects were identified. Only one, the Community Tree Growing Project, specifically deals with forest ecosystems and aims to increase tree cover in vulnerable, resource constrained communities. It has also established a Climate Change Unit in the Ministry of Water and Environment.

Way forward for Uganda's adaptation and mitigation actions

As a LDC and being largely rural based, adaptation is key on Uganda's agenda. Adaptation actions are being implemented by various organizations primarily to assist farmers to decrease their vulnerabilities (such as in coffee plantations). Although forests are considered a priority area not a lot of interventions are being implemented for them.

Uganda's NAPA also identifies 9 projects that it considers a priority. One of them is related to community forestry. A lot needs to be done to find avenues and opportunities for integrated mitigation and adaptation strategies in the country and as such there is a lot of room in areas such as agroforestry, EbA and FLR.

Data collection is an urgent need of the hour. Because forests play such a key role in the country's economy, it is an urgent requirement that effective adaptation actions that have built in mitigation benefits are implemented in forests. Data collection and analyses will help towards this goal. There is also a need to learn from neighbouring countries such as Rwanda, who have effective forest promotion activities.

Missing Links and Recommendations

Typhoon Haiyan devastated parts of Southeast Asia, particularly the Philippines, on November 8, 2013, just three days before the UNFCCC COP 19 was to take place in Warsaw, Poland. The magnitude and impact of this typhoon was unprecedented and the impacts are still being dealt with to date.

The most important aspect of this typhoon was the realization (perhaps a little too late for the people of the Philippines) that ecosystem management and restoration are a necessity not a luxury, in order to deal with climate change.[cccv] This does not mean just achieving adaptation through ecosystem management but, and perhaps more importantly, achieving the goals of mitigation, to protect against extreme weather events.[cccvi]

Deforestation played an extensive role in exacerbating the impacts of this storm. The Ormoc City for example had been severely deforested and felt the impacts of Haiyan the hardest.[cccvii] Similar incidents around the globe demonstrate that deforestation is having huge impacts on the planet, not only in terms of increasing the effects of climate events but also by contributing to increasing greenhouse gases.

Forest Landscape Restoration is therefore one key strategy, combined with appropriate (and potentially at the lowest accountable representative level) landscape management that must be given importance to, in order to deal with both degradation and deforestation. It is also one area where mitigation and adaptation syntheses can be effectively applied and can be hugely successful. In order for such approaches to be seen as adaptation, the restoration and management efforts need to take into account climate change scenarios, for example, restoring with "climate appropriate" species for the particular location.

Mitigation and adaptation strategies differ in temporal and spatial scales, in the sense that mitigation has global benefits while adaptation works locally.[cccviii] Both strategies have thus been treated as distinct from each other at both the global as well as the national and local levels. In particular, global negotiations and national policies have focused more on mitigation than adaptation.[cccix] However, this is changing, for example with the increased attention given to adaptation at the Warsaw COP. In addition to providing global goods, mitigation (restoration etc.) can provide important local goods (e.g. NTFPs), as well as important adaptation benefits (e.g. diversification, adaptive capacities in management, making landscape level tradeoffs).

Currently, adaptation and mitigation are seen as separate from each other in terms of policies in that NAPAs and NAMAs are separate requirements of UNFCCC, with NAPAs only mandatory for developing countries. Many developing countries are also not bound to submit NAMAs. At the international level the funding streams for both mechanisms are entirely separate from each other; adaptation has the adaptation fund and mitigation has REDD+ funds.[cccx] At the national levels, both are under the jurisdiction of separate government agencies, which makes any coordination extremely difficult.[cccxi] Adaptation usually falls under the Ministry of Environment, while mitigation resides with the Ministry of Forestry. As such the two approaches are limited by their inadequacy and inefficiency. There is also a duplication of activities, which means funds are generally wasted. Furthermore, competition for funding complicates matters further.[cccxii]

A potential role for IUCN could be in making the case more strongly for synergies between these two pillars (adaptation and mitigation) – in terms of implementation (piloting in a number of countries, for example), learning, further exploring the literature and case studies on this; and then using this evidence to work with some governments to demonstrate the real value added (economics, adaptive capacities, sustainable land use, mitigation). This means working together on adaptation and mitigation with those government sectors more responsible for national planning (and not just Environment or Forestry).

Mitigation projects can benefit adaptation projects (by having positive or negative impacts on adaptive capacity and provided there is adaptation additionality) and adaptation can similarly have positive or negative impacts on mitigation goals.[cccxiii] This clearly shows that there are linkages between mitigation and adaptation that must be considered when planning and implementing projects for either strategy. These linkages can clearly be seen in the forestry sector, especially in the context of REDD+ projects (when looking at REDD+ in the context of FLR).[cccxiv] Other areas where the two can be integrated are community forestry and agroforestry. Current discourse, therefore, is now concentrating on what exactly these linkages are and how they can be utilized to provide effective strategies.

Adaptation has to take place both in terms of forests adapting to CC, as well as by forest communities through improved and sustainable management. Mitigation projects such as REDD+, can benefit adaptation of forests to climate change, by decreasing degradation pressure and vulnerability, conserving biodiversity, and increasing resilience.[cccxv] But for each to be seen as contributing to adaptation, they need to demonstrate additionality by taking into account the best science in climate change scenarios. They can also positively impact forest communities by providing ecosystem services, increased livelihood opportunities and strengthening institutions.[cccxvi] On the other hand their negative impacts can include restricting access of local communities to forest resources and making communities dependent on external funding.[cccxvii] The benefits from REDD+ can be effectively achieved and the tradeoffs avoided, if and when REDD+ mitigation projects are considered under the umbrella of FLR.

> *"We must go further and explore other synergies between development sectors related to forests and between development and climate policies, with the landscape as our spatial area of study."*
>
> *Anne Marie Tiani, Scientist at CIFOR*

Conversely, projects for adaptation can effectively contribute to carbon sequestration through FLR, (as well as agroforestry and community forestry, which are components of FLR).[cccxviii] However, further forest degradation/ conversion can take place if adaptation options are missing (e.g. the FLR does not take into account the climate change additionality[1]), or not implemented effectively, thus hindering mitigation objectives.[cccxix]

There is therefore a need to understand the synergies between the two options and to ensure that trade-offs are minimized and opportunities are built upon, such that both the global agenda and local needs are met.[cccxx] In particular, an attractive option is the integration of REDD+ and adaptation, which will provide 'triple win' solutions of low emissions and increased resilience to climate change, as well as supporting development.[cccxxi] Such integration clearly achieves the goals of forest landscape restoration, in that, it works towards conserving the functions of forest ecosystems.

The original purpose of REDD+ must however be considered: that is its conception by some countries as a purely market-based mechanism. The accepted wisdom was that reduced deforestation would generate credits that could be sold and traded in domestic and international carbon offset markets. This however did not happen due to the failure of establishing a functioning global carbon market. As such, REDD+ now mostly relies on Overseas Development Aid (ODA). However, the main goal of ODA is supporting development and poverty reduction, not achieving emission reductions. [cccxxii] Therefore, there is a crucial need to consider mechanisms such as FLR that directly support REDD+ in developing countries, in addition to working towards functioning and efficient trading of REDD+. Otherwise there is the possibility of not being able to achieve objectives of development and poverty reduction or mitigation.

[1]According to the UNFCCC, additionality refers to an effort that is supplemental to the business-as-usual (BAU) scenario in at least two areas: (i) the additionality of financial contributions of developed countries to mitigate climate change in developing countries; and (ii) the additionality of greenhouse gas (GHG) emissions generated by mitigation activities.

Achieving integrated mitigation and adaptation through landscape management, especially forest landscape management and restoration, is possible and is in fact a promising option. Such strategies will increase the effectiveness of both options, minimize costs thus enhancing efficiency and reducing risks (thus ensuring continuity and increasing resilience).[cccxxiii] However, for such landscape management to be successful – governance arrangement need to be representative, at the lowest accountable level, and benefit those who are "working the land". This may be the biggest challenge of all – but one which can be met by making the case for the triple wins.

An initial example of this is Indonesia, which in partnership with Governments of Denmark, Germany, the EU and ICRAF, has developed a method called Land-Use Planning for Low-Emissions Development Strategies or LUWES, which uses participatory techniques to bring together farmers, district government agencies, non-governmental organizations and businesses in a landscape to identify and measure their joint emissions and design ways to reduce them. Its inclusiveness ensures that local people's rights and access are not taken away thus empowering them, which in turn increases their resilience and adaptive capacity.[cccxxiv]

Similar initiatives can be undertaken in the countries studied. Forest landscape based, integrated mitigation and adaptation show huge promise, for example by including adaptation into REDD+ as well as CDM projects; and by providing access to mitigation funding to FLR related adaptation projects.[cccxxv] Such integration and mainstreaming would maximize co-benefits and enhance resilience to cope with climate change. At the international level, climate change mitigation and adaptation together can be combined with other multilateral agreements for forests and biodiversity.[cccxxvi] However, risks must be considered when embarking on such an undertaking. A diversity of stakeholders are involved in the two options and this may make integration more complex at the institutional level.[cccxxvii] This can be mediated if a focus is placed on the lowest accountable representative body (e.g. village), and ensuring no one is left out at that level. It must be kept in mind that not all activities will be synergized and some may have to be separate to attain maximum impact.[cccxxviii] It is also important to understand that the goals of different strategies that are being integrated are not undermined in the long run.

The country case studies provided recommendations for each country. Following are some recommendations that can provide a starting point for the implementation of successfully integrated activities.

Recommendations:

Global

- Have an officially agreed and coherently defined understanding of the importance of synergies between mitigation and adaptation at the international level and on to the agenda of the next UNFCCC Conference of Parties.
- Move REDD+ away from ODA to a performance based system linked to emissions reduction.[cccxxix]
- Highlight adaptation benefits from mitigation options and mitigation benefits from adaptation in IPCC assessment reports.
- Enhance coordination between WG II and III resulting in a much more realistic synthesis report.

National

- Climate change mitigation and adaptation need to be mainstreamed in national development and economic planning and FLR can demonstrate the integration between the two in this context.
- Make the economic, social and environmental cases for a stronger integration of adaptation and mitigation at the national and local levels in a manner that takes into account additionality.
- Representative Governance structure to the lowest accountable level needs to be the basis for local level action.
- Compile detailed studies and analyses to better understand how synergies can be captured and how other development and economic priorities impact mitigation, adaptation and the synergies between the two. This can be done through research and lessons learned from pilot projects.
- Undertake research on the key synergies and tradeoffs among different objectives in forest landscapes, including climate change adaptation, climate change mitigation, food security, poverty alleviation, and ecosystem conservation.
- Improve forest governance, remove perverse subsidies and strengthen institutional capacity for FLR options to work and to provide co-benefits for mitigation and adaptation.
- The countries assessed in this document need to define clear mechanisms and guidelines for REDD+,[cccxxx] which will take into account access, use and tenure rights, as well as cost and benefit sharing. These when developed under FLR mechanisms are easily achievable and implementable. In addition, adopting a forest based sustainable livelihoods approach can contribute to decreasing vulnerabilities of communities.[cccxxxi]
- Mitigation options beyond REDD+ and which look at complete landscapes, must be actively promoted. As such, there is a need to learn lessons from agroforestry and community forestry initiatives in the countries.
- To ensure that synergies are clearly applied for mitigation and adaptation, there is a need to ensure that institutions and agencies are coordinated.
- Benefits from carbon credits need to be shared down to the most local levels and as such stakeholder participation is crucial at all levels (including that of the private sector in REDD+).
- Outline finances for both mitigation and adaptation and especially for funding integrated projects between the two. Additional funding opportunities need to be explored.
- Increase technical capacity of development practitioners, forestry experts and communities to ensure successful and integrated projects.
- An understanding of REDD+ is thus crucial, as well as how it would impact forestry mechanisms[cccxxxii] and how it can be subsumed under FLR.

- Data gaps are huge in terms of forest landscape capacities and analyses regarding their potential for mitigation and adaptation synergies are also needed. Investing in data collection and analyses is crucial.
- An analysis of the inter-relationship between adaptation and mitigation is needed to understand their joint potential and limitations.[cccxxxiii]
- On-ground integrated mitigation-adaptation initiatives should be pilot-tested to evaluate their potential for replication.[cccxxxiv] Initially these can be started in the countries reviewed and the evidence used to demonstrate value addition to governments.
- Finally, an understanding of the need to include disaster management and disaster risk reduction is required and must be included in FLR related mitigation-adaptation options.

Conclusion

The purpose of this document was to review current literature and discourse on integrated mitigation-adaptation options in FLR. International policies and frameworks show that combining the two will achieve concrete co-benefits and that there is a rich learning on the synergies between mitigation and adaptation in Forest Landscape Restoration. Review of country level interventions showed that there are effective synergies that FLR offers. However, currently this learning is compartmentalized and has not resulted in effective on-ground evidence of success. Also, while various institutions are working for integrated mitigation-adaptation activities in FLR, this learning has not translated towards other sectors. Additionally, at the country levels - especially in the context of those projects where the government is involved - such linkages are rarely observed.

It is clear that both mitigation and adaptation can support and benefit each other and the countries reviewed can achieve this effectively. This document can thus be used to inform policy and practice at the national levels, helping other NGOs and government organizations to achieve the co-benefits of mitigation and adaptation together. The results of this study can also help to develop and implement IUCN's strategies and actions to establish linkages between climate mitigation and adaptation in forest landscapes and subsequently in other sectors. This can be done initially through forming working groups with IUCN at the center, to look into formalizing these synergies at the policy (and international negotiations) and on-ground practical (technical) levels.

The recommendations provided are just a starting point that will pave the way to effectively integrated mitigation-adaptation options. The bottom line is that this is entirely possible, and has the potential to be hugely successful with further research, understanding and lessons learned through pilot testing. The important aspect to remember is that FLR is not just about forest/ ecosystem restoration or afforestation; it is also about improving livelihoods, increasing resilience and other goods and services. Because whole landscapes are considered, trade-offs between conflicting interests can be minimized and effectively designed projects could provide benefits for biodiversity, climate and people.[cccxxxv] This is the rich learning that can provide mitigation-adaptation co-benefits to other sectors as well.

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