Reducing Emissions *from* Deforestation *and* Degradation (REDD)

A CASEBOOK OF ON-THE-GROUND EXPERIENCE

Acknowledgements

Contributing Authors: Nicole R. Virgilio, Sarene Marshall, Olaf Zerbock and Christopher Holmes
Editing: Lisa Hayden
Design: DeGarmo Creative

We would also like to thank the following people for their input and contributions: Greg Fishbein, Rane Cortez, Bronson Griscom, Stavros Papageorgiou, Marc Steininger, Jeannicq Randrianarisoa, Pierrot Rakotoniaina, James MacKinnon, Andriambolantsoa Rasolohery, Ben Vitale, Peter Gudritz, Kelly Aylward, Tiana Rakotosamimanana, Todd Stevens, Linda Krueger and Marisa Arpels

Special thanks to The David and Lucile Packard Foundation for its generous support of this endeavor.

Please cite this document as:
Reducing Emissions from Deforestation and Degradation (REDD): A Casebook of On-the-Ground Experience. 2010.
The Nature Conservancy, Conservation International and Wildlife Conservation Society.
Arlington, Virginia.

PHOTOS ON COVER: © Scott Warren; © Mark Godfrey/TNC; © Bridget Besaw

Reducing Emissions *from* Deforestation *and* Degradation (REDD)

A CASEBOOK OF ON-THE-GROUND EXPERIENCE

The Nature Conservancy
Protecting nature. Preserving life.™

CONSERVATION INTERNATIONAL

WILDLIFE CONSERVATION SOCIETY

Acronyms

AR Afforestation/Reforestation

BioCF Biocarbon Fund of the World Bank

CAR Climate Action Reserve

CCAR California Climate Action Registry

CCB Climate, Community and Biodiversity Standard

CDM Clean Development Mechanism

CI Conservation International

DBH Diameter at Breast Height

EU ETS European Union Greenhouse Gas Emissions Trading System

FSC Forest Stewardship Council

GHG Greenhouse Gas

GtCO2/GtC Gigatons of carbon dioxide/Gigatons of carbon

IFM Improved Forest Management

IPCC Intergovernmental Panel on Climate Change

NGO Non-governmental Organization

REDD Reducing Emissions from Deforestation and Forest Degradation

RGGI Regional Greenhouse Gas Initiative

tCO2e/tC Metric tons of carbon dioxide equivalent/Metric tons of carbon

TNC The Nature Conservancy

UNEP-WCMC United Nations Environment Programme World Conservation Monitoring Centre

UNFCCC United Nations Framework Convention on Climate Change

WCS Wildlife Conservation Society

VCS Voluntary Carbon Standard

Conversions

1 hectare (ha) = 2.47 acres (ac)

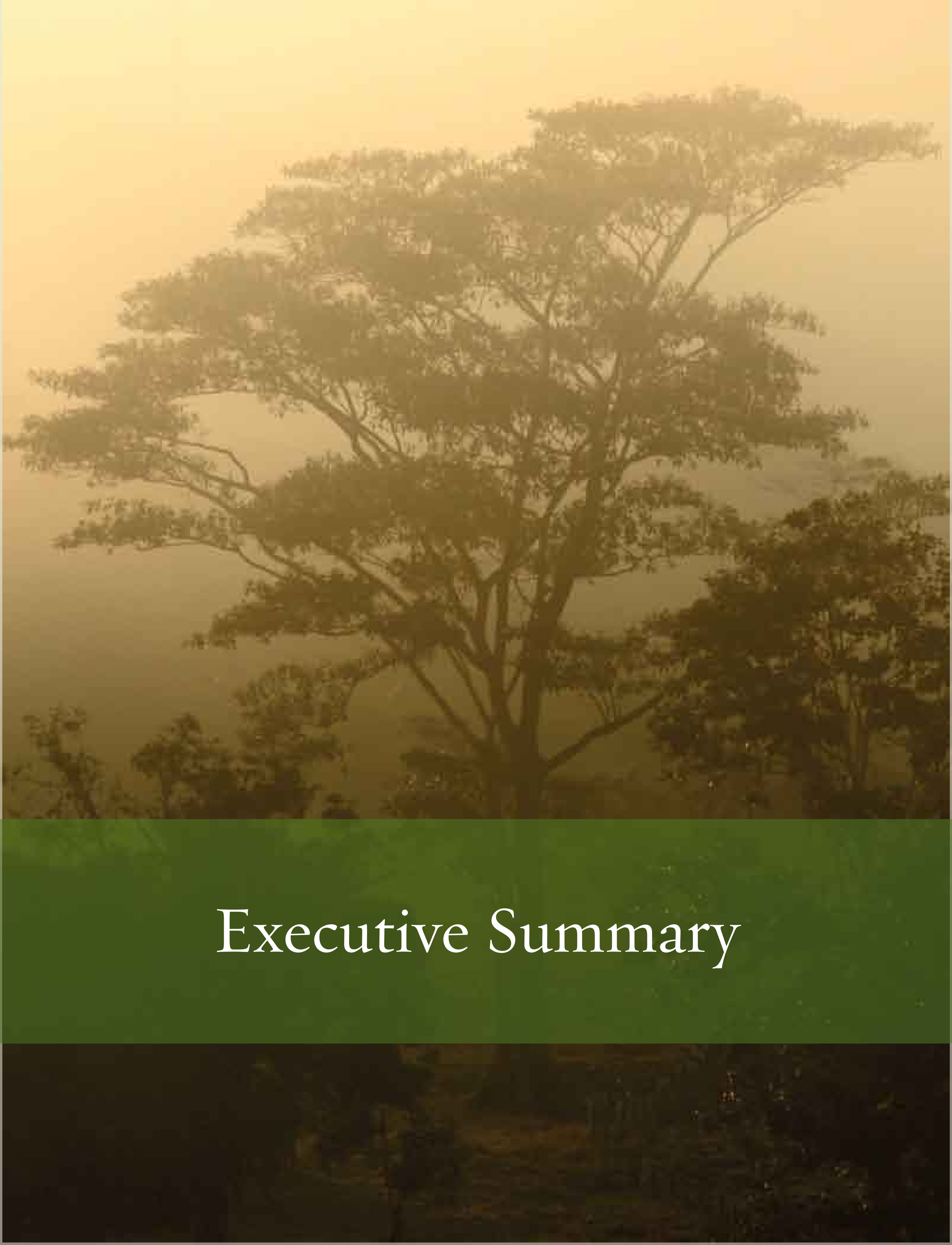
1 metric ton of carbon dioxide equivalent (tCO2e) = 44/12 metric tons carbon (tC)

1 metric ton = 1,000 kilograms (kg) = 2,205 pounds (lb) = 1.10 short (U.S.) tons

1 megaton (Mt) = 1 million metric tons

1 gigaton (Gt) = 1 billion metric tons

Table of Contents



Executive Summary

© Digital Vision/Getty Images

Forests have a critical role to play in addressing climate change. About 15 percent[1] of annual global carbon dioxide emissions are caused by deforestation and forest degradation (van der Werf, et al., 2009; Canadell, et al., 2007) and it will be extremely difficult to solve the climate change problem without reducing these emissions.[2] Recognizing the importance of and providing incentives for conserving (as well as restoring and better managing) forests provides an effective way to mitigate climate change while offering a cost-effective and near-term option to ease the transition to low carbon economies (Stern, 2006; Eliasch, 2008). Within the current policy context, there is interest in including the full scope of forest carbon activities in an overall REDD framework—Reducing Emissions from Deforestation and Forest Degradation, Forest Conservation, Sustainable Management of Forests and Carbon Stock Enhancement[3]—dubbed REDD Plus. Despite this potential, nearly all regulatory climate policy frameworks and markets still fail to include Reducing Emissions from Deforestation and Degradation (REDD) as a tool for climate change mitigation.

The failure to include REDD within regulatory frameworks is a legacy of previous concerns regarding the additional, verifiable and permanent climate benefits of REDD activities. Ongoing work to resolve these concerns should help policy makers incorporate robust REDD strategies into climate change plans at the local, national and international level. Although no legally binding agreement was reached at the December 2009 United Nations climate conference in Copenhagen, REDD Plus was one of the areas where there was strong agreement in both the importance of addressing emissions from deforestation and degradation and the need for creation of an international REDD Plus framework.

Advances in technology and practical implementation experience have created a growing body of research and evidence that reducing carbon emissions through forest conservation can be a credible part of the fight against climate change (IPCC, 2007c; FAO, 2005). Existing projects, spearheaded by organizations such as The Nature Conservancy (TNC), Conservation International (CI) and Wildlife Conservation Society (WCS), have provided the basis for groundbreaking methodologies in estimating, preventing and mitigating leakage, setting project baselines, and verifying carbon benefits. These projects have not only resulted in climate change mitigation, but also valuable community and biodiversity benefits, creating a win-win-win situation. This report explores the primary challenges in demonstrating this credibility, including:

- Demonstrating that the climate benefits from REDD are additional (i.e. would not have happened anyway). (Section 1)
- Setting realistic baselines (i.e. business-as-usual scenarios). (Section 1)
- Measuring, monitoring, reporting and verifying the carbon stocks preserved in forests and actual emissions avoided. (Sections 2 and 5)
- Addressing leakage (i.e. the shifting of emissions elsewhere). (Section 3)
- Managing risks to the permanence of the emissions reductions generated (i.e. strength in avoiding potential reversals). (Section 4)
- Ensuring the involvement of and benefits to local and indigenous peoples. (Section 6)
- Ensuring such efforts enhance, rather than undermine, environmental co-benefits. (Section 7)
- Expanding the scale and scope of REDD efforts. (Section 8)

1 This is a more recent estimate than the frequently cited 17.4%—which was derived from the 2007 Intergovernmental Panel on Climate Change (IPCC) report (IPCC, 2007b). The estimate of "about 15 percent" (van der Werf, et al., 2009; Canadell, et al., 2007) takes into account emissions from peat lands (excluded from the IPCC estimate), as well as increased fossil fuel emissions and updated deforestation data.

2 Eliasch Review. 2008. Climate Change: Financing Global Forests. Crown Copyright. p.1: "Analysis for this Review estimates that, in the absence of any mitigation efforts, emissions from the forest sector alone will increase atmospheric carbon stock by around 30ppm by 2100. Current atmospheric CO_2e levels stand at 433ppm. Consequently, in order to stabilize atmospheric CO_2e levels at a 445-490ppm target, forests will need to form a central part of any global climate change deal."

3 In the international climate change policy dialogue surrounding national-level REDD Plus activities, "Sustainable Management of Forests" implies that forest areas designated for the production of timber are managed in such a way as to effectively balance social, economic and ecological objectives. "Carbon Stock Enhancement" could include both the restoration/improvement of existing but degraded forests and increase of forest cover through environmentally appropriate afforestation and reforestation. Since most of the examples that we are profiling in this report are project-level activities, we will be using the terminology most often seen in forest carbon project standards to describe forest carbon activities: Reducing Emissions from Deforestation and Degradation (REDD), Improved Forest Management (IFM) and Afforestation/Reforestation (AR).

Climate change mitigation strategies across all sectors, not just the forestry sector, must address carbon accounting and credibility challenges, including leakage and permanence. While these issues have been mentioned with many types of emissions reductions efforts, the concerns, unfortunately, are more commonly raised with forest carbon activities.

Project Experience

With 38 years of combined experience in undertaking forest carbon pilot projects on the ground, TNC, CI and WCS have built a repository of knowledge in forest carbon science and project implementation. In total, these three organizations have implemented 34 pilot projects (with 18 more in development) that represent the full range of "forest carbon activities."[4] Of this total, 17 are REDD specific. These projects serve as examples of the important role forests can play in climate change mitigation. This hands-on experience has helped dispel concerns about the effectiveness and feasibility of forest carbon projects, and contains valuable lessons for the design of future projects, as well as for the development of state and national REDD programs, climate change policies and financial vehicles aimed at REDD.

There are four REDD pilot projects profiled in this document (project snapshots on pages 7–10), which are providing important insights into REDD activities:

- Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor/Restoration Project in Madagascar
- Makira Forest Protected Area Project in Madagascar
- Noel Kempff Mercado Climate Action Project in Eastern Bolivia
- Berau Forest Carbon Program in Indonesia (in development)

The purpose of this report is to present some of the lessons learned from this experience, specifically as they relate to commonly cited challenges to creating real, credible and verifiable carbon benefits to the atmosphere through forest carbon activities. The four projects profiled in this report are briefly described in the "Project Snapshots" section to familiarize the reader with their basic design and strategy. The report then reviews basic forest carbon science in the section entitled "REDD 101," and the history and current state of climate change policy and carbon markets as they relate to forest carbon. Finally, the eight sections that follow under "Technical Challenges and Field Experience," describe the main challenges to REDD, using one of four projects profiled in the report as an in-depth case study to demonstrate how this challenge was successfully overcome on the ground and what lessons were learned from the experience.

The lessons learned from these and other case studies help demonstrate:

Realistic baselines can be estimated and additionality can be demonstrated

Satellite imagery, field measurements, laboratory work, sophisticated modeling and carefully researched assumptions are all being used to establish accurate estimates of business-as-usual emissions scenarios from deforestation and degradation. These baselines can be adjusted or recalculated over time to encompass changes in management, government and drivers/patterns of land use change, therefore remaining a dependable reflection of what would likely have happened in the absence of project interventions. Lessons learned from the process of project-level baseline estimation can help inform the discussion on how to most appropriately calculate national-scale baselines. Although additionality (reductions in emissions that are above and beyond what would have occurred without the REDD project) cannot be measured exactly, several tests are available to help reliably demonstrate it by examining conditions such as common practice in the project area, barriers to implementation and current regulations.

The measurement technology exists

Field studies and satellite imagery enable accurate measurements of the carbon sequestered in growing trees and stored in forests, as well as changes in land use (and subsequent emissions) over time. Field methods to determine vegetation cover and measure carbon density have been successfully used for many years. Global land use change data, determined from satellite photographs and used to calculate CO_2 emissions (combined with field-based carbon estimates), is available from as early as 1972,[5] and advances in the interpretation of

© Bridget Besaw

4 "Forest carbon activities" are generally understood to encompass one or more of the following typologies: Reducing Emissions from Deforestation and Degradation (REDD), Improved Forest Management (IFM) and Afforestation/Reforestation (AR).

5 USGS Website: <https://landsat.usgs.gov/about_mission_history.php>

© Ami Vitale

this data are occurring every day. Such advances include methods which now allow for the estimation of degradation from logging and fire, two activities which can contribute substantially to forest carbon emissions (Asner, et al., 2005; Souza and Roberts, 2005). Measurement and monitoring techniques employ rigorous scientific methods and are rapidly becoming more economical to use on both small and large scales.

Credible carbon benefits can be achieved

Third-party verification of carbon offsets to stringent standards developed for REDD demonstrates that emissions reductions from REDD projects can be real, measurable and verifiable. Project assumptions, methodologies and calculations are subject to a transparent and rigorous independent inspection. All projects profiled in this report plan to undergo third-party verification to an established standard, with the exception of Noel Kempff, which was developed prior to the existence of modern REDD standards and has already been verified to a standard based on the Clean Development Mechanism's Afforestation/Reforestation guidance. In fact, in the first half of 2009 it was determined that 96 percent of all forest carbon projects on the voluntary market were verifying to third-party standards (Hamilton, et al., 2010). Other standards which target social and environmental co-benefits, in addition to climate benefits, are in existence and being used more frequently as a complement to carbon standards, helping to ensure that human rights are respected and environmental integrity remains high.

Leakage can be managed and accounted for

Many projects are currently managing leakage using a threefold strategy: 1) incorporating leakage prevention elements into project design and choice of location, 2) calculating leakage that is likely to occur through risk assessments and monitoring, and 3) discounting carbon benefits accordingly if leakage cannot be prevented. Most projects incorporate community development aspects into their design, which provide options for community members to meet their needs without simply deforesting elsewhere. Some projects target degraded lands in their choice of location, which are unlikely to displace agriculture or timber harvest. Nonetheless, even if leakage cannot be completely avoided, economic models and risk assessments have been developed and used to discount project carbon benefits and assure they remain real.

Impermanence can be managed

Project developers are managing the risk of impermanence by incorporating risk mitigation strategies into the project design, aligning interests of key stakeholders, using available financial, legal and institutional structures, and employing insurance mechanisms such as credit buffers. Many of the strategies are very similar to those used in leakage management, such as community development and land tenure facilitation, while others, such as the legal designation of protected status and adoption/enforcement of environmental laws, rely on government participation and support. Risk assessments, similar to those described for leakage management, can be performed to determine the likelihood of impermanence, and an equal amount of carbon credits can be deposited into a pooled registry buffer, spreading the risk over many projects and effectively reducing the chances of catastrophic loss.

There exists a win-win-win potential

REDD offers the potential for a triple benefit—climate change mitigation, community development and biodiversity conservation—and the most robust projects capture all three. As national and international climate change policy negotiations

© Louise Goggin

move forward, the participation of indigenous peoples (who stand to be the most adversely affected by the impacts of climate change (African Development Bank, 2003)) in a REDD mechanism will be critical to the outcome. The projects profiled in this report have illustrated the importance of involving indigenous peoples and local communities in project planning and implementation, as well as demonstrating that REDD projects can be implemented to provide numerous co-benefits to local people, plants, and animals that depend on healthy forest ecosystems for survival.

Lessons for moving to national scale

While project-scale REDD initiatives, as most of the efforts profiled in this report are, can produce credible carbon benefits, there is an emerging interest, especially in climate policy dialogues, in moving to national REDD Plus schemes. Lessons learned and methodologies developed from earlier on-the-ground pilot efforts, such as those detailed in this report, among others, can help inform these larger scale efforts. The interest in national-scale efforts is in part because of the magnitude of the positive climate impact that such nation-wide programs could have, but also because of the advantages of such large-scale efforts in engaging governments and dealing with certain technical challenges across whole countries. Establishing national carbon accounting, for example, would likely enable simpler and more cost-effective methods for dealing with baselines than at the project scale (which generally relies on complex modeling), while capturing any potential intra-country leakage.

Similarly, efforts that are broader in scope, such as REDD Plus—which could include Reducing Emissions from Deforestation and Forest Degradation, Forest Conservation, Sustainable Management of Forests and Carbon Stock Enhancement—are gaining traction, not only for their potential to result in more carbon benefits, but their ability to ensure the sustainability of carbon benefits by maintaining production and access to resources for local communities. REDD Plus was included in the Copenhagen Accord, which came out of the United Nations Framework Convention on Climate Change (UNFCCC) COP-15 held in December 2009, and many governments, including the United States, provided significant financial support to expand the scope of REDD to the abovementioned activities.

Despite the advantages of national REDD programs, in the near term, many countries lack the institutional capacity and legal safeguards to ensure that a centralized REDD Plus regime would equitably allocate incentives to local actors (Costenbader, 2009). The implementation of sub-national scale pilot programs that span entire political jurisdictions can be a critical step in the "pathway to success" that most countries will need to follow. Thus, while there are benefits to moving towards national-level accounting as soon as feasible, it is likely that for some time many nations will need to address the credibility of REDD efforts with methods such as those profiled in this report, but on a sub-national scale (see "Berau" example). Since the dynamics and drivers of deforestation vary between nations due to a variety of geographic, political, economic and cultural factors, pilot REDD activities can provide valuable lessons to the design of national REDD plans regarding what works, and what does not, both in terms of actually reducing deforestation in the field, as well as monitoring those efforts.

RIGHT: © Sterling Zumbrunn/CI

Introduction

The purpose of this report is to present some of the lessons learned from our on-the-ground project experience in Reducing Emissions from Deforestation and Forest Degradation (REDD), specifically as it relates to commonly cited challenges to creating real, credible and verifiable carbon benefits to the atmosphere. The "Introduction" briefly describes the profiled projects and provides background information on forest carbon science, policy and finance.

Project Snapshots

The experiences detailed in this report are based on four pilot REDD projects—implemented by Conservation International, Wildlife Conservation Society and The Nature Conservancy, respectively. The symbols below allow for quick and easy identification of key project elements.

Symbol Key

Scope — *Type of forest carbon activities included in the project*

REDUCING EMISSIONS FROM DEFORESTATION AND FOREST DEGRADATION (REDD)—An activity which reduces forest carbon emissions by lessening or preventing forest conversion and degradation (including that which results from fire, fuel wood harvest and logging).

IMPROVED FOREST MANAGEMENT (IFM)—An activity which increases carbon stocks and/or reduces carbon emissions from forests by changing the way in which they are managed. Management changes may include implementing harvest methods that result in less ancillary damage to remaining trees, extending harvest rotations thereby leaving more carbon stored on the land, increasing the stocking of poorly stocked forests by encouraging growth of denser/healthier trees and converting previously harvested forests to no-cut protected areas.

AFFORESTATION/REFORESTATION (AR)—An activity which increases carbon stocks by re-establishing forest where it had previously been cleared, through planting or natural regeneration.

Degradation — *A reduction in carbon stocks that does not directly result in complete land use conversion*

Project is employing strategies specifically aimed at addressing drivers of forest degradation.

Scale — *Size of the geographic/political boundaries of the project*

Project Level (e.g., a single protected area or collection of properties that does not follow geopolitical lines).

Geopolitical Unit (e.g. state, province, district, municipality, etc.).

Verification — *Third-party assessment confirming that claimed carbon benefits adhere to an acknowledged carbon standard*

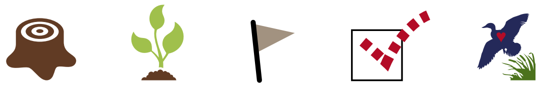
Carbon benefits have been verified.

Carbon benefits are not currently verified; however, there are plans to undergo verification in the future.

Co-benefits — *Benefits to local peoples and the environment from project activities*

Project is pursuing validation to an acknowledged social and/or environmental standard.

The Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor and Restoration Project



The primary forests of Madagascar harbor incredibly high numbers of species found nowhere else in the world, but this habitat has been reduced to less than 15 percent of the nation's land cover due to a variety of factors, including seasonal subsistence slash-and-burn rice cultivation ("tavy agriculture") and charcoal production. The Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor and Restoration Project ("Mantadia project") was created in 2004 to try to combat forest loss in Madagascar, through a partnership between the Government of Madagascar (via the Ministry of Environment, Water, Forests and Tourism) and a network of national and international non-profit organizations, including Conservation International.

The Mantadia project is comprised of two components: REDD and AR. The REDD component, known as Corridor Ankeniheny-Zahamena (CAZ), is expected to reduce deforestation on approximately 420,000 hectares, which includes a newly created 371,000 hectare multiple-use protected area. Management of some portions of the protected area will be transitioned to local community management, with increased patrolling by local forest agents and the development of biological monitoring procedures. This project component is expected to result in the reduction of at least 10 million metric tons of carbon dioxide equivalent (tCO_2e) emissions over the 30-year project lifespan.

The AR component, known as Tetik' Asa Mampody Savoka (TAMS), or '*Make the fallows go back to forest,*' will eventually restore forest cover on approximately 3,000 hectares of degraded lands, using a mix of native forest species to reconnect existing forest fragments (so far, the first phase of reforestation has been carried out on 610 hectares). This project component is expected to sequester approximately one million tCO_2e over the 30-year project lifespan.

The project is addressing both permanence and leakage in its design, using legal protected area status, community development activities (with alternative agricultural opportunities), credit buffers and discounts, and monitoring of adjacent areas/activities via satellite and surveys. The project is planning to undergo validation and verification under the Voluntary Carbon Standard (VCS) for the REDD component, VCS and Clean Development Mechanism for different portions of the AR component, and Climate, Community and Biodiversity Standard for both components.

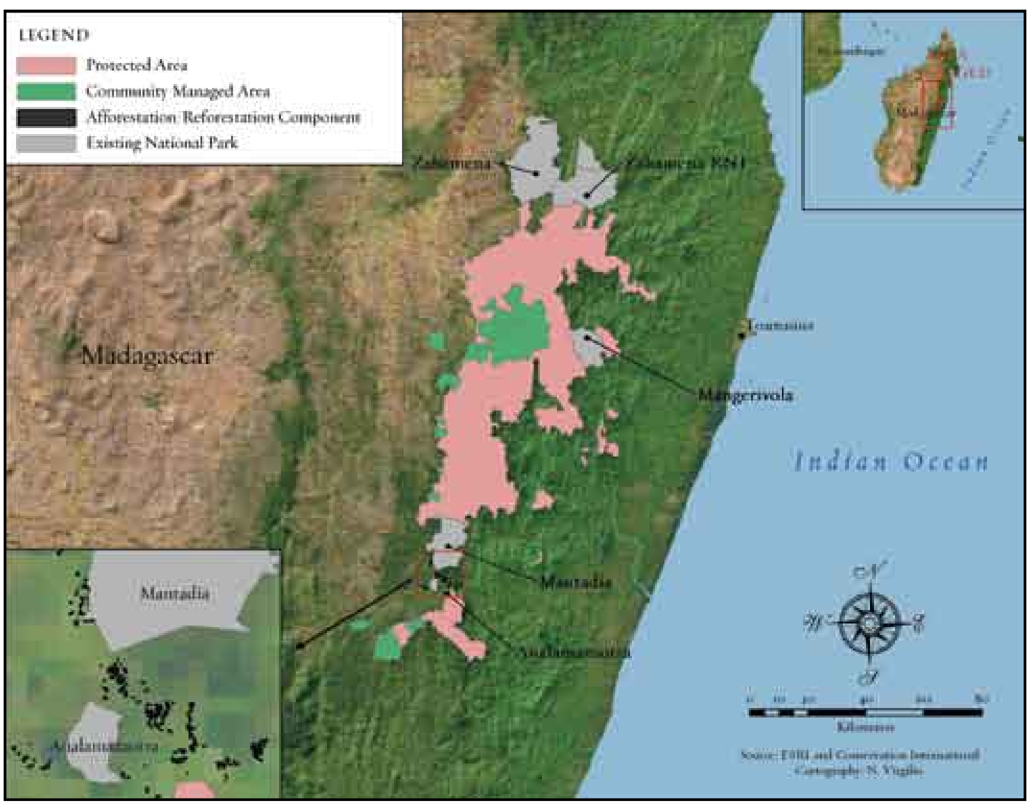
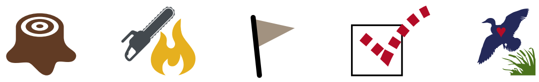


FIGURE 1 The Ankeniheny-Zahamena-Mantadia Biodiversity Conservation Corridor and Restoration Project. The Protected Area and Community Managed Area together make up the REDD component of the project.

The Makira Forest Protected Area



In 2001, the Madagascar Ministry of Environment, Forest and Tourism, in collaboration with the Wildlife Conservation Society, launched a program to create the 372,470-hectare Makira Forest Protected Area ("Makira project"). This action protected the largest remaining contiguous tract of low- and mid-altitude rainforest in eastern Madagascar—ecologically and biologically important because of the high biodiversity value and large numbers of plants and animals found nowhere else in the world.

The establishment of the Makira Forest Protected Area is based on an integrated approach to reduce human threats to the region's forests, while at the same time addressing the needs of the local communities and engaging these communities in the management of the protected area. The project combats the principal cause of deforestation in the area—slash-and-burn agriculture ("tavy"), driven by both subsistence and economic pressures—as well as threats from bush meat hunting, collection/exploitation of timber and non-timber forest products, burning of forest land for cattle grazing, illicit commercial exploitation of the forests' hardwood species, and illicit commercial mining of quartz and precious stones.

The project design involves three-part zoning of the Makira forests and surrounding areas *(Zone of Strict Protection, Multiple-Use Zones and Zone of Community Management)* and covers a total area of 697,827 hectares—which includes a 372,470-hectare protected area and a 325,357-hectare buffer zone of community managed land. Of the total area, 522,750 hectares are forested and eligible for carbon crediting. The project is expected to avoid the emission of an estimated 9.5 million metric tons of carbon dioxide equivalent over its 30-year lifetime. Permanence and leakage are being addressed in the project design through designation of legal protected area, community development focused on sustainable land management and legal property rights, the establishment of a project endowment, the use of credit buffers and discounts, and monitoring of adjacent areas/activities via satellite and surveys. The project is currently undergoing validation under the Voluntary Carbon Standard (VCS) and Climate, Community and Biodiversity Standard and also plans to verify carbon benefits through VCS.

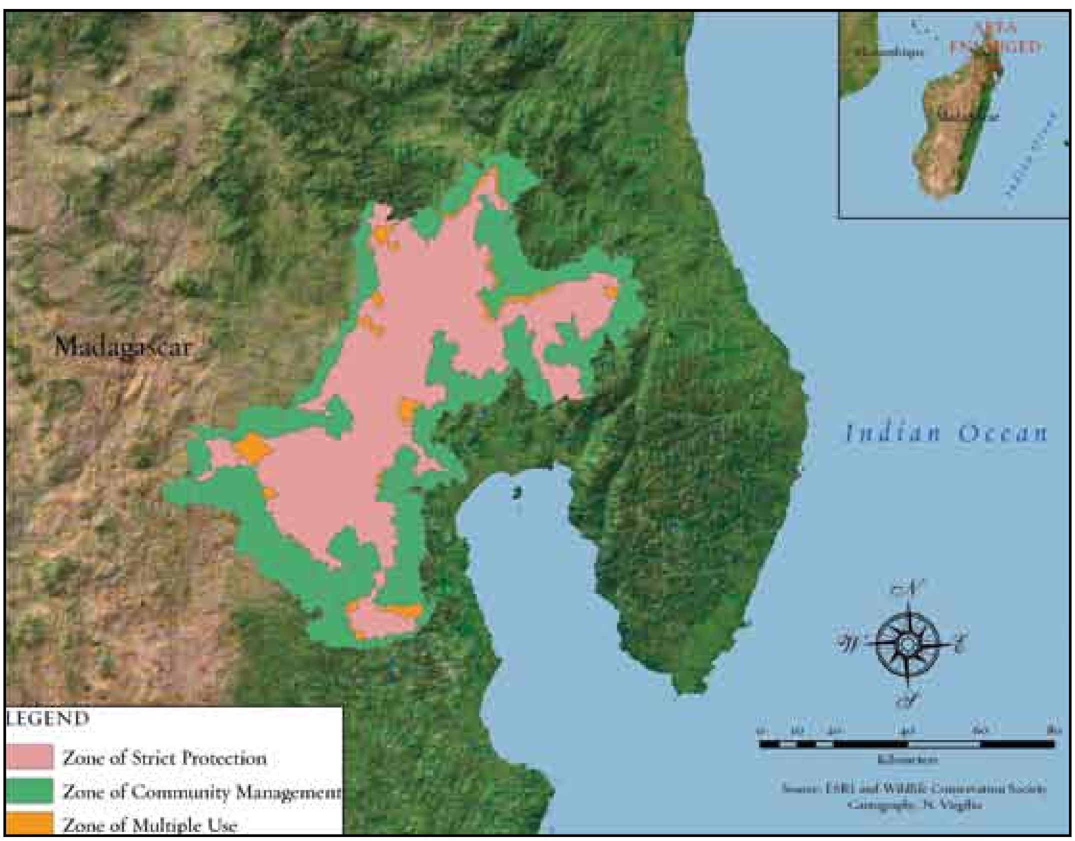


FIGURE 2 The Makira Forest Protected Area, Madagascar. The Zone of Strict Protection and Zone of Community Management together constitute the REDD project.

The Noel Kempff Mercado Climate Action Project

The Noel Kempff Mercado Climate Action Project (Noel Kempff project), located in Bolivia and implemented in 1996, is addressing emissions from both deforestation and forest degradation on 642,184 hectares of forested land.

To alleviate the threat of deforestation from local agricultural expansion, The Nature Conservancy and local NGO partner Fundación Amigos de la Naturaleza (FAN), engaged in a comprehensive 10-year community development program. The most important aspect of the program was assisting indigenous communities living adjacent to the Noel Kempff Mercado National Park to gain legal recognition as an indigenous organization and tenure over ancestral lands bordering the project area. As a result, pressures to deforest within project boundaries were reduced.

Project developers also worked with the government of Bolivia to cancel the rights to commercial harvest in the proposed project area, compensate the owners of area timber concessions for lost income and expand a pre-existing national park to encompass these former concessions, effectively stopping degradation from timber harvesting. A novel economic model of the national Bolivian timber market was used in the calculation of leakage due to these project activities and carbon benefits are discounted to reflect this analysis. Ongoing project monitoring is being conducted by FAN, funded by initial investments, and a permanent project endowment is in place to fund monitoring after the 30-year project crediting period is up.

Success of the Noel Kempff project thus far is demonstrated by the third-party verification of 1,034,107 metric tons of carbon dioxide equivalent (tCO_2e) through 2005.[6] It is estimated that over the course of the project lifetime, 5,838,813 tCO_2e will be avoided by project activities.

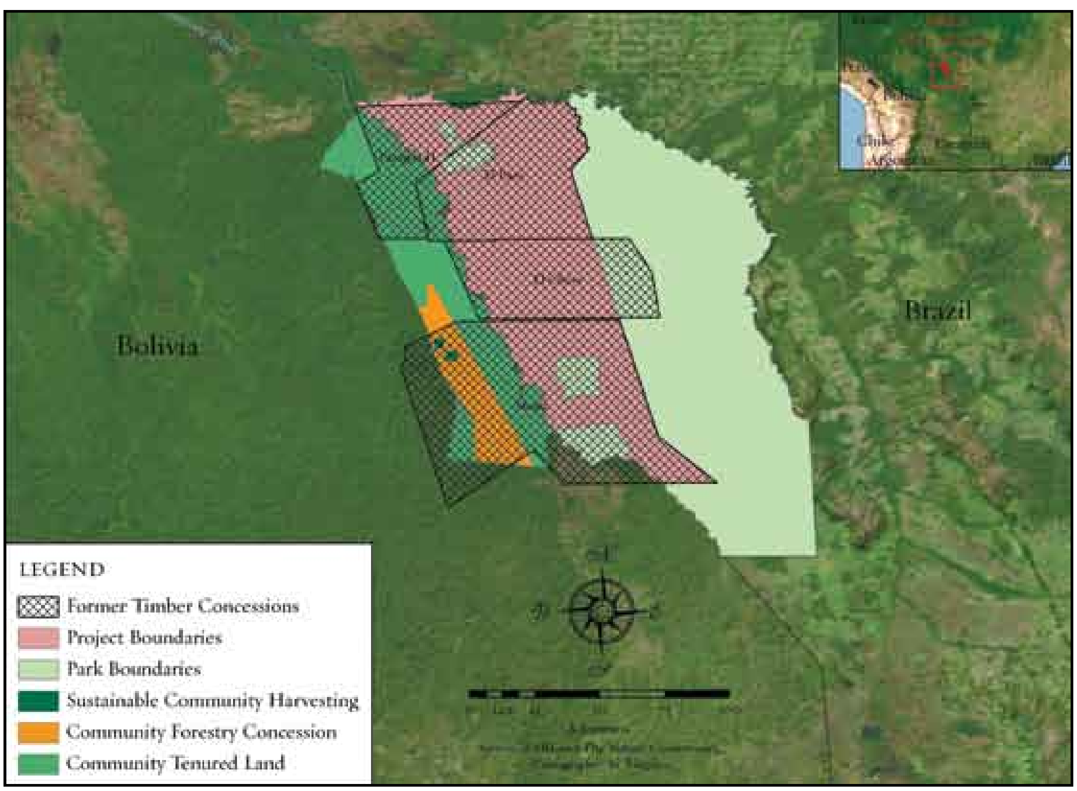


FIGURE 3 The Noel Kempff Mercado Climate Action Project.

6 Noel Kempff was developed prior to the existence of modern REDD standards and has been verified to a standard based on the Clean Development Mechanism's Afforestation/Reforestation guidance.

The Berau Forest Carbon Program

Large-scale forest carbon programs are needed to achieve the most significant climate change mitigation impacts, and one such program in development, the Berau Forest Carbon Program (Berau Program), is an example of the next step in project evolution. Berau, a district in remote northeastern Borneo that is heavily forested and well-endowed with wildlife, faces threats from commercial logging and rapid expansion of oil palm development, among many others.

In partnership with the local government, the Government of Indonesia and others, The Nature Conservancy is co-developing a groundbreaking forest carbon program that addresses the drivers of deforestation and forest degradation across this entire 2.2-million-hectare political jurisdiction using a multi-pronged approach. First, the program is working with logging concessionaires to implement Improved Forest Management (IFM) practices that reduce forest damage and carbon emissions while sustaining wood production and maintaining jobs. Second, the program will create a model for directing oil palm development away from healthy natural forest areas, and towards already degraded lands. Third, the program will work with local communities to strengthen management of new and existing protected areas so they do not lose carbon through illegal logging and clearing for agriculture.

These site-specific activities will be complemented with cross-cutting efforts to build the capacity and institutions to support sustainable land use planning, carbon accounting and community involvement programs that are well-integrated with existing government operations. Project partners will develop a unified, district-wide carbon accounting framework that will measure and monitor avoided emissions from all of the project components and plan to submit the methodology for approval by the Voluntary Carbon Standard. Leakage and impermanence avoidance measures are still in development but will be included in the program design. It is estimated that the program will avoid the emission of 10 million metric tons of carbon dioxide equivalent over five years.

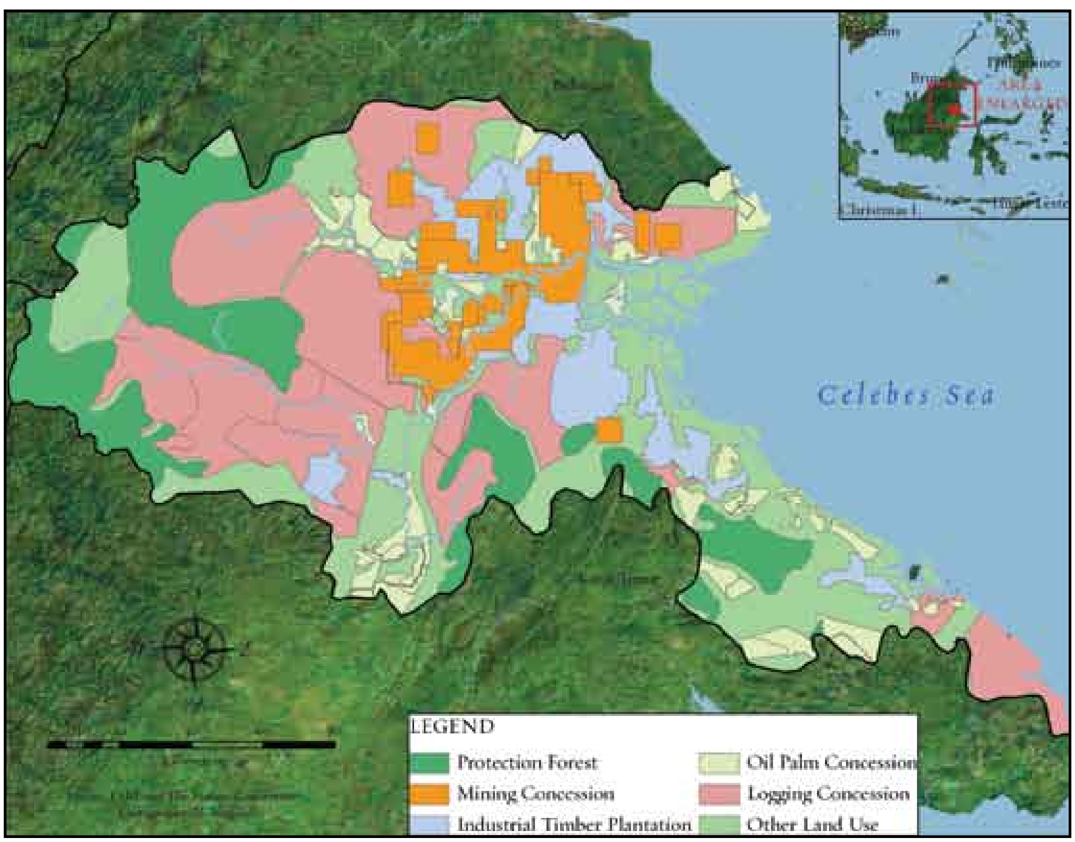


FIGURE 4 The Berau Forest Carbon Project in East Kalimantan on the island of Borneo, Indonesia.

REDD 101

The Science: Climate Change, Trees and Carbon

Climate Change Science

Strong scientific evidence shows that, since the industrial revolution, the burning of fossil fuels and the destruction of forests have caused the concentrations of heat-trapping greenhouse gases to increase significantly in our atmosphere, at a speed and magnitude much greater than natural fluctuations would dictate (IPCC, 2007c). If concentrations of greenhouse gases in the atmosphere continue to increase, the average temperature at the Earth's surface could grow from 1.8 to 4°C (3 to 7°F) above 2000 levels by the end of this century (IPCC, 2007c). Impacts of climate change, many of which are already being seen, include temperature increase, sea level rise, melting of glaciers and sea ice, increased coral bleaching, changes in the location of suitable habitat for plants and animals, more intense droughts, hurricanes and other extreme weather events, increased wildfire risk, and increased damage from floods and storms. The rural poor are often most at risk for being severely and negatively impacted by climate change, as their livelihoods are closely tied to ecosystems which provide water for drinking, wildlife for hunting and fishing, and medicinal plants (African Development Bank, 2003). Deforestation and degradation also have detrimental effects on soils, reducing the amount of carbon stored in soils over time, as well as increasing erosion and polluting rivers.

The Role Of Forests In The Carbon Cycle

Trees absorb carbon dioxide gas from the atmosphere during photosynthesis and, in the process of growing, transform the gas into the solid carbon that makes up their bark, wood, leaves and roots. When trees are cut down and burned or left to decompose, the solid carbon chemically changes back to carbon dioxide gas and returns to the atmosphere. Even if the trees are harvested, only a fraction of harvested trees makes it into long-term wood products such as houses and furniture. For example, one study estimates that for every tree harvested using conventional logging techniques in Amazonia, 35.8 additional trees were damaged (Gerwing, et al., 1996). As much as 20 percent of usable timber volume that was extracted from a typical hectare was never removed and instead left to rot in the forest. Furthermore, less than 35 percent of the timber that made it to the sawmill was actually converted into usable boards. Hence, the majority of the harvested forest vegetation ends up as waste and, whether burned or left to decay, emits carbon dioxide gas as it breaks down (see Figure 5).

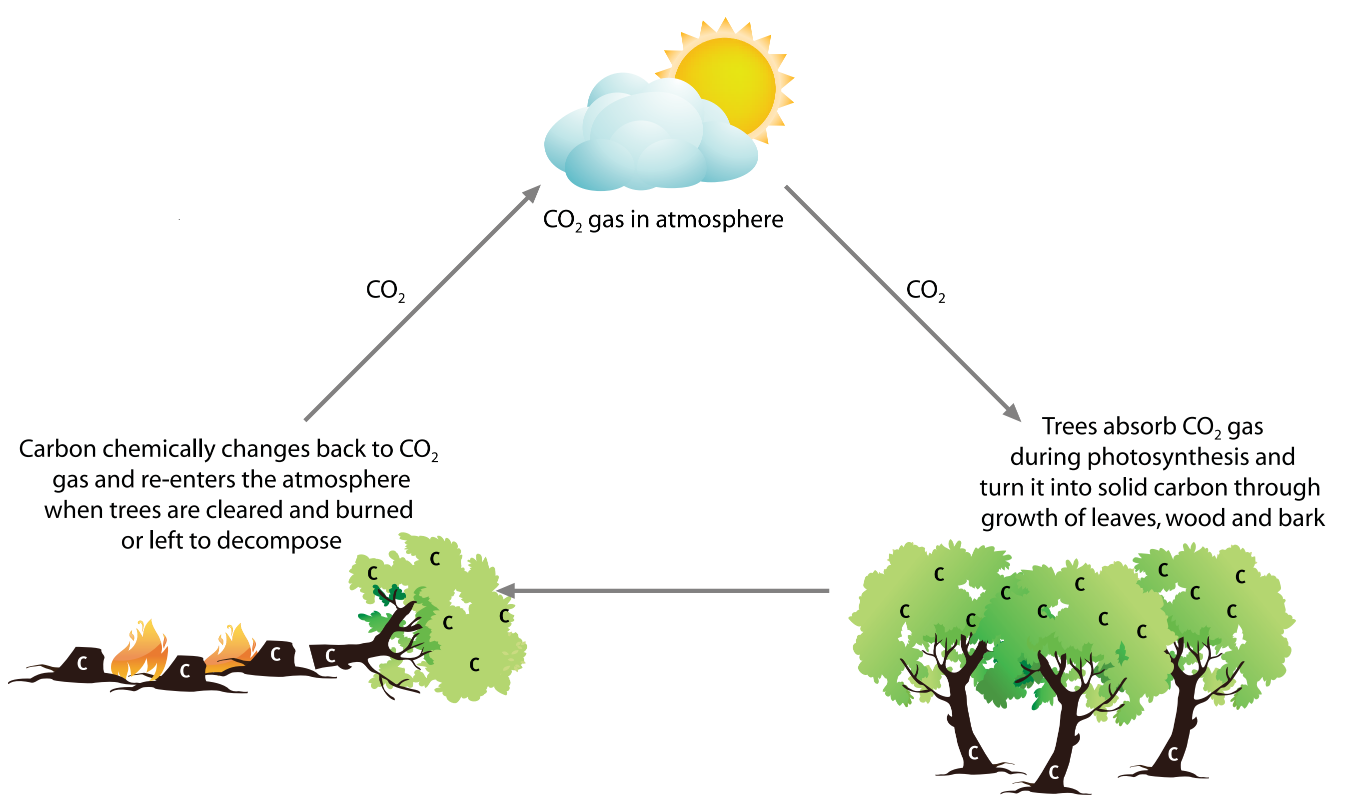


FIGURE 5 Simplistic diagram of trees and the carbon cycle.

Forests and other terrestrial systems annually absorb approximately 9.53 gigatons of carbon dioxide equivalent (GtCO2e),[7] while deforestation and degradation of forests emit approximately 5.87 GtCO2e, for net absorption of 3.67 GtCO2e (IPCC, 2007a). Forests therefore play an important role in the global carbon cycle as both a "sink" (absorbing carbon dioxide) and a "source" (emitting carbon dioxide). According to the most recent Intergovernmental Panel on Climate Change (IPCC) report, the 5.87 GtCO2e emitted by deforestation and degradation of forests accounts for 17.4 percent of total emissions from all sectors, more than the emissions of the entire global transportation sector (see Figure 6) (IPCC, 2007b). More recent estimates put this percentage at about 15 percent, due mainly to increases in fossil fuel emissions and the use of updated data (van der Werf, et al., 2009; Canadell, et al., 2007). Policy and economic incentives to curb deforestation and forest damage have the potential to enhance the natural functioning of the world's forests in sequestering, or storing, carbon and to reduce their role as a significant source of emissions.

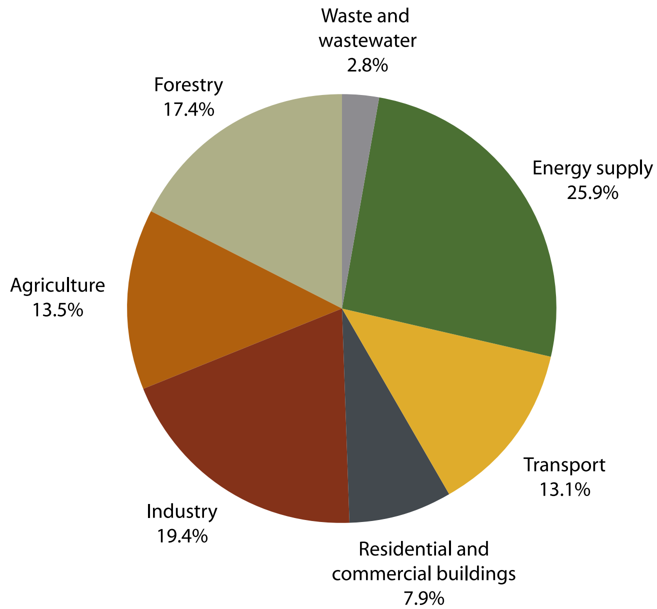


FIGURE 6 Attribution of global greenhouse gas emissions. Source: IPCC, 2007.[8]

Forest Degradation

While deforestation refers to the entire loss of patches of forest through clearing and conversion to other land uses (e.g., farming, ranching and development), forest degradation refers to the loss of biomass (living vegetation) in forests through timber harvest, fuel wood gathering, fire and other activities which do not result in complete conversion to other land uses. In its classification of "forest," the IPCC uses a minimum crown cover of 10-30 percent.[9] Thus, by this definition, up to 90 percent of a forest can be cleared before it is considered deforested. As such, forest degradation can lead to substantial carbon emissions, and is often an important precursor to deforestation. For example, roads created by logging operations open up previously untouched land to conversion by colonists. Also, openings in the forest canopy caused by forest degradation increase the risk of forest fire, which in turn increases the risk of conversion of land to pasture for grazing and ultimately conversion for agriculture (see Figure 7). It is estimated that degradation represents at least 20 percent of total tropical forest emissions (Griscom, et al., 2009).

The Policy and Financial Context

UNFCCC/Kyoto Protocol

The United Nations Framework Convention on Climate Change (UNFCCC) was created following the 1992 Earth Summit in Rio de Janeiro as a forum for governments to tackle the challenge posed by climate change.[10] The Kyoto Protocol, the first specific commitment to protect the shared resource of the climate system, was negotiated in 1997 and set binding targets for 37 industrialized countries and the European Community ("Annex I" countries) to reduce greenhouse gas emissions an average of five percent below 1990 emissions levels over the first five-year commitment period (2008 to 2012). All other countries, or "Non-Annex I" countries (mainly developing nations), are not currently bound to emission reduction targets. The United States did not ratify the Kyoto Protocol, and thus is not bound by these targets, however, the U.S. government has actively engaged in talks about a post-2012 agreement, when the first commitment period ends.

The Clean Development Mechanism (CDM) was created as a part of the Kyoto Protocol to help Annex I countries meet their emissions targets, and to encourage developing countries to contribute to emissions reduction efforts. The CDM allows emissions removal projects in developing countries to earn certified emissions reduction credits, which can be traded and sold, and used by industrialized countries to meet a part of their targets under the Kyoto Protocol. In the forest sector, the CDM only allows for emissions reductions through Afforestation/Reforestation (AR), excluding activities aimed at Reducing Emissions from Deforestation and Degradation (REDD) and Improved Forest Management (IFM). REDD and IFM activities were excluded largely because of skepticism over the credibility of carbon benefits they produce. The CDM rules governing AR activities are extremely complex and,

7 One gigaton (Gt) is equal to one billion tons.
8 Please note that this graphic is based on the 2007 IPCC Report, which estimates that emissions from forestry make up 17.4 percent of total annual emissions (IPCC, 2007b). Although more recent studies (van der Werf, et al., 2009; Canadell, et al., 2007) indicate that this percentage is now closer to 15 percent, calculations for the other sectors have not yet been updated.
9 First articulated in Decision 11 of COP 7; Land use, land-use change and forestry: <http://unfccc.int/resource/docs/cop7/13a01.pdf#page=54>
10 UNFCCC website November 4, 2009: <http://unfccc.int/essential_background/convention/items/2627.php>

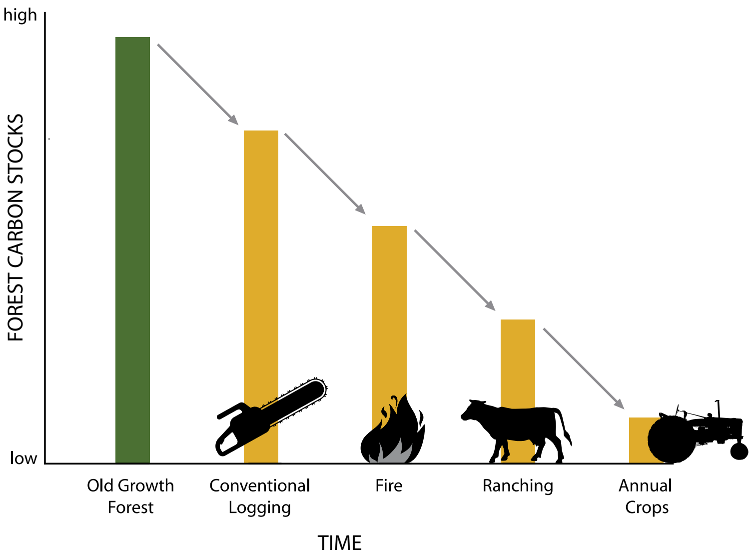


FIGURE 7 Illustrative interaction between degradation and processes leading to conversion. Source: Griscom, et al., 2009.

thus far, only 13 projects have been registered, representing 0.5 percent of all CDM projects.[11]

In 2005, The Coalition of Rainforest Nations, led by Papua New Guinea and Costa Rica, put forth a proposal to reconsider including REDD under the UNFCCC and subsequent protocols. Since then, the push for REDD inclusion has picked up momentum. The 2007 UNFCCC meeting in Bali resulted in the creation of the "Bali Roadmap," an agreement to negotiate a new post-2012 climate change protocol by the December 2009 UNFCCC meeting in Copenhagen. The Bali Roadmap opened a negotiation stream to include REDD in a post-2012 agreement, as well as mentioned the important role of Conservation, Sustainable Management of Forests and the Enhancement of Forest Carbon Stocks in developing countries. The idea of a post-2012 agreement that would include the abovementioned forest carbon mitigation strategies, both reducing emissions and enhancement of carbon stocks, dubbed "REDD Plus," has gained popularity amongst players in the international dialogue. Still others support the idea of a REDD (or REDD Plus) strategy that is incorporated into a larger overall Agriculture, Forestry and Other Land Use (AFOLU) framework.

Although the December 2009 meeting in Copenhagen did not ultimately result in a legally binding post-2012 climate treaty, headway was made in discussions on REDD Plus and the concept maintained general support. The resultant "Copenhagen Accord," a politically binding agreement engaged by 97 countries, includes a paragraph recognizing the crucial role of REDD Plus and agreeing on the need to mobilize financial resources from developed countries through the immediate establishment of a REDD Plus mechanism.[12] Subsequently, six nations (United States, United Kingdom, Norway, France, Japan, and Australia) pledged $3.5 billion to support immediate REDD Plus activity between 2010 and 2012.

U.S. Climate Change Policy

Although the United States' failure to ratify the Kyoto Protocol put a chill on developing federal climate change policy, many U.S. states and regions have taken policy actions to reduce emissions. In 2006, the landmark California Global Warming Solutions Act (AB32) established a comprehensive program of regulatory and market mechanisms to achieve real, quantifiable, cost-effective reductions of greenhouse gases. Likewise, 10 Northeastern and Mid-Atlantic states, which make up the Regional Greenhouse Gas Initiative (RGGI), have agreed to cap and then reduce CO_2 emissions from the power sector 10 percent by 2018. In 2008-2010, there was also significant momentum building in the U.S. Congress to develop national climate change policy, with the House of Representatives passing the first-ever comprehensive climate change bill in June 2009.[13] Passage of a climate bill through both chambers of Congress would represent a landmark achievement for both domestic and international climate change mitigation efforts, as the United States contributes one quarter of global greenhouse gas emissions annually and has the potential to play an important leadership role in international negotiations.

Despite a limited role for forests in existing international climate frameworks, proposed U.S. climate policies have tended to be more favorable towards including incentives for protecting forests. In part, this is because the private sector is interested in forest carbon offsets as a cost-effective vehicle for reducing greenhouse gas emissions. The EPA has estimated that international offsets would lower the cost of U.S. climate legislation by 89 percent, with the majority of such offsets expected to come from forests (EPA, 2009). In fact, many U.S. corporations are adopting sustainability programs to proactively reduce their carbon footprints in anticipation of climate regulations and these efforts have spurred voluntary investments in forest carbon programs.

Cap and Trade

A cap and trade system is a market-based mechanism in which a regulating body establishes an upper limit—or "cap"—on the amount of carbon dioxide that may be emitted by covered (regulated) entities, such as power companies and manufacturers. The regulator then issues a number of "allowances" equal to the cap, and distributes these allowances to regulated entities through auction, direct allocation, or a combination of both. The

11 CDM website March 30, 2010: <http://cdm.unfccc.int/Projects/projsearch.html>
12 Copenhagen Accord: <http://unfccc.int/files/meetings/cop_15/application/pdf/cop15_cph_auv.pdf>
13 HR2454: American Clean Energy and Security (ACES) Act.

A. In Annex 1 countries, an administrator will set a cap on emissions for covered entities.

B. The administrator may give some emissions allowances to covered entities for free.

C. The administrator will auction off the rest of the emissions allowances to covered entities.

D. Companies who can make reductions at a low cost will sell extra allowances to companies who can only make reductions at higher cost.

E. f countries can protect their standing forests and reduce the rate of deforestation, they can sell emission reduction credits to covered entities in Annex 1.

F. Covered entities must turn in allowances and offset credits equal to their emissions

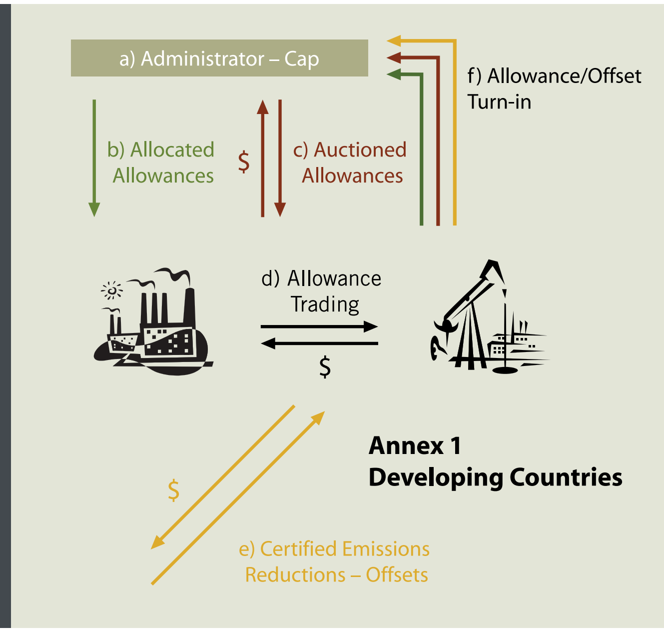


FIGURE 8 Simplistic cap and trade diagram.

regulated entities—or "sources"—must report on each unit of emissions they produce and submit enough allowances to cover these emissions at the end of each compliance period. Sources that do not have enough allowances to cover their projected emissions can either reduce their emissions, buy allowances on the market from sources with excess allowances, or, if permitted, generate or buy credits from emissions offset projects (see Figure 8). "Offsets" are emission reduction credits that are generated through activities in sectors not regulated under the cap. If the forest sector is not covered by the cap, this creates the opportunity for activities that reduce emissions from or sequester carbon in forests (so called "forest carbon projects") to play an important role in climate change mitigation. The Kyoto Protocol, European Union Emissions Trading System (EU ETS) and most climate change bills proposed in the United States to date all contain "cap and trade" elements.

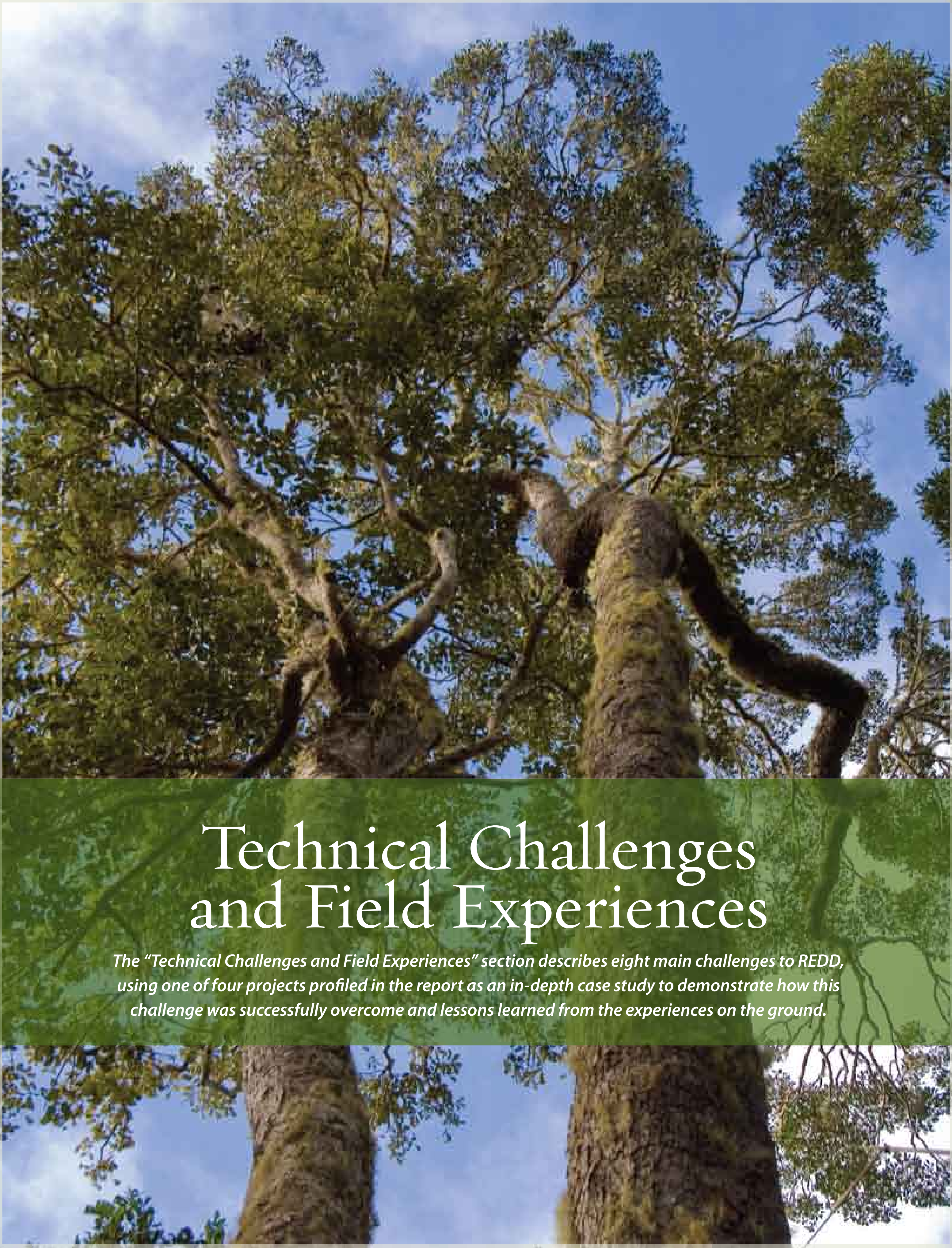
Carbon Markets

There are various financial mechanisms which could fund REDD activities, both public and private, ranging from upfront grants or other payments for forest conservation, to ex-post[14] purchase of carbon credits from REDD activities within a "carbon market." Various carbon markets—some regulatory (e.g., CDM, EU ETS, New South Wales and RGGI) and others voluntary (e.g., Chicago Climate Exchange and the OTC market)—have developed to facilitate the trading of emissions allowances or credits for emissions reductions. Currently, only voluntary markets allow offsets from all three types of forest carbon activities (REDD, IFM and AR). A recent Ecosystem Marketplace report, entitled "State of the Forest Carbon Market," estimates that 20.8 million tCO_2e have been transacted by 226 forest carbon projects over the past 20 years, resulting in $149.2 million in carbon finance (Hamilton, et al., 2010). Many of the challenges associated with measuring, monitoring and accounting for emissions reductions from forest carbon activities can be addressed with approaches that have been applied to projects developed for voluntary markets. Official registries for these reductions assure that such credits are unique and traceable. Some compliance markets, such as the CDM and RGGI, allow for AR activities, but others, such as the EU ETS, exclude forest carbon entirely. Not all countries support the use of markets to fund emissions reductions from the forest sector and instead prefer the use of public funding.

© Julie Larsen Maher/WCS

14 Occurring after credits have been produced and verified.

 RIGHT: © Sterling Zumbrunn/CI



Technical Challenges and Field Experiences

The "Technical Challenges and Field Experiences" section describes eight main challenges to REDD, using one of four projects profiled in the report as an in-depth case study to demonstrate how this challenge was successfully overcome and lessons learned from the experiences on the ground.

SECTION 1

Baselines and Additionality

© Russell A. Mittermeier/CI

A "baseline," also referred to as the "business-as-usual scenario," is defined as the level of carbon dioxide emissions and carbon sequestration that would have occurred in the absence of the forest carbon project, and is required in order to calculate carbon benefits. Baselines are generally described as falling under one of two categories: historical or projected. In the simplest sense, historical baselines take an average of emissions data from a previous time period (e.g. the most recent 10 years) and, using spatial modeling in the calculation, determine the business-as-usual emissions level for the next several years (until it is reassessed using more current historical data). Projected baselines, on the other hand, might employ historical emissions data, expected changes in critical factors such as population growth or infrastructure development, and spatial modeling of future land use change to determine baselines (see Figure 9). In contrast to historical baselines, which stay steady over time, projected baselines might suddenly increase to account for future expected land use change due to phenomena such as frontier deforestation.[15]

It is also typical (and required by most accepted standards) for REDD projects that contain IFM and/or AR components to have separate baselines for each component, due to the need for different methodologies[16] to be used for carbon accounting. As mentioned, REDD baselines can be estimated using historical and/or projected data. A project with an IFM component might employ the average carbon stocks over the business-as-usual harvest cycle as the baseline for this aspect, while a project that includes AR activities many times simply uses the carbon stocks of the pre-project land use (assuming they wouldn't change in the future in the absence of the reforestation project).

Since baselines are essentially predictions of a future state, it is generally considered best practice to revisit them over defined intervals or performance periods in order to adjust for any changes in situation, government, socio-economic forces, etc. that occur over time, helping to ensure accuracy as projects proceed (see Figure 10).

"Carbon benefits"—the additional emissions prevented by REDD activities (or sequestered by AR or IFM activities)—are determined by comparing the with-project forest carbon stocks with business-as-usual stocks (see Figure 11), after making appropriate deductions for leakage and/or impermanence buffers (see sections entitled "Leakage" and "Permanence"). Differences between the with-project and baseline forest

15 "Frontier Deforestation" is that which is predicted to occur at some point during a project crediting period in an area with historically low deforestation rates but the potential for future incursion, settlement and/or infrastructure development (VCS, 2008b).

16 A "methodology" is a detailed approach to determining a project baseline, greenhouse gas sources and sinks, specific additionality tests and planned monitoring processes under a standard specific to the particular project type and circumstance (See "Standards and Verification" section for more info).

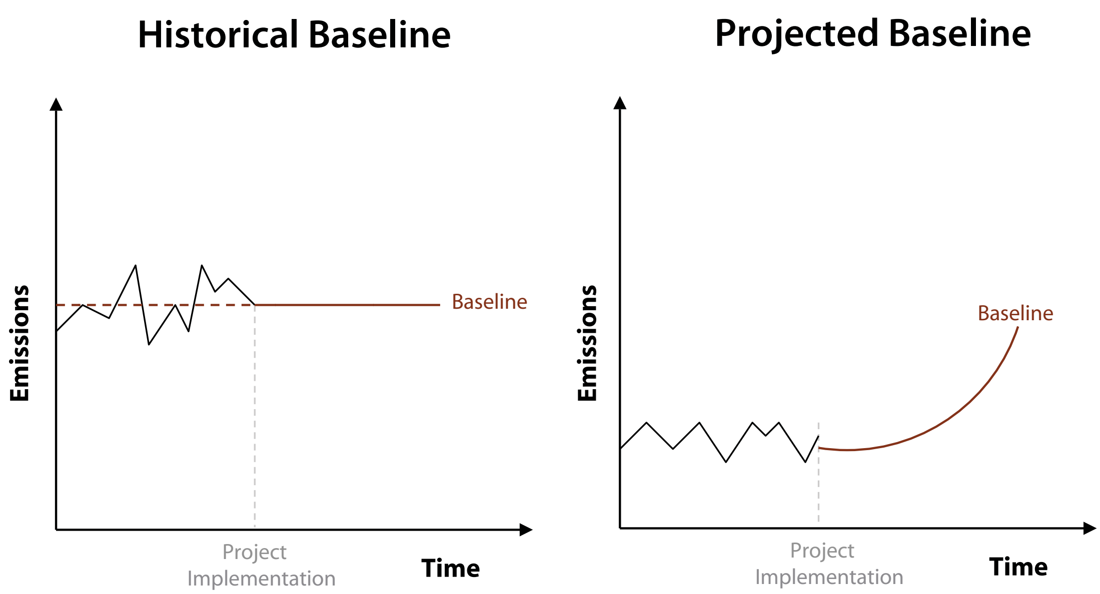
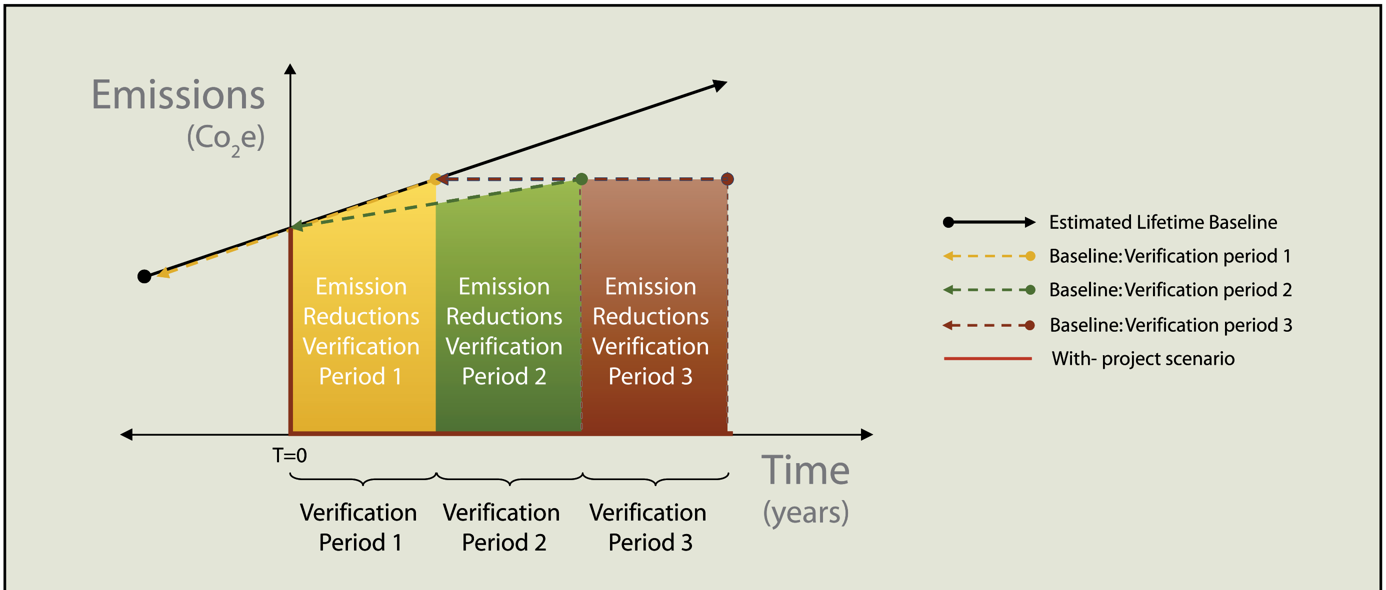


FIGURE 9 Simple graphic of Historical vs. Projected Baselines.



Estimated Lifetime Carbon Benefits vs. Verified Carbon Benefits

It is important to distinguish between estimated lifetime carbon benefits, which are initially calculated at the beginning of the project and are apt to change if the baseline is adjusted in the future, and verified carbon benefits, which are confirmed by an independent third-party after each verification period as the project goes along and remain static. Eventually, when the project has reached the end of its crediting period, a final static verified lifetime carbon benefits number can be calculated.

When carbon benefits are monitored as a part of the verification process (usually every five years), the baseline is updated, based on data from the previous performance period, to accurately reflect recent trends. This results in a dynamic baseline (see Figure 10). Unlike estimated carbon benefits, verified benefits, based on these backward-looking observations, will not change regardless of any adjustments made to the baseline(s) for future periods, as they were based on the current circumstances at that time. Thus, even if the baseline is adjusted in subsequent verification periods, previously verified benefits will remain both accurate and credible.

FIGURE 10 General illustration of possible adjustments made to a project baseline vs. verified carbon benefits.

© Olaf Zerbock/CI

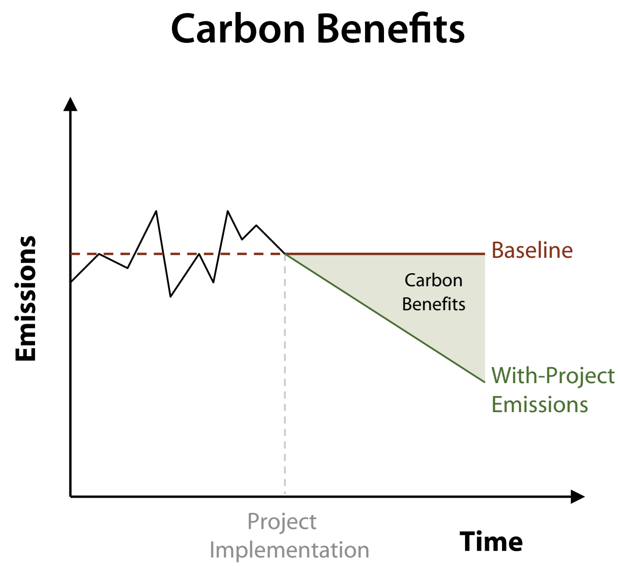


FIGURE 11 Simple graph depicting carbon benefits resulting from REDD project actions using an historical baseline.

carbon stocks are converted into carbon dioxide equivalent and referred to as "avoided carbon dioxide emissions."

"Additionality" refers to whether carbon dioxide captured, stored or prevented from reaching the atmosphere as a result of project activities is above and beyond what would have happened under business-as-usual (baseline) practices. All climate mitigation projects must demonstrate additionality in order to prove that claimed carbon benefits are real and would not have been achieved without project interventions. Since additionality involves assessing what would have (but did not) happen, it cannot be measured exactly. Through various systems, such as the Kyoto Protocol's Clean Development Mechanism (CDM) and the Voluntary Carbon Standard (VCS), tests have been developed to determine whether project activities are likely additional to what would have occurred under business-as-usual practices (see Figure 12). Specifically, as per the CDM AR Additionality Tool, projects must demonstrate that they could not be implemented in the absence of CDM registration because of one or more of seven implementation barriers (CDM, EB 35 annex 17).[17] VCS offers an option of choosing between three tests: 1) The Project Test,[18] 2) The Performance Test,[19] or 3) The Technology Test[20] (VCS, 2008a).

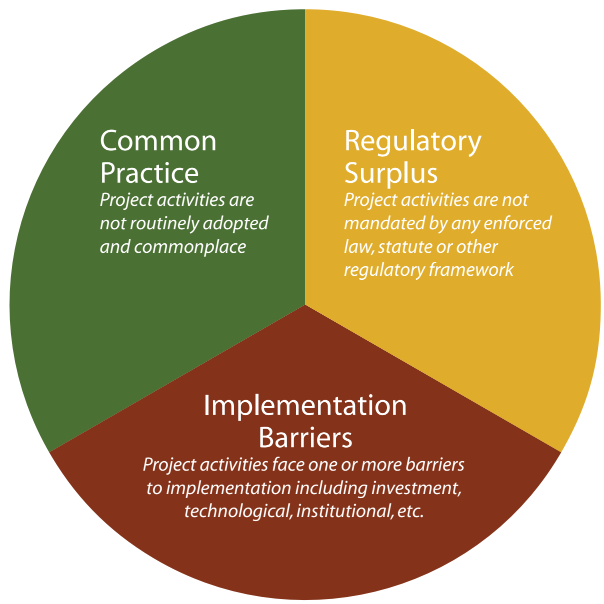


FIGURE 12 The building blocks of additionality: An answer of "yes" to all three categories can help demonstrate additionality.

17 These barriers include: 1) investment barrier, 2) institutional barrier, 3) technological barrier, 4) local tradition barrier, 5) common practice barrier, 6) ecological condition barrier, and/or 7) social condition barrier.

18 Includes Regulatory Surplus (the project is not mandated by any enforced law, statute or other regulatory framework), Common Practice (the project is not common practice in the sector/region) and Implementation Barriers (the project faces barriers of at least one of the following types: Investment Barrier, Technological Barrier and/or Institutional Barrier).

19 Includes Regulatory Surplus and Performance Standard (emissions generated by the project are below an approved baseline).

20 Includes Regulatory Surplus and Technology Additionality.

CASE STUDY

Ankeniheny–Zahamena–Mantadia Biodiversity Conservation Corridor and Restoration Project

Additionality

Developers of the Mantadia project used tests similar to those discussed in the previous section to demonstrate that the carbon benefits resulting from project activities would be additional to those expected in the absence of the project.

Forest conservation was clearly not common practice in the area where the Mantadia project was carried out. Traditionally, lands in and around the project area were cleared for tavy agriculture—an activity that was expanding yearly, as demonstrated by the high annual deforestation rate of 0.63 percent over the period 1990-2005 (calculated by comparing the extent of forest cover detected in Landsat images taken in 1990, 2000, and 2005). The voluntary planting of trees was also not considered common practice (with the exception of *Eucalyptus* plantations to make charcoal). Native species reforestation was previously non-existent in Madagascar and the project has expended significant effort in creating a new body of knowledge on native species propagation in cooperation with the University of Antananarivo.

From a financial perspective the project could not have been expected to occur in the absence of significant up-front funding. Restoration of forest with native species is extremely expensive and the government of Madagascar indicated that they did not have funding to create and restore the protected area without the project. Instead, the project activities were initiated using funding from CI, USAID, World Bank,[21] and others. This funding has been secured through an innovative financing structure combining philanthropic contributions, international development assistance and carbon revenues. Most of the plans for financing of the project are based on assumptions of future carbon revenue, and even then, carbon finance is expected to cover only a percentage of total project costs.

The creation of a new multiple-use protected area located in the corridor between the pre-existing parks of Mantadia and Zahamena was conceived under the government of Madagascar's Durban Vision, in which the system of protected areas was to be significantly expanded. However, historically, deforestation typically still occurred within protected areas due to a lack of capacity for enforcement. Hence, the success of this expansion was predicated on the availability of new sources of revenue to increase government capacity to enforce protection, monitoring and alternative livelihoods, especially through the use of carbon financing. So while the government was committed to creating new protected areas, these protected areas would not have been likely to succeed or would not have come to fruition due to the lack of government capacity and financial resources to appropriately design and implement them.

© Olaf Zerbock/CI

Baselines

Since there are two separate components to the Mantadia project (REDD and AR), project developers are using two separate methodologies for calculating baselines and expected project carbon benefits. Developers of a new project can use a methodology written and approved for another project; however, if one does not exist that applies to the project type and conditions, project developers must develop their own (subject to third-party approval).

21 The Mantadia project is part of the second Tranche of the BioCarbon Fund operationalized in March 2007.

REDD Component

The REDD component of the Mantadia project is using a new methodology designed to be compliant with the Voluntary Carbon Standard's (VCS) Agriculture, Forestry and Other Land Uses (AFOLU) guidance. Since the AFOLU guidance was first released in November 2008, four years after the Mantadia Project began, there weren't any approved REDD methodologies at the time of the project start and project proponents had to submit their own methodology to the standards committee for approval. Thus in 2008, the BioCarbon Fund of the World Bank (BioCF) commissioned an expert consultant to create such a methodology (called "*The Methodology for Estimating Reductions of GHG Emissions from Mosaic Deforestation*"),[22] that could be applied to the project, and potentially other REDD projects in its portfolio. The methodology was specifically designed with the Mantadia project in mind, as 'mosaic' deforestation land-use patterns are found in the area of eastern Madagascar surrounding the Mantadia project.

The BioCF methodology combines two basic components to predict future emissions from deforestation in the business-as-usual (baseline) case: 1) quantitative assumptions of the *future rates of deforestation* (based on historical rates of deforestation in and around the project area and assumed future changes in underlying drivers of deforestation such as infrastructure development, agriculture expansion, market factors, etc.) and 2) a spatial land use change model to create a *prediction of where that deforestation will occur* based on the relationship between past deforestation and certain variables that represent significant drivers (e.g. distance to roads, terrain slope, distance to markets, etc.). Being able to predict where future deforestation will occur is important because different classes of existing forest contain different quantities of carbon likely to be lost if deforested. Field sampling conducted by Winrock International in 2004, as well as further sampling conducted by CI in 2008, provided data on carbon stocks in the project area (66 sampling plots in the REDD component). By combining this information, the baseline scenario was constructed to predict the amount of GHG emissions likely to occur in the absence of the project. The Mosaic Deforestation Methodology described estimates only the baseline emissions from deforestation (degradation is not included) and currently only considers emissions from the loss of above- and below-ground biomass due to deforestation (RED) (carbon pools explained in detail in "Measuring and Monitoring" section).

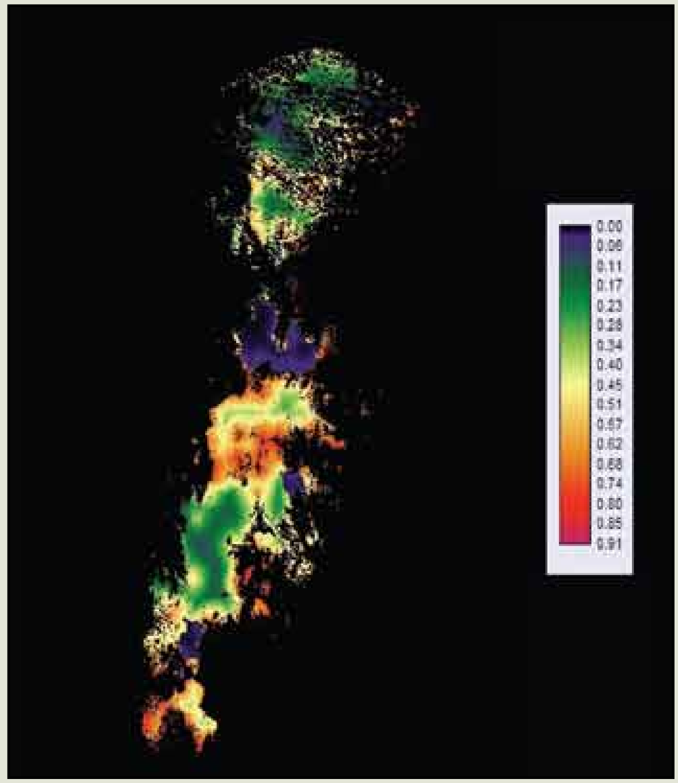


FIGURE 13 Modeled deforestation risk and location in the project area by 2035. Blue indicates low deforestation risk and Red indicates high deforestation risk. Source: CI, Madagascar.

The spatial model used for the REDD component of Mantadia is the Clark Laboratories' Land Change Modeler (2008) based on the IDRISI software, originally developed for use by Conservation International. Spatially explicit forest cover and deforestation driver information was used from three points in time (1990, 2000, and 2005). Once the model of expected future deforestation was created using deforestation and driver relationships from 1990 to 2000, the prediction strength of the model was tested by forecasting the forest cover in 2005 and comparing the result with the 2005 real forest cover derived from satellite image processing. This allowed the model to be calibrated until the *predicted* result closely matched *actual* forest cover in 2005. The resulting model was then run forward from the present time in order to predict the location of future forest cover changes inside the project area out to 2035 (the baseline case) based on the historic rate of deforestation (see Figure 13).

22 "Mosaic Deforestation" is defined by the VCS as occurring where population pressure and local land use practices produce a patchwork of cleared lands; where forests are accessible; and where the agents of deforestation and degradation typically are present within the region containing the area to be protected (VCS, 2008b).

The project will periodically re-evaluate the baseline from the REDD project component based on new data related to the rates and drivers of deforestation in the project and reference areas.[23] As per VCS rules, a re-assessment of the baseline will occur at least once every 10 years.

AR Component

The reforestation component of the project is using a baseline and monitoring methodology approved under the Kyoto Protocol's Clean Development Mechanism (CDM), entitled "Reforestation or Afforestation of land currently under agricultural use (AR-AM0004)."[24] Essentially, the CDM methodology is applicable to conditions where the agricultural or grazing activity taking place is expected to continue into the future in the absence of the project and where the carbon stocks on that land are expected to remain low if the area is not restored to forest. The methodology is conservative, taking into account only the increase in above- and below-ground biomass in its calculations of emissions reductions, ignoring the likely gains in soil carbon and other carbon pools. Carbon stock measurements were taken in 2004 and 2008, with a total of 57 sampling plots. Trees planted through the project, and the associated carbon gains, will be monitored at least every five years via on-the-ground plots, which would identify and account for any unexpected changes or loss (e.g. fire, insects, etc.) of accumulated carbon stocks. The baseline will not be monitored, as the methodology does not require it; the project will use a baseline "frozen" at the time of validation.

LESSONS learned AND takeaways

The technology and methodologies currently exist to create credible, verifiable project baselines.

- The baseline for the Mantadia project employs satellite imagery, field measurements and sophisticated modeling, which helps encompass differences across various ecological landscapes and drivers/patterns of land use change. The baseline methodologies are being developed in consultation with forest carbon experts, cross-checked, made available for public comment and verified by independent third parties through a double approval process. The robust methods used in the development of the project baseline will serve as a model for future projects with mosaic deforestation patterns.

Project baseline methodologies should be based on empirical evidence and models.

- The estimation of Mantadia carbon stocks, based on 66 biomass inventory plots located in the project area, is an integral component of the project baseline. Other empirical, measurable data including deforestation rates, drivers of deforestation, time series satellite imagery and testable land use change models will enable the specific calculation of the project baseline, of which the accuracy can be explicitly determined. Such methodologies include precise scientific calculations for use in project carbon accounting, ensuring credibility and verifiability.

The most accurate project baselines are cross-checked with recent historical data and adjusted over time if necessary.

- Forest carbon projects generally include an estimate of lifetime carbon benefits, both for feasibility analysis and garnering investor interest. These estimates are derived from analysis of past land cover, regional land cover change and drivers, and the baseline is projected into the future, sometimes 20, 30, or even 50 years. There are inherent risks with predicting a baseline this far into the future. Given that underlying drivers of deforestation, such as socioeconomic factors and government policies may change, it is a best practice to cross-check the baseline periodically as a project progresses (VCS requires reassessment of the baseline at least every 10 years for REDD projects) (VCS, 2008), and to adjust the baseline if necessary to capture any changes that might affect the baseline moving forward. Indeed, the Mantadia project baseline will be re-evaluated every 10 years as required by VCS.

23 A "reference area" is a larger area with similar conditions, agents and drivers used for comparison over time.
24 AR-AM0004: <http://cdm.unfccc.int/UserManagement/FileStorage/KYBDLQFMI6R20X58OGH3Z71N9TSU4A>

SECTION 2

Measuring and Monitoring

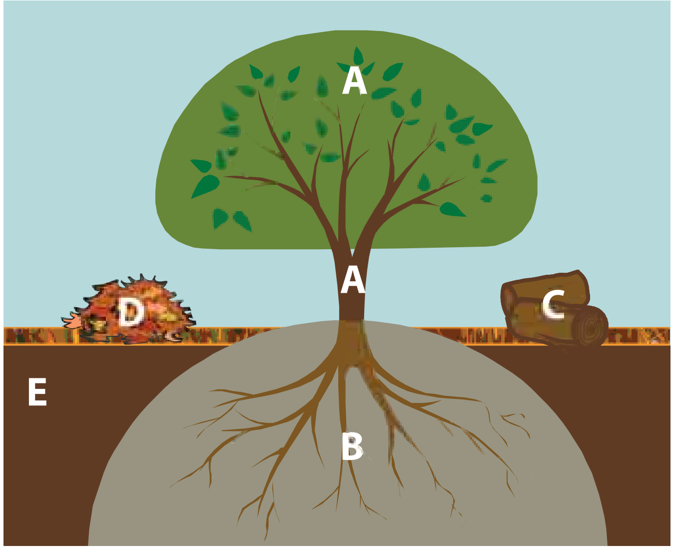
© Bridget Besaw

Measuring and monitoring are the processes by which the amount of carbon stored in forests ("carbon stocks"), as well as changes in these amounts, are calculated and tracked, using both satellite technology and field measurements (complimented by laboratory testing). Measuring and monitoring fall under the larger category of "carbon accounting," which refers to the calculation of carbon benefits over time as a result of forest carbon activities. Carbon stocks are not isolated to the trees themselves, but instead are made up of several "carbon pools", as shown in Figure 14. Soil and above-ground live biomass generally constitute the largest carbon pools (FAO, 2005).

While measuring and monitoring are perceived by some as a challenge to producing real, verifiable carbon credits, the methods used are time-tested and steeped in rigorous scientific theory. The basic steps involved in carbon accounting for REDD activities are illustrated in Figure 15.

Carbon Stocks

Delineating forest type and area is generally accomplished using satellite imagery, cross-checked with on-the-ground observations. The types of forest present at a REDD project site, as well as the extent of these forest types, are very important for carbon calculations, as different forest types have different associated carbon density. For example, a typical redwood forest in the western United States might contain 397 tC/ha, as



A. Above-ground Live Biomass (trunk, branches, leaves)
B. Below-ground Live Biomass (roots)
C. Dead Wood (stumps, broken off branches, fallen trunks)
D. Litter (dead leaves and vegetation)
E. Soil (typically up to 30 cm depth)

FIGURE 14 Five carbon pools make up the carbon stocks of a forest (not drawn to scale).

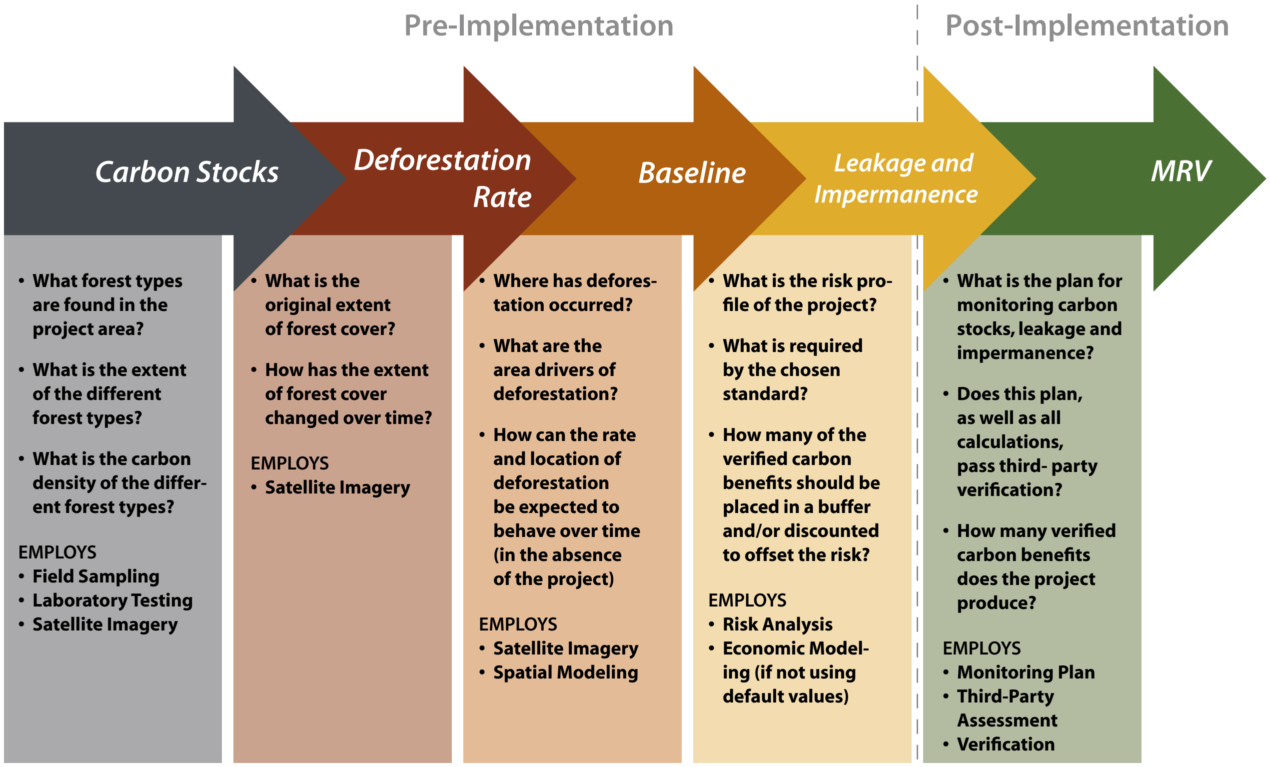


FIGURE 15 General steps involved in carbon accounting for REDD activities at the project scale. "MRV" in the diagram stands for "Monitoring, Reporting and Verification."

compared to the typical aspen/birch forest, which might contain 161 tC/ha.[25]

The density of carbon stocks associated with different forest types is determined with field surveys. On-the-ground field methods are used for determining carbon density, which have been employed for many years and have long been accepted as scientifically credible. Since measuring every single tree inside the project area would be cost prohibitive and highly inefficient, sampling methods are required. Methods entail designing a statistically rigorous sampling scheme to collect data on carbon pools in representative sections of the forest, and extrapolating that information for the entire project area. Such extrapolations are standard practice in ecological surveying and the accuracy level of the results can be specifically calculated. Desirable accuracy is usually within 10 percent of the sample mean.

Common sampling methods include measuring the height and diameter at breast height ("dbh") of live trees to determine above-ground biomass, and collecting soil, leaf litter and dead wood to be analyzed for carbon content in the lab with precise instruments. Below-ground biomass is usually calculated through scientifically accepted equations (Cairns, et al., 1997). Field measurements, when used in combination with satellite imagery to track land cover change over time, allow for the calculation of carbon stock changes.

Deforestation Rate

The annual rate of deforestation in a REDD project area is typically obtained using satellite images from several points in time, which allows scientists to track changes in land use and forest cover during that period. Landsat satellites have been collecting data on land cover since 1972, with an ability to zoom into areas as small as 60 meters from 1972-1982 and 30 meters since 1982.[26] This historical Landsat satellite data is available, for free, from the United States Geological Survey (USGS).

Significant advances have been made in interpreting satellite data and using it to precisely measure deforestation rates by comparing change in satellite photos taken over time on a pixel by pixel basis (see Figure 16).[27] Other advances in the interpretation of Landsat satellite data now allow for the detection of degradation from logging and fire (Asner, et al., 2005; Roy, et al., 2008). Lidar[28] and radar technology may be used to reduce the need for on-the-ground field measurements in carbon stock calculation and can help overcome the challenge posed

25 Derived from tables provided on page 68 of: U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2005. Global Change Program Office, Office of the Chief Economist, U.S. Department of Agriculture. Technical Bulletin No. 1921. 161 pp. August, 2008. <http://www.usda.gov/oce/global_change/AFGGInventory1990_2005.htm>
26 USGS Website: <https://landsat.usgs.gov/about_mission_history.php>
27 Landsat data is made up of many square "pixels" (similar to those on a TV or computer screen), which represent areas 30 meters by 30 meters in length.
28 An optical remote sensing technology that measures properties of scattered light to find range and/or other information of a distant target.

by clouds, which can hide the landscape in satellite photos. With time, these latter options are expected to become more economical and easier to use at large scales.

Baseline

Using information on area, density and rate, it is then possible to calculate the project baseline; the business-as-usual emissions scenario (baselines are explained in detail in the "Baselines and Additionality" section). Methods of calculation vary depending on the form deforestation takes (e.g. mosaic vs. frontier)[29] and associated drivers; however, several standards such as the Voluntary Carbon Standard (VCS) and Climate Action Registry (CAR) provide detailed guidance on developing baselines. Calculation of the baseline emissions scenario for REDD projects might involve running spatial land use change models (and forest growth models if the project has an IFM component). Along with the baseline emissions scenario, it is also necessary to estimate the with-project emission scenario, since the difference between the two yields the carbon benefits from project activities. Usually, the assumed deforestation rate in this scenario would be quite low, with the assumption that project interventions succeeded in slowing or stopping deforestation in the project area, and is sometimes taken from a comparable established protected area nearby.

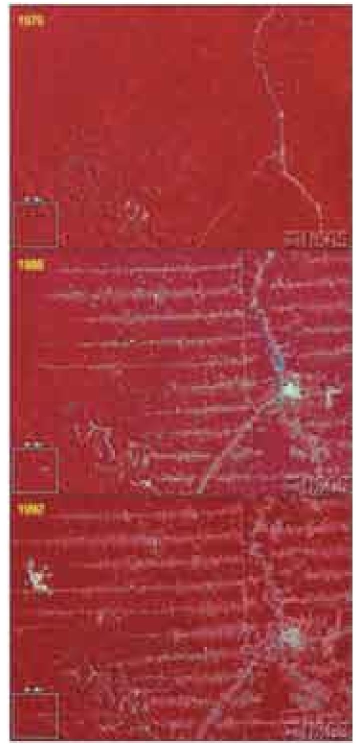


FIGURE 16 False-color Landsat images of Rondônia, Brazil. Notice how the typical fishbone pattern of deforestation grows with time. Images like these allow scientists to determine deforestation rates. Source: USGS (Campbell, 1997).

Leakage and Impermanence

Although many REDD project developers would agree that the most effective strategies target leakage and impermanence from project conception by incorporating preventative measures into the design (such as education, community outreach, and alternative livelihoods programs), the two challenges are sometimes impossible to completely avoid. As such, it is becoming increasingly common practice to use buffers and discounts in carbon accounting, which provide insurance that any unexpected loss of carbon can be covered (these topics are covered in depth in the "Leakage" and "Permanence" sections). Risk analysis, which is included in standards such as the VCS, can help determine the amount of carbon credits that should be deposited into a pooled impermanence buffer that spreads the risk over an entire project portfolio and/or the amount of carbon credits taken off the top of each project to cover predicted leakage. Such an approach would help assure a conservative estimate of generated credits is obtained.

Monitoring, Reporting and Verification (MRV)

Monitoring is necessary to cross-check anticipated carbon benefits over time and includes tracking the variables discussed above (deforestation rate, baseline, leakage and impermanence), as well as carbon stocks on the ground. In many cases, and as is currently required by standards such as VCS (every 10 years), the REDD project baseline will be monitored and re-evaluated at various points in the future using current data, to ensure the predicted scenario is still on target (see Figure 10). The baseline might then be adjusted based on observed changes to the underlying assumptions used in its creation. Monitoring also allows project developers to catch any leakage and/or impermanence soon after occurrence, as well as make adjustments to discounts and buffers as needed.

Verification and reporting are two means by which to ensure quality and transparency, and avoid double-counting of carbon credits. A review of the project and related measurements, calculations and documentation is generally conducted by an independent third party, to demonstrate that the chosen standard has been followed (a process known as "validation"). Verification of carbon benefits by a third party occurs after project implementation and is a means to demonstrate that generated carbon benefits are real (more detailed information in the "Standards and Verification" section). Formal registries, such as the Climate Action Registry and Chicago Climate Exchange, list and allow for the tracking of verified carbon benefits generated from REDD projects.

29 "Mosaic Deforestation" is that which occurs where population pressure and local land use practices produce a patchwork of cleared lands; where forests are accessible; and where the agents of deforestation and degradation typically are present within the region containing the area to be protected. "Frontier Deforestation," on the other hand, is that which is predicted to occur at some point during a project crediting period in an area with historically low deforestation rates but the potential for future incursion, settlement and/or infrastructure development (VCS, 2008b).

Makira Forest Protected Area

Carbon Stocks

In 2004, Winrock International was contracted by Conservation International (CI) and the Wildlife Conservation Society (WCS) to prepare a feasibility study for estimating the quantity of avoided carbon emissions that could be achieved through the creation of the Makira Forest Protected Area. Winrock visited the region in August 2004 to conduct a preliminary carbon inventory and to provide training to WCS staff on long-term measurement and monitoring of carbon. Above-ground, below-ground, standing dead and lying dead biomass[30] were measured in three temporary mature primary forest inventory plots in an area of relatively untouched, dense primary forest within the park boundaries (see Figure 17). Also used in this study was data from a WCS contracted consultant, who carried out inventories in degraded forests, and inventory data from a 1995 national study of the conditions of Madagascar's Classified Forests, which employed satellite imagery analysis. The values from these three data sources were combined and weighted by the proportion of primary and degraded forest within the area of the proposed protected area, resulting in a weighted average forest carbon stock for the defined project area, which is currently being updated as the project goes through VCS validation.

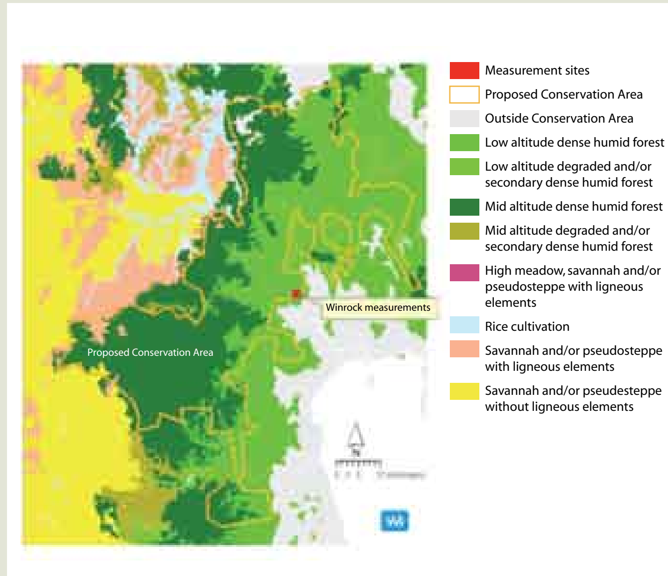


FIGURE 17 Site of 2004 Winrock carbon inventory plots and forest strata. From (Martin et al. 2004).

Deforestation Rate

In the 2004 feasibility study, to define a business-as-usual deforestation rate, WCS staff initially identified four zones around the proposed protected area that were characterized by different land use pressures (threats driving land cover conversion). Annual deforestation rates were generated for each zone from the number of hectares deforested between 1990 and 2000 (based on Landsat satellite imagery). The deforestation rate for each zone was then multiplied by the proportion of the total area in that zone in order to calculate the weighted average baseline deforestation rate of 0.149 percent. Winrock estimated that this business-as-usual deforestation rate would increase at a rate of one percent per year due to population growth. The deforestation rate in the with-project scenario was predicted to gradually decline to about 0.07 percent over the first 10 years of the project, using the deforestation rate of nearby and similar Mantadia National Park over the time period 1990-2000 in the calculation. From this, it was estimated that over the 30-year project lifetime, the Makira Forest Protected Area Project would avoid the emission of 2,589,898 tC, or 9,496,294 tCO_2 equivalent.[31, 32]

In 2009 WCS updated the deforestation rate projected in the 2004 feasibility study, as it began the VCS validation process. Using data produced from a 15-year national assessment of forest cover change, the historic deforestation rate within a 6,184,964-hectare reference area—a larger area encompassing the project and with similar conditions, agents and drivers for comparison over time—was calculated to be 0.76 percent (see Figure 18) (MEFT, USAID and CI, 2009). The calculations of projected future deforestation rates for the reference area were based on this analysis and the location of future deforestation was predicted using the IDRISI Andes Land Use Change Model (see Figure 19). Deforestation in the with-project scenario is now predicted to decline to about 0.04 percent over the first 10 years, using the current deforestation rate of neighboring Masoala National Park. The estimated lifetime carbon benefits of the project are currently being revised based on these updated deforestation rates and are contingent upon validation of the Makira Project Design Document (PDD).

30 Carbon value testing for dead and down tree samples were conducted within a laboratory.
31 This estimate does not include a leakage discount, which will be determined during VCS validation, and deducted from the total.
32 It is important to note that additional data collection and analysis are currently underway as a part of VCS certification. The results of the 2004 feasibility study, which was completed before VCS came into existence in late 2005, are being revisited so as to ensure that the project baselines, carbon stock estimates and GHG emissions reduction estimates and MRV adhere to VCS guidelines.

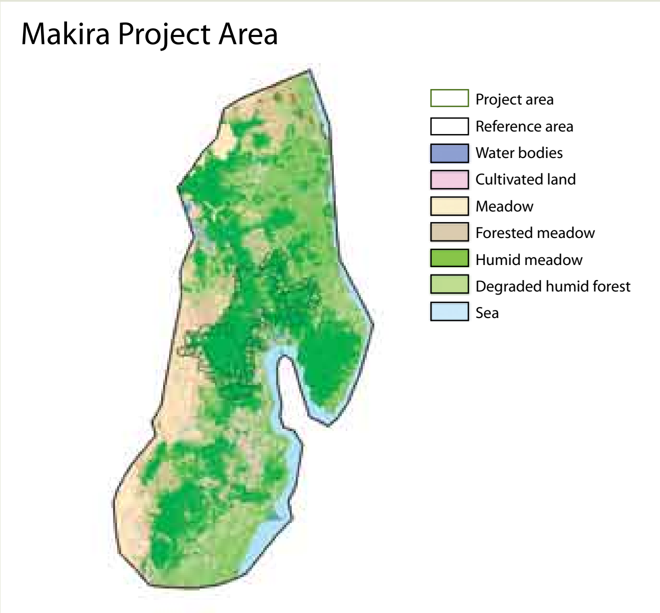


FIGURE 18 This map depicts the reference area, project area and leakage belt for the Makira project—as updated in accordance with VCS. Cartography: WCS Madagascar.

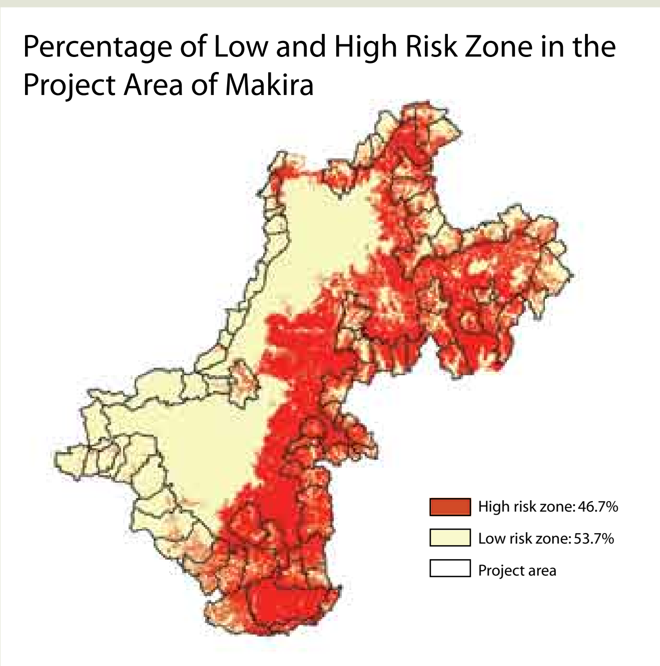


FIGURE 19 Spatial model of deforestation risk within the project area. Cartography: WCS Madagascar.

Leakage and Impermanence

Deforestation for agriculture is the principal and immediate threat in the Makira project area, coming from the population surrounding the protected area. Leakage and impermanence avoidance strategies are being used within the project, including the use of tools such as a community-managed buffer zone, sustainable land use practices, alternative livelihoods programs, assignment of legal rights to lands, protected area status and a permanent project endowment. Specifically, the project includes both a Zone of Strict Protection and an actively engaged Zone of Community Management, which surrounds the protected area and serves as a buffer to leakage (a leakage belt). Given the geography of the area and the resource use habits of the local communities, leakage as a result of the establishment of the project is considered limited. Thus, no leakage discount is being used in the project.

Project developers plan on utilizing impermanence buffers to further safeguard carbon assets. An impermanence buffer is being estimated through a risk analysis. Preliminary analysis estimates that the most appropriate risk buffer for Makira will likely be 20 percent of the carbon benefits. The risk buffer for Makira was calculated using the VCS risk analysis of risk likelihood multiplied by significance of risk. The result places Makira in the medium risk class—natural disaster due to cyclone activity and concerns of illegal logging pressures are principal drivers of this risk calculation. These verified emissions reductions will not be marketed and instead placed in a pooled reserve, to be drawn upon in the case of impermanence.

Monitoring, Reporting and Verification (MRV)[33]

Following the initial verification of the avoided deforestation estimates attributed to the project—this first verification process is currently underway—the avoided deforestation baseline for the Makira Forest Protected Area Project will be monitored and re-evaluated every five years. Monitoring parameters will include assessment of relative changes in the project deforestation rate compared to regional deforestation rates (represented by the reference area) and national deforestation rates. Remote sensing imagery—most likely Landsat—will be used in combination with forest cover measurement plots. Field data collection protocols will follow Winrock International's *'Terrestrial Carbon Measurement Standard Operating Procedures'* (Walker et al. 2009). The development of the carbon monitoring protocols, particularly

33 Although the main focus of this "Monitoring" section is carbon, it is important to note that monitoring of community and environmental impacts (positive and negative) will also be taking place. Monitoring of impacts on biodiversity and communities is planned on a bi-annual basis, the modalities of which, particularly measuring community net positive benefits, are also in development. Monitoring of biodiversity impacts will follow already established community participatory ecological monitoring protocols. This participatory ecological monitoring has been initiated in Makira's forests since 2007 and also includes monitoring of the state of wellbeing and forest and resource use tendencies of the local community populations.

© Christopher Holmes/WCS

the number and location of forest cover measurement plots, is on-going, but will likely include a series of plots distributed throughout areas of the forest that have been identified as having high deforestation risk. The final MRV plan will be presented in the project design document.

Although the project is not expected to result in leakage, leakage will still be monitored through a combination of satellite imagery analyses, high resolution aerial photography imagery analyses, and field data collection within the 'leakage belt'. The zone of greatest risk to leakage immediately borders the Zone of Community Management. Monitoring will follow the same temporal program as the baseline, with annual field monitoring coupled with more periodic aerial and satellite imagery analyses.

LESSONS learned AND takeaways

The technology currently exists to achieve high levels of certainty in forest carbon measurement.

- Projects such as Makira utilize time-tested field measurement techniques, laboratory carbon testing, satellite imagery and advanced modeling to measure and monitor carbon stocks, methods employed by foresters and ecologists for decades. Existing protocols in place through voluntary systems provide guidance and structure for measuring, monitoring and verification, and methodologies written for use within these protocols guide the use of available technologies for robust carbon accounting.

Ground measurements are an important complement to remote sensing used in measuring and monitoring.

- Remote sensing, using aerial photography or detailed satellite imagery, is helpful to determine the type of forest stands present in a project area, to detect clearings and to monitor over time, and in conjunction with field measurements, can be used to estimate the total biomass present. This technology has promising applications for large-scale measuring and monitoring; however, it should be complemented by measurements on the ground, similar to those conducted in the Makira project. It is possible that as detailed data is accumulated over time for many of the world's forest ecosystems and as future advances in technologies are made, the need for comprehensive ground measurements will be reduced; however, it is unlikely that ground measurements will be completely replaced by remote technologies.

© Bridget Besaw

SECTION 3

Leakage

© Hermes Justiniano

Leakage, in the context of project-level REDD activities, refers to changes in greenhouse gas emissions that occur outside of project boundaries as a result of the project's emissions reduction activities. On a national scale, leakage can also occur between countries, for example, if deforestation is shifted from one country to another. Although, by definition, leakage can be positive (the "spillover effect"), resulting in the broader adoption of low-carbon activities, most debates about REDD activities have focused on the possibility of negative leakage. Negative leakage results from shifts in emissions that negate some or all of the carbon benefits associated with REDD activities. For this reason, leakage must be accounted for and addressed in order for REDD activities to demonstrate they produce net carbon benefits.

Leakage comes in two main forms: "activity-shifting leakage," when forest carbon activities directly cause carbon-emitting activities to be shifted to another location outside of the project boundaries (or outside the country, at the national scale); and "market leakage," when a project or policy changes the supply-and-demand equilibrium, causing market actors to shift their activities. For example, if a project constrains the supply of a commodity, such as agricultural products or timber, market prices may rise and producers elsewhere may increase their activities in response. Estimates of market leakage automatically incorporate activity-shifting leakage in their calculation, since all actors, including those proximate to project activities that might shift their operations, are covered. Leakage is less likely in areas where alternative employment is available, land use activities are subsistence and land tenure is clear and enforced. In contrast, it is more likely if employment options are limited, land use activities are commercial in scale and land tenure is undefined. Leakage is not a phenomenon unique to the forest sector (discussed in the "Leakage in Other Sectors" box).

Project-scale activities must make attempts within the project design to analyze the risk of leakage, take steps to prevent or reduce leakage, and monitor and account for any leakage that does occur. Prevention and monitoring activities often rely on mechanisms such as agricultural intensification, alternative employment opportunities, tracking activities of key project participants and support for clear land titling. Additionally, leakage effects must be estimated and used to apply leakage deductions in carbon accounting. Most voluntary carbon standards now recommend a leakage deduction of 10-20 percent, dependent on a number of project risk factors. This percentage is subject to increase with higher-risk projects. One key advantage of nation-wide carbon accounting systems is the fact that they can capture leakage across whole countries (see "Scale and Scope" section for more detail).

Leakage in Other Sectors

Although often thought of as an issue specific to forest carbon activities, leakage is a challenge for emissions reduction strategies in all sectors. For instance, in the global energy sector, climate change policies have the potential to change supply and demand dynamics within fossil fuel markets, resulting in market leakage (Sergey, 2001). The potential for leakage in the fossil fuel sector has been estimated at 5-20 percent and ultimately will depend on the level of participation in global mechanisms (IPCC, 2007.)

The following are examples of two such leakage scenarios:

1 » Under the restrictions of the Kyoto Protocol, demand for carbon intensive energy sources such as coal might decrease within Annex I countries, leading to a price drop on global markets. Given the cheaper price of coal, non-Annex I countries, which do not have emission reduction targets under the Kyoto Protocol, might switch to carbon-intensive coal in lieu of relatively more expensive and less carbon-intensive fossil fuel options such as oil. This increase in emissions from non-Annex I countries could partially offset carbon gains achieved by Annex I countries by increasing non-Annex I country emissions higher than they would have been without the compliance mechanism.

2 » The emissions restrictions placed on Annex I countries by the Kyoto Protocol could drive some energy-intensive industries (such as cement, steel, aluminum and chemical sectors) to relocate to developing (Non-Annex I) countries, where emissions are not currently strictly regulated. This has the potential to increase emissions from these countries and undermine emissions reductions in Annex I countries.

© Hermes Justiniano

CASE STUDY

Noel Kempff Mercado Climate Action Project

© Hermes Justiniano

The Noel Kempff Mercado Climate Action Project ("Noel Kempff") provides an example of how REDD projects might be designed to analyze the risk of, prevent, monitor, calculate and account for leakage. The project considered both activity-shifting leakage and market leakage in its design and analysis. Since the project had two separate components—avoided deforestation and avoided forest degradation—with different actors and drivers, the treatment of leakage was distinct for each component.

Avoided Deforestation Leakage

For the avoided deforestation component, the potential for activity-shifting leakage was from local communities living along the border of the project area, in the form of subsistence agricultural expansion. Therefore, the communities were the focus of extensive community development activities associated with the project design, meant to both improve livelihoods and prevent leakage, including: the formation of an official indigenous organization, application for and granting of legal land tenure, educational campaigns, healthcare, workshops in sustainable agriculture, alternative employment opportunities and development of a management plan for sustainable forestry in ancestral lands. As a result of these activities, it was anticipated that there would be no activity-shifting leakage from the avoided deforestation component of the project. Nevertheless, it is being monitored as described in "Leakage Monitoring." Similarly, as the threat of deforestation came from subsistence agricultural expansion and not commercial agricultural expansion, it was anticipated that there was no risk of market leakage.

Avoided Forest Degradation Leakage

The potential for activity-shifting leakage from the avoided forest degradation component of the project was from area timber harvesters, who were compensated to give up their harvesting rights in the project area and who might have begun new harvesting activities elsewhere. To avoid this, project developers negotiated the "Agreement to Prevent the Displacement of Noel Kempff Environmental Benefits," signed on January 16, 1997 by the former concessionaires, preventing them from initiating new logging activities for a period of five years, as well as allowing Bolivian project partner FAN to monitor their activities outside the project area. Furthermore, project developers closed sawmills operated within the concessions and purchased/retired harvesting equipment from concessionaires (as part of the overall concession buyout). Many concessionaires take out loans when purchasing equipment, and thus must harvest to generate income and pay off the loans. Purchasing and retiring the equipment took away the pressure for concessionaires to shift harvest activities elsewhere by taking away the debt associated with the equipment.

Furthermore, it prevented the possibility for equipment to be sold inexpensively to other harvesters when the indemnified concessionaires left the business. As a result of these equipment purchases, as well as expense and activity tracking of the indemnified concessionaires (explained under "Leakage Monitoring"), it was anticipated that there was no risk of activity-shifting leakage from the avoided forest degradation component of the project.

A real risk of market leakage existed within the avoided degradation component of the project, as it was possible that the reduced volume of timber available on the market, due to the cancellation of project-area commercial timber concessions, could result in higher market prices and the expansion of harvesting elsewhere. It is very difficult to prevent market effects when harvesting is stopped entirely (with the incorporation of Improved Forest Management, on the other hand, it is possible to keep production up while still producing carbon benefits). Hence, it was necessary to calculate the market effect of reduced timber supply and deduct this from the carbon benefits of the project. Project developers employed an economic national timber model developed specifically for Bolivia that was also used in the project's baseline calculations (Sohngen and Brown, 2004).

The model represented a landmark achievement in quantifying leakage on a national scale, as it analyzed the impact of project activities on the entire Bolivian timber market. The modeled total annual timber production for all of Bolivia in the business-as-usual scenario was compared to the modeled total annual timber production for all of Bolivia "with-project," to calculate leakage for this component of the project. Various scenarios were used which explored the interdependence between price and demand for timber, as well as up-front cost constraints, resulting in the final leakage estimate of 11 percent of *total* carbon benefits from the project between 1997 and 2005 (16 percent of carbon benefits from the *avoided degradation* project component alone between 1997 and 2005). This quantity (127,515 tCO2e for the years 1997–2005) was subtracted from the initial verified carbon benefits of the project to determine the final discounted total carbon benefits. Leakage will also be estimated and deducted from carbon benefits evaluated in future verification periods as they occur.

Leakage Monitoring

Project managers are monitoring a 15-km buffer strip adjacent to the project area for increases in community-driven deforestation in order to capture any activity-shifting leakage from the avoided deforestation component of the project (see Figure 20). It is believed that community members, with no access to personal or public transportation, would not be likely to travel more than 15 km by foot to deforest for subsistence agriculture elsewhere. Thus far, no activity-shifting leakage has been detected through monitoring of the buffer area.

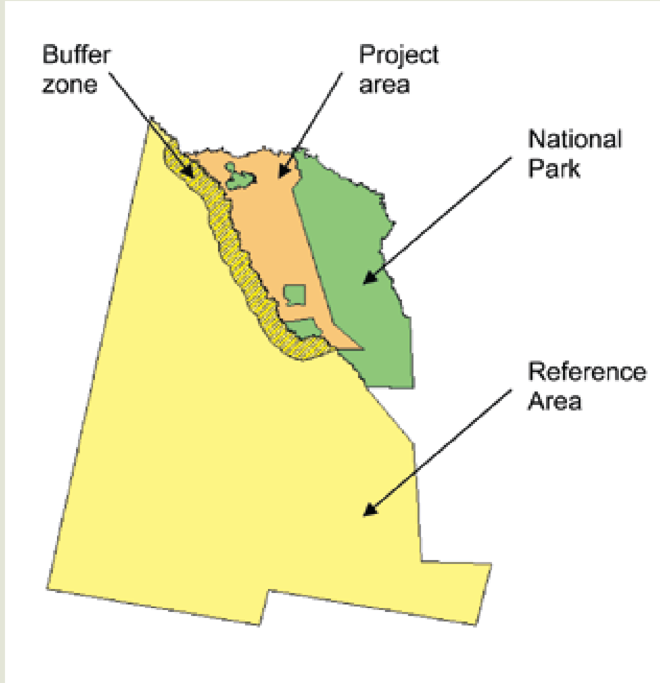


FIGURE 20 Leakage monitoring in Noel Kempff Climate Action Project, including buffer area. Source: Noel Kempff PDD.

Project managers have tracked the activities and expenditures of concessionaires compensated through the project and have not seen evidence of activity-shifting leakage from the avoided degradation component. Parameters for the economic timber model, used in calculating market leakage for the avoided degradation project component, are being monitored annually to every five years, depending on the particular parameter.

International Leakage

International leakage was not included in the leakage analysis for Noel Kempff. However, because it was determined that timber prices in Bolivia are not highly sensitive to supply changes (the country is considered a "price-taker" not a "price-setter" on the international markets), international leakage could be assumed to be quite small.[34]

34 Personal communication, Brent Sohngen. August 26, 2009.

LESSONS learned AND takeaways

Projects can be designed to reduce the risk of leakage.

- Careful choice of project location and design can minimize the chance that leakage occurs. In the Noel Kempff example, community development (most importantly the facilitation of land tenure by local communities), the tracking of compensation funds and purchasing/ retiring of timber harvest equipment were all part of the project design to minimize activity-shifting leakage. However, since commercial timber concessions were closed completely and converted to protected areas, there was a risk of market leakage from lost timber production. This risk was calculated and accounted for in determining carbon benefits from the project. Future projects that replace carbon-intensive activities with less carbon-intensive activities without sacrificing productivity can reduce the chance that leakage will occur. For example, in order to minimize timber market effects, projects can incorporate Improved Forest Management techniques, which can maintain timber production near pre-project levels while still generating carbon benefits. Similarly, in areas where agricultural expansion is a driver of deforestation, agricultural production may be maintained though intensification on existing land and spatial planning/zoning that directs development to already degraded/deforested lands.

Credible estimation of project leakage is feasible.

- In some cases, it might be impossible to completely avoid leakage from project activities. However, it is possible to predict leakage from project activities using econometric models. Such models automatically incorporate activity-shifting leakage in their design. Various parameters, all of which can be tracked through time, are used to estimate the impact project activities will have on markets. For example, in the case of Noel Kempff, it was determined that the closure of four commercial timber concessions would likely result in market leakage within Bolivia. In order to quantify and account for these effects, an economic model was developed, which predicted leakage within the Bolivian timber market to be 11 percent of total carbon benefits between 1997 and 2005. Parameters used in the model will be monitored over time and leakage will be deducted from calculated carbon benefits during each future verification event.

The use of leakage discounts in project carbon accounting helps to ensure the credibility of carbon benefits.

- Leakage discounts, calculated according to several risk factors associated with project activities, are becoming standard practice to help assure that carbon credits will be supplied in the event that leakage occurs. Well-respected voluntary standards such as VCS and CAR now require such discounts, which contribute to overall conservative estimates of carbon benefits (see "Standards and Verification" section for more information). These standards provide guidance on the size of an appropriate discount, based on various project aspects and risk factors. Default discounts, generally ranging from 10-20 percent (but sometimes larger for higher risk projects), are provided, or projects have the option of conducting their own leakage analysis, similar to the one that was performed in Noel Kempff. The 11 percent market leakage calculated for the Noel Kempff project (for carbon benefits between 1997 and 2005) serves as a leakage discount.

SECTION 4

Permanence

© Olaf Zerbock/CI

Permanence refers to how robust a project is to potential risks that could reverse the carbon benefits of the project at a future date. Although all sectors have the potential for impermanence (see "Permanence in other Sectors" box for more information), REDD projects face particular scrutiny due to an inflated perception of risk from poor management, fire, pests, etc. that can lead to the destruction of forests and the subsequent release of emissions. The concept of permanence is the cause of much confusion mainly because of a lack of consensus about "how long is permanent" and inconsistencies with the way it is talked about across scale and scope.

There is an inherent risk of partial or total reversal of carbon benefits within all sectors, forest carbon included, attributable to both natural and anthropogenic causes (e.g., changes in government). The magnitude of this risk, be it negligible or substantial, is particular to the place in which the activity is being carried out and to the drivers of deforestation, political situation, ecological conditions, socio-economic circumstances, economy, etc., and it is possible to quantifiably estimate this risk. In recognition of the risk of impermanence, it is common practice for those undertaking REDD activities to implement strategies to prevent reversal of carbon benefits and design measures to account for the unlikely event of a reversal, which will ensure the credibility of generated carbon benefits.

First and foremost, it is important that all stakeholder interests (e.g., government, communities and business) are aligned with the long-term project objectives. Several legal, financial and institutional tools are available to both prevent and manage the possibility of impermanence. Specific approaches, such as the purchase of conservation easements (or similar contractual agreements), creation of protected areas, community development and the establishment of endowments for project management and monitoring, can help ensure permanence. Ultimately, strategies must be tailored to the particular project site and situation.

Additionally, voluntary carbon standards have adopted the use of "impermanence buffers," or a reserve of carbon credits, pooled over many projects (usually 10-20 percent of total benefits, determined by a risk analysis, but can be up to 40 percent) which are set aside and not commercialized, to assure real credits can still be delivered in the chance of a partial reversal. In some instances, these buffers can be partially recaptured as a project demonstrates permanence and lower risk over time. Other compliance standards that deal only with AR activities (e.g., CDM) issue temporary rather than permanent credits for forestry activities as a mechanism for dealing with possible impermanence. The temporary nature of these credits means that the compliance buyer has to re-purchase them or substitute them with permanent credits at the end of the commitment period.

Permanence in Other Sectors

Although permanence is a consideration for all sectors involved in greenhouse gas reduction strategies, the forestry sector is typically viewed as more vulnerable and held to higher expectations and stricter requirements. The following examples demonstrate how impermanence can be experienced in other sectors:

In the transportation sector, consider the implications of switching from a gas-guzzling SUV to a fuel efficient hybrid car. Even if the driver goes back to an SUV after 10 years of driving the hybrid, the result is that less is gas used over that time period than would have occurred in the baseline scenario (baseline = driving an SUV) resulting in an overall carbon benefit. The permanence of this benefit is generally not questioned; however, if the transportation sector were held to the same standards as the forestry sector, the gas saved from driving the hybrid would be required to be put aside, never to be used in the future, whether intentionally or accidentally. Forest carbon stocks—analogous to gasoline in this example—are, however, expected to be put aside and protected in perpetuity.

The same comparison could be made in the energy sector. Consider the implications of a homeowner changing from incandescent light bulbs to efficient compact fluorescents. Even if the homeowner reverts back to incandescent bulbs after the lifespan of the compact fluorescents, the energy savings over time equates to less coal burned at the plant which produced the household electricity. Again, there is no expectation that this coal be set aside and not burned in the future. Such a reduction would be considered permanent by current standards.

© Christopher Holmes/WCS

CASE STUDY

Makira Forest Protected Area

© Christopher Holmes/WCS

Permanence of the Makira Forest Protected Area is being safeguarded through legal, institutional and financial mechanisms. The area is soon to be designated as an IUCN category II protected area. Makira has maintained temporary status as a protected area since 2005, and the dossier for permanent protected area status is currently in review with the Madagascar Ministry of Environment, Forest and Tourism's (MEFT) Direction for Protected Area Systems. As a protected area, Makira is safeguarded by national and local environmental laws of Madagascar, namely: the Malagasy Constitution, the Malagasy Environmental Code, the Decree to Make Investments Compatible with the Environment, the Procedural Code for Establishing Protected Areas and customary contracts with the local communities and authorities. These environmental laws ensure that Makira's establishment properly addresses engagement with civil society with no forced removal of local communities as a result of protected area establishment, and stipulate that no commercial extraction of any type is allowed in the limits of the protected area (with controlled subsistence extraction of forest resources being allowed in Zones of Community Management following the customary contracts).

In addition to its status as a protected area, Makira will be managed under a co-management governance structure with the local communities. Formal integration of the local communities will come via the inclusion of Community Resource Management Association (COBA) representatives on the Oversight Steering Committee, which validates all Makira work plans and reports. The COBA representatives will also be engaged to work with Wildlife Conservation Society (WCS) and MEFT as part of the project Management Committee, responsible for carrying out all validated management activities.

A series of Community Resource Management Sites (the Zone of Community Management) have been established around the protected area, serving as a buffer to encroachment—there are currently 27 operational Community Resource Management Sites representing 90,000 hectares, with 55 more planned. Once complete, 325,357 hectares will be under community management. These contracts between WCS (acting on behalf of the Ministry of the Environment as the project manager) and COBA, representing involved community members, formally engage the communities in sustainable forest resource management based on a validated management plan and hold the communities accountable for mismanagement through periodic evaluation by forest department officials. WCS will support the Management Committee through the provision of technical support for sustainable land-use practices, improved livelihoods activities and transparent governance. Furthermore, the establishment of Community Resource Management Sites, the formation of COBA and the contract signed by these groups with the Ministry of the Environment has allowed these groups to legally exclude outsiders from using their resources, further decreasing the potential for deforestation from slash-and-burn agriculture.

A current five-year strategic plan (2008-2013) envisages the introduction and application of alternative sustainable production techniques and the practice of intensive agriculture so as to lessen the deforestation pressures in the Community Resource Management Sites. To further ensure that local communities have the technical and governance capabilities to effectively manage their terrestrial resources, WCS is engaging with regional development authorities in the areas of market-based eco-agriculture and micro-credit programs for "green" activities. WCS, in collaboration with local communities, is helping households to adopt land use alternatives that counter the destructive and unsustainable practice of slash-and-burn agriculture. The activities include i) improved intensive rice cultivation, ii) soil fertility augmentation through composting, iii) improved crop rotation practices, iv) village tree nurseries for reforestation, and v) promotion of alternative livelihood practices for dependable revenue flow.

Alternative livelihood activities currently in development include advancing community-based ecotourism and identifying and establishing markets for sustainably produced natural products such as bio-vanilla, bio-clove, and eco-silk. The distribution of forest carbon revenue among the local communities will serve as an incentive to maintain transparent governance and effective resource management efforts. Through a revenue distribution mechanism that remains to be formalized with the government, 50 percent of all forest carbon revenue generated from the Makira Forest Protected Area will flow back to local communities. This revenue will provide the necessary incentives to allow community members to improve land use practices, engage in sustainable revenue opportunities and support alternative livelihoods, promoting a permanent transition away from destructive land use practices.

Project developers plan to use part of the forest carbon revenue generated for the establishment of a principal long-term financing mechanism—likely an endowment through a designated foundation—that would serve the life of the project, and ensure the adequate human resources, material resources, and infrastructure to properly manage the protected area system.

Project developers also plan to deposit a percentage of verified carbon credits into a pooled risk buffer, following guidance provided in the Voluntary Carbon Standard (VCS) risk analysis tool, to help mitigate the risk of impermanence posed by natural disasters and anthropogenic sources. For Makira, this risk buffer is currently estimated at 20 percent of the verified carbon benefits and places Makira in the medium risk class. Natural disaster due to cyclone activity and concerns of illegal logging pressures are principal drivers of this risk calculation.

LESSONS learned AND takeaways

Legal, institutional, management, financial and governance structures can be employed to reduce the chance of impermanence.

- Laws and standards are critical tools to ensure permanence, but also must be coupled with enforcement capacity, monitoring tools and processes in civil society and within various levels of government. The Makira project relies on established Malagasy laws, legal contracts, participatory processes, alternative livelihood programs and an eventual endowment to provide long-term project funding. In places where such structures or capacity do not exist prior to implementation, considerable funding and effort may be needed to work with local, regional or state-level institutions to develop them.

It is important that all stakeholder interests are aligned with the long-term project objectives in order to achieve lasting change.

- In order for REDD to be successful, incentives will need to reach the actors responsible for addressing the drivers of deforestation and for shifting land use to a more sustainable and low-carbon model. These actors span multiple scales, from national governments to sub-national governments to indigenous peoples and forest-dependent communities to individual landowners/users. A project that is inclusive and sensitive to these sometimes disparate motivations will be best positioned to succeed in the long run and maintain the project objectives. A well defined participatory process, with clearly articulated expectations and structure, can help to achieve the level of communication that is necessary for the success of these projects. The Makira project represents an excellent example of this concept; including an open dialogue with the Ministry of Environment, a co-management structure with local communities that includes a central organization with representatives on steering and management committees and a revenue distribution mechanism to ensure that carbon funds are funneled back to the communities.

The use of impermanence buffers can help manage the risk of impermanence.

- Impermanence buffers, as planned for the Makira project, calculated in accordance with several risk factors for project activities, are becoming standard practice in forest carbon projects to help ensure that issued carbon credits are not reversed. Well-recognized voluntary carbon standards such as the VCS and CAR both require the use of a pooled buffer system. Registries, which bank these buffer credits together, spread the risk over the hundreds of projects they service and in effect reduce the risk posed by failure of any one project. In the event of a reversal, credits are replaced by an equal amount drawn from the credit buffer, resulting in no net loss. National scale/larger scale portfolios are naturally self-insuring, as they also spread the risk over many areas and projects, reducing the risk of catastrophic loss. However, even in a national-level system, some buffer will likely be needed.

SECTION 5

Standards and Verification

© Ami Vitale

Standardized methods are required to establish the "rules of the game," ensuring quality and consistency across all REDD projects. Voluntary and compliance systems are inherently different; the inclusion of forest carbon into compliance systems (e.g., Clean Development Mechanism and Joint Implementation) is subject to regulations to guide project activities, so that resulting credits can be considered robust and credible. Voluntary carbon transactions are not subject to these regulations, however, and it is ultimately up to buyer and seller to agree on the level of accounting rigor to be used in the project.

To meet growing demand for comparability and transparency in the marketplace, over time, several comprehensive voluntary standards have been developed, drawing from existing regulatory standards as well as project experiences, to meet the needs of voluntary carbon markets. These have been designed to address key concerns about permanence, leakage, additionality, social and environmental benefits and risk within forest carbon projects. Most voluntary standards now include REDD—as well as IFM and AR—and are helping serve as models for future inclusion of forest carbon activities within regulatory structures. Many of these standards not only provide a means to estimate, verify, register and track carbon benefits, but also to ensure social and environmental benefits (see Table 1 for a sampling of some of the more well-known standards relevant to forest carbon projects). Most standards require an accredited third-party evaluation of the project to assure the project complies with the chosen standard (a process known as "validation") and another evaluation to verify the credibility of claimed project benefits (a process known as "verification"). This process ensures transparency and usually results in the issuance of verified carbon credits and/or certification for projects that meet the requirements of the standard (project proponents are generally given an opportunity to fix identified problems with project design or calculations that might prohibit verification prior to the final decision).

Standards are comprised of general project guidance and require the development of specific methodologies for carbon accounting, particular to the project type and conditions. Methodologies provide specific guidance for baseline carbon accounting and monitoring through step-by-step instructions. For example, methodologies specifically provide the techniques, equations and assumptions to be used to determine above-ground biomass or how to calculate a baseline. Over time, methodologies have been adapted for voluntary standards, borrowing from or referring to CDM modalities and procedures and IPCC Good Practice Guidelines, or developed from project experiences where there was no prior guidance, and continue to be developed as needed.

The Voluntary Carbon Standard (VCS) is emerging as a dominant standard for the quantification of carbon benefits from forest carbon projects, particularly REDD, within the voluntary market. One innovative aspect of the VCS is that projects are evaluated in terms of the risk of impermanence, and projects are required to deposit a percentage of their credits into a pool of credits that the VCS uses to provide a buffer in the event that a protected forest is lost during the project accounting period. By using this approach, the VCS is able to offer permanent credits to interested buyers, as opposed to the temporary nature of CDM credits. Under the VCS, the risk analysis and buffer determination are subject to two separate independent third-party assessments ("double approval process") to assure that risks are adequately addressed.

Other standards, such as the Climate, Community and Biodiversity standard (CCB) and Forest Stewardship Council (FSC), have been designed to ensure adequate consideration of environmental and social co-benefits in project development. Although these standards do not specifically address carbon, they can be used in conjunction with carbon standards to ensure equity, transparency and the broadest suite of project benefits.

STANDARD NAME	VOLUNTARY OR COMPLIANCE	PROJECT TYPES	CARBON VERIFICATION	ENVIRONMENTAL AND/OR SOCIAL BENEFITS	GEOGRAPHICAL REACH
Clean Development Mechanism (CDM)	Compliance	AR	Yes	No (safeguards only)	Non-Annex I countries
Regional Greenhouse Gas Initiative (RGGI)	Compliance	AR	Yes	Environmental—Yes Social—No	10 Northeast and Mid- Atlantic US states
AB32	Voluntary	AR, REDD and IFM	Yes	Environmental—Yes Social—No	California
Climate Action Reserve (CAR—Formerly California Climate Action Registry)	Voluntary	AR, REDD and IFM	Yes	Environmental—Yes Social—No	US
Chicago Climate Exchange (CCX)	Voluntary to join, compliance once committed	AR and IFM	Yes	Varies (IFM might include both benefits depending on certification system—no requirement for AR)	US or non-Annex I countries
Voluntary Carbon Standard (VCS)	Voluntary	AR, REDD and IFM	Yes	No (recommendations but no requirements)	Global
1605B	Voluntary	AR and IFM	Yes	No	Mainly U.S. (however projects outside the U.S. are technically allowed)
EPA Climate Leaders	Voluntary	AR	Yes	No	Mainly U.S. (however projects outside the U.S. are technically allowed)
Climate, Community and Biodiversity Standard (CCB)	Voluntary	All land-based projects	No	Yes	Global
Forest Stewardship Council (FSC)	Voluntary	IFM	No	Yes	Global

TABLE 1 Sampling of standards that include forestry activities—gray indicates carbon standards and green indicate non-carbon standards.

CASE STUDY

Noel Kempff Climate Action Project

When the Noel Kempff Mercado Climate Action Project was initiated in 1996, there were not any specifications for carbon project design or validation, nor were there established standards to guide REDD project development. However, the United States, as a signatory to the United Nations Framework Convention on Climate Change (UNFCCC), had begun a program called the United States Initiative on Joint Implementation (USIJI). Noel Kempff was submitted under the USIJI guidelines and received approval in 1996. After the U.S. failed to ratify the Kyoto Protocol, the USIJI system became obsolete. Since REDD projects were also excluded from the Kyoto Protocol's Clean Development Mechanism (CDM), it was not possible to validate or verify Noel Kempff under a compliance regime.

Instead, Noel Kempff underwent an ex-post validation and verification assessment for the voluntary market in 2004-2005 for carbon benefits generated since 1997. The validation and verification processes were executed by Société Générale de Surveillance (SGS), registered as a Designated Operational Entity to the CDM. As no REDD voluntary or compliance standard existed at the time against which the project could be assessed, the project partners contracted with carbon experts to develop a new methodology, based upon the principles of the CDM guidelines for Afforestation/Reforestation projects (as defined October 2005). SGS used this methodology, as detailed in the Project Design Document (PDD), as the basis for its validation and verification processes (FAN, 2006). SGS assessed the project's additionality, baseline, potential leakage, monitoring plan, environmental and social impacts against the relevant UNFCCC and Kyoto Protocol requirements (where appropriate), as well as according to host country criteria and the guiding principles of completeness, consistency, accuracy, transparency and scientific appropriateness.

SGS's first validation and verification review resulted in several Corrective Action Requests (CARs), two major and eight minor. These included requests to improve the PDD and to develop an action program to address the needs of the communities adjacent to the park. The requested corrections were made to the PDD and a socioeconomic impact assessment was conducted by FAN to determine the needs of the communities. A community development action program was developed, which requires "establishment of a conditioned benefit sharing

© Margo Burnham

mechanism based on a participative approach" that would help "to raise the standard of living at a minimum up to the level that the communities experienced before the commencement of the project" (SGS, 2005). These CARs were subsequently closed out and the project received validation and verification from SGS in 2005, with a total of 1,034,107 metric tons of CO_2 verified by SGS for the period of 1997-2005. There are no plans to verify under any of the voluntary standards that have come into recognition since that first verification took place; however, the methodologies designed in Noel Kempff were instrumental in the development of many of these current standards.

It is important to note that although all CARs associated with the first validation and verification review were closed out to SGS's satisfaction, future verifications may be in jeopardy. As of this writing, key milestones in the community development action program have not been reached. The program called for the Government of Bolivia to establish the necessary legal instruments to commercialize their share of the carbon credits and to assign carbon credit revenue according to the earmarks set out in the Noel Kempff Comprehensive Agreement. Given turn-over of government officials and other obstacles, the Government of Bolivia has yet to complete these milestones. The Noel Kempff experience brings to light the need for strong local government capacity to establish the necessary legal, financial and institutional means to manage carbon revenue and benefit sharing.

© Tony Rath

LESSONS learned AND takeaways

Standards ensure REDD activities are consistent in their rigor and elicit confidence in the produced carbon benefits.

- Although REDD standards did not exist when Noel Kempff was begun in 1996, the project partners went through the process of designing and vetting science-based methodologies to guide project carbon accounting, many of which shaped the standards of today. Detailed standards now exist to guide projects in the production of real, measurable and verifiable forest carbon benefits, as well as to promote environmental and social co-benefits. Carbon standards and methodologies provide step-by-step guidance on carbon accounting, appropriate risk calculations and deductions. Using carbon standards in combination with environmental and social standards can help projects to ensure that these aspects are adequately considered in project design. It is becoming common practice for REDD projects in development (engaged in activities not currently recognized by regulatory systems) to comply with and strive to achieve verification through one or more of the recognized voluntary standards.

Third-party validation and verification is key to providing transparency and confidence in carbon benefits produced through project activities.

- Validation is a complex process by which an independent third-party organization, which has been certified to evaluate projects according to a specific standard, thoroughly reviews the design, methodologies, calculations and strategies employed in a project. The validator then provides feedback to the project developers, requiring changes where needed prior to the granting of validation. After validation occurs, or sometimes simultaneously with validation, a third party verifies the carbon benefits generated by the project in a separate review process called verification. In most cases, documentation associated with verification is publicly available to ensure transparency. This process varies with the particular standard, but is meant to inspire confidence in the resulting verified carbon benefits, ensuring that they were produced in accordance with the chosen standard and are indeed real and credible. The successful verification of 1,034,107 metric tons of CO_2 from the Noel Kempff project demonstrated the legitimacy of carbon benefits produced.

SECTION 6

Involving and Benefitting Local Communities and Indigenous Peoples

© Russell A. Mittermeier/CI

Upwards of 300 million of the world's poorest people depend directly on forest resources for their survival and livelihoods (Pimental, et al., 1997), while other estimates put this number closer to one billion (Lynch, 1995). Large tracts of the world's remaining forests are on indigenous lands, and indigenous peoples are often the best stewards of the lands and waters from which they have historically met their daily needs for food, water and fuel. In fact, a 2009 study found indigenous areas provide greater protection from deforestation than other types of strictly protected areas (Nelson and Chomitz, 2009). Yet, as development pressures encroach upon once-isolated regions, changes can occur that create new economic hardships for people who are pursuing traditional lifestyles. Science tells us that these same groups, who have done little to cause the climate crisis, are among the first to face direct adverse consequences of climate change, due both to their close relationship with the environment and its resources, and their limited financial and institutional capacity to adapt to this threat (UNDG, 2008).

Interventions that assign value to forests have the potential to contribute significantly to the well-being of local communities and indigenous peoples by protecting the resources on which they depend. Such programs can provide the resources needed to support community development and sustainable alternative employment. Likewise, conserving and/or restoring forests can help buffer communities against the worst effects of climate change, as healthy forests can better resist and recover from the impacts brought about by climate change (ranging from severe storms that cause mudslides to decreased rainfall that affects crop yields and food supply). Yet, REDD efforts designed without consideration of the views and needs of local communities may have negative social and financial impacts on these people, including loss of employment or limits on access to forest resources on which they depend. Ultimately, this can end up undermining the success of the REDD intervention itself, by increasing the risk of leakage or impermanence caused by unmet local needs.

Community organization is a critical first step for community involvement. Existing community organizational and decision-making structures may serve as important vehicles to evaluate and participate in project design, helping assure fair participation in project planning and implementation. In some areas, communities may not have an organizational structure with designated representatives and a formal means of relaying information. The absence of such structures can pose a challenge to ensuring that community members are consulted during the initial stages of project development. In government-led carbon projects, it is essential for communities to gain official recognition of their roles, responsibilities, rights and benefits early in the project design phase.

As policy-makers nationally and internationally negotiate how to design and implement REDD incentives, indigenous peoples must be fully and effectively engaged in the discussions to ensure that those who rely on forests for daily survival directly benefit from conservation efforts. In the context of the international climate change dialogue, concerns about the rights and participation of local and indigenous communities in the design and implementation of REDD programs have become very high profile. Officially sanctioned organizations, such as the United Nations Permanent Forum on Indigenous Issues, as well as non-governmental organizations and advocacy groups, have spoken out on the key role of indigenous peoples and their stake in the fate of forests. The United Nations Declaration on the Rights of Indigenous Peoples, adopted in 2007, sets out the individual and collective rights of indigenous peoples, as well as their rights to culture, identity, language, employment, health, education, lands and other issues—most importantly the right to "free, prior and informed consent" in any appropriation of the aforementioned items (DRIPS, 2007). A well-designed REDD framework will depend upon, among other things, equitable participation and distribution of benefits for indigenous peoples and local communities.

Although REDD projects have the potential to benefit local communities by helping to avoid the worst impacts of climate change and providing opportunities for economic and community development, care must be taken to respect the rights of those who stand to be affected most by such efforts. Standards exist which can be used in conjunction with carbon standards to help guide project developers in assuring that these rights are acknowledged and maintained. The Climate, Community and Biodiversity (CCB) standard, listed in Table 1, is specifically designed to ensure social and environmental co-benefits and provides a checklist and guidance for project developers to ensure net positive community impacts, stakeholder participation and monitoring of project impacts, demonstrated through verification by an accredited third party.

© Olaf Zerbock/CI

CASE STUDY

Ankeniheny–Zahamena–Mantadia Biodiversity Conservation Corridor and Restoration Project

Community Profile

The 30 rural communities surrounding the Mantadia Project comprise approximately 315,000 inhabitants. Population density in the southern portion of the corridor in the towns of Andasibe, Ambatovola and Beforona averages 31 inhabitants/km². The principal component of the local economy surrounding the project is agriculture, which is the main means of subsistence for all communities and makes up their way of life. The traditional agriculture system is extensive and dominated by slash-and-burn ("tavy") practices, largely for hillside rice production, and it has been identified as the greatest threat to surrounding forests and local environmental services.

© Olaf Zerbock/CI

Community Involvement

The Mantadia project is ensuring consultation with and participation of local communities. Seven local non-profit organizations (NGOs) are aiding in the representation of the communities living adjacent to the protected area. The management structure of the protected area provides for consultative processes in the design and implementation of resource management, organizing local communities and NGOs into Local Management Units and empowering them to create local management plans and assume responsibility for implementation. These Local Management Units are federated into Regions and overseen by the protected area management authority, which reports to the Ministry of the Environment. A guidance and monitoring steering committee, made up of representatives from the government, local management units and civil society, evaluates proposed activities and monitors implementation for the overall multi-use protected area.

Alternative Employment

Since its beginning, Mantadia has employed several hundred local community members to implement the Afforestation/Reforestation (AR) component of the project. These jobs include the identification of the project boundary, site preparation, nursery propagation, planting and maintenance. The majority of jobs created are expected to be temporary, occurring in the first 9-12 years of the project, though some employment related to ongoing maintenance and monitoring will be supported throughout the life of the project, along with employment related to sustainable livelihoods. The REDD component of the project will engage local communities in the management of the protected area, creating employment opportunities and providing means for local resource management.

Alternative Income

In areas adjacent to the reforestation component of the project, a series of alternative agricultural activities aimed at increasing and diversifying cash crop revenue are being piloted. These will reduce pressure on native and replanted forests and provide potential alternative uses of degraded agricultural lands—especially hillsides—that are no longer useful to local populations and are at risk of further degradation due to soil erosion and expansion of invasive species (see Figure 21). These activities will help enable a shift in land use practices from slash-and-burn agriculture to more sustainable activities. Market studies have been completed, determining that these endeavors can be expected to be successful. Although these activities are likely to have a positive effect on the amount of carbon on the landscape, they will not be counted as 'carbon credits' in either the AR or REDD calculations.

Sustainable forest gardens are planned as a part of these alternative agricultural activities and will be comprised largely of local trees and plants, including fruit trees, which can be planted to mimic local forest structure and function. The resulting valuable products will provide food and income to local communities. Fruit gardens are currently of great interest to local communities as a stable source of revenue. The region is well placed with regard to markets, being situated on the main route between the capital and the major port currently used to move charcoal to the market.

Fuel-wood plantations, which will reduce pressures on natural forests, are also planned for the degraded hillsides. These plantations will provide additional fuel sources, as well as decrease the risk of leakage associated with firewood collection in adjacent protected forests. Fuel-wood plantations will provide a source of fuel for the region and potential revenue from charcoal sale in the capital. To diversify food production in the corridor, food crops will be established in between the trees using improved, low-carbon techniques such as zero tillage and mulching, and better quality crop seeds. In addition, compost will be used for growing green vegetables where water is permanently available, which delivers a very quick financial return. Other income generating activities, such as bee keeping, will be progressively tested and disseminated to the stakeholders with the aim of sustainably increasing their revenue.

Land Tenure

An additional benefit for local residents in the reforestation component of the project is the clarification of land tenure. Approximately 97 percent of the Mantadia project area is formally owned by the government. The remaining three percent had either been historically held under private use or held under traditional use rights by local residents. In order to formalize land tenure and clarify carbon rights, the government established a local registry office near the project site as part of its Programme National Foncier, funded in part by the Millennium Challenge Corporation, which enabled the formalization of previously customary land tenure, and provides the capacity to settle disputes in a participatory and equitable manner. The government promoted a process whereby farmers would receive a tenurial instrument (similar to a private title) granting them secure tenure over their lands in exchange for placing a portion of that land under reforestation for the lifetime of the CDM project. These tenure holders then agreed to transfer rights to the carbon sequestered by the trees on their land to the government for the 30-year lifetime of the project. The local farmers view clarification of land tenure as one of the main benefits of the project.

The government of Madagascar, as aggregator and vendor of carbon tons, has also committed a minimum of 50 percent of gross carbon revenues from all REDD projects to be channeled to community development activities. A portion of these funds will flow through a community grants structure, with additional percentages to cover ongoing protected area management (including employment of local community members in protected area management) and transaction costs.

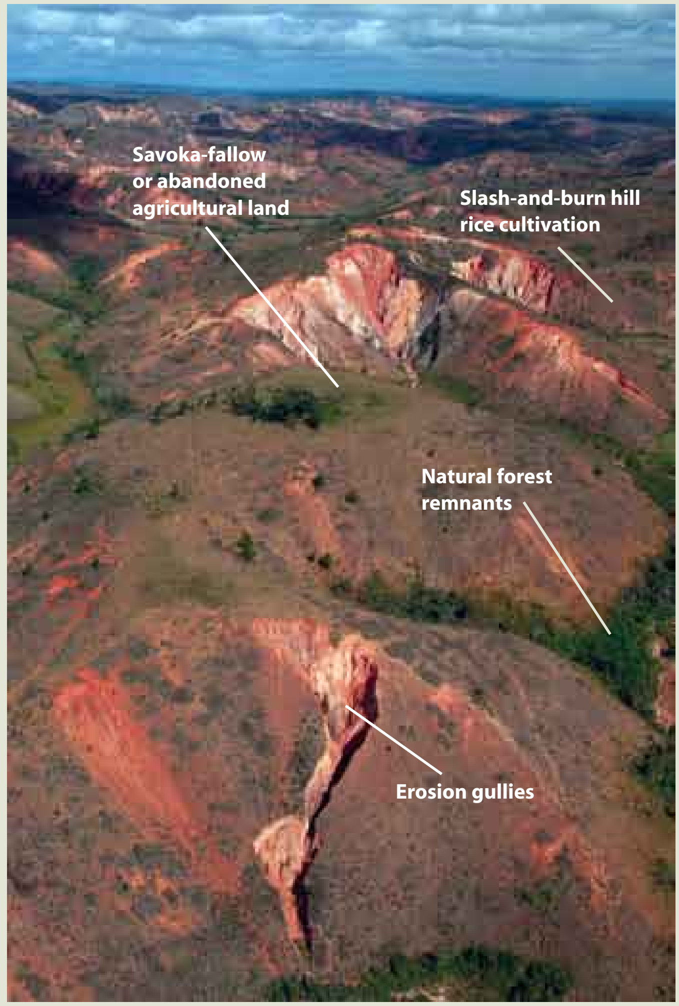


FIGURE 21 An example of land targeted for alternative agricultural activities.
© Olaf Zerbock/CI

Social Standards

The project is being designed to align with guidance provided in the Climate, Community and Biodiversity (CCB) standard and it is expected that the project will be validated under CCB at the same time that it goes through Voluntary Carbon Standard (VCS) verification.

LESSONS learned AND takeaways

Carbon projects can generate tangible benefits for local communities.

- Well-designed REDD projects can result in significant co-benefits for local peoples in the form of alternative income opportunities, land tenure, capacity building and creating mechanisms for civil participation within government decision-making. Likewise, by protecting the forests on which traditional communities often rely for their livelihoods and customs, REDD projects can sustain local cultures and traditions. The Mantadia project serves as an example of a REDD project that is likely to result in an overall benefit for local communities—to be demonstrated through the CCB certification process. Through the project, local people have received tenure over ancestral land. They have also been employed by the project to conduct site preparation, nursery propagation, planting and maintenance. Alternative income strategies are planned which include fruit, vegetable and charcoal production on previously degraded lands. Additionally, the government of Madagascar, as aggregator and vendor of carbon tons, has also committed a minimum of 50 percent of gross carbon revenues from all REDD projects to be channeled to community development activities.

Consultation with and participation of local communities and indigenous peoples is necessary to ensure overall community benefits.

- Local communities and indigenous peoples, whose lives are closely tied to the land, are likely to be the most impacted by project activities. Thus, it is essential that they are consulted and have adequate participation during all stages of project development. Impacts on local people should be monitored and rectified if found to be negative. Every effort should be made to ensure that project benefits are equitably distributed to local communities and indigenous peoples. This not only promotes fairness and equity, but reduces the risks of leakage and impermanence. The Mantadia project is ensuring consultation with and participation of local communities, with managing NGOs and implementing NGOs set up in the communities that have regular meetings to gather feedback.

Alternative income activities can be a means of ensuring financial benefits for local communities, but they must be well designed to ensure success.

- There is a need for advanced business planning to determine the viability of economic development strategies and avoid losses on investments. Although well intentioned, many alternative income activities ultimately fail due to low demand or inability to effectively market the product. For economic activities to succeed, it is important that REDD projects employ business planning expertise that can assess the feasibility of business ventures, adequately analyze supply chain issues, realistically project cost structures and help develop robust marketing plans to help achieve the desired results. Given that the Mantadia project is well placed with regard to markets, being situated on the main route between the capital and the major port currently used to move charcoal and other products to the market, it is expected that such issues will not pose a problem to the realization of these activities and market studies conducted for the project indicate they are apt to succeed.

Project design standards help ensure that proper community consultation and participation occurs and that communities benefit from project activities.

- Standards such as CCB contain general principles and guidance, and can point project developers to more specific guidelines which can be incorporated into project design and help project developers appropriately address the myriad of social factors associated with forest carbon activities. Verification to such standards provides assurances that projects adequately consider social impacts. The Mantadia project is using CCB guidelines in its project design and plans to be certified against this standard in addition to the VCS carbon-accounting standard. It is becoming increasingly common for forest carbon projects to comply with a social and environmental standard such as CCB.

SECTION 7

Assuring Environmental Co-Benefits

© istock.com

Just as REDD projects can be designed with benefits to the community in mind, so can environmental co-benefits (including biodiversity conservation and enhancement, ecosystem services and watershed protection) be enhanced by forest carbon activities, creating the potential for a triple win. While the absence of regulations requiring that environmental co-benefits be considered may produce perverse incentives to maximize carbon benefits to the detriment of other values (e.g., activities which introduce exotic species or low-biodiversity monoculture plantations), careful selection of project location and design can result in projects with higher environmental integrity, including enhanced resilience to potential disturbances (such as pests or disease).

Environmental NGOs typically use strategic analyses to determine the best places to concentrate their energies and resources. For example, under The Nature Conservancy's Conservation by Design framework, project locations are chosen with respect to a variety of factors, including the prevalence, health and importance of certain ecosystems, biodiversity and habitats suitable for groups of plant and animal species, as well as social and political factors. Many ecosystems with high concentrations of biodiversity are also high in carbon, particularly in tropical regions (UNEP-WCMC, 2008). For example, in 2008 the United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC) published an atlas which highlights areas where high carbon content and

© Julie Larsen Maher/WCS

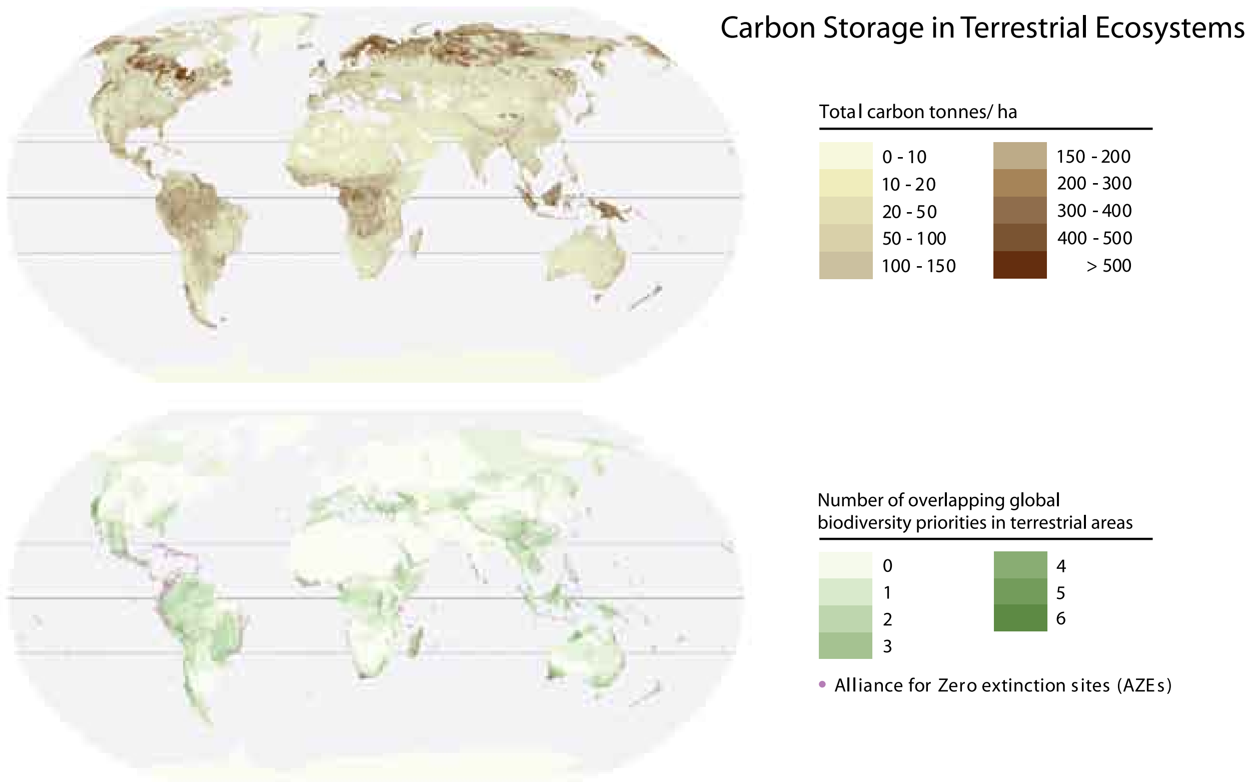


FIGURE 22 Map of carbon storage in terrestrial ecosystems and overlap with high biodiversity priority areas. Source: UNEP-WCMC, 2008.

high biodiversity overlap, indicating the potential for REDD activities to simultaneously combat climate change and biodiversity loss (see Figure 22). The use of such maps in prioritizing locations for REDD activities can help enhance the biodiversity outcomes of such projects.

Project design also provides an opportunity to ensure environmental co-benefits. Designing forest carbon efforts involves identification of strategies to prevent emissions, and many strategies to achieve those goals—such as establishment of protected areas, sustainable management plans for natural resources, or payments for environmental services—can simultaneously enhance outcomes for biodiversity or ecosystem services, such as water (Stickler, et al., 2009).

Several standards have been created which guide project developers in the consideration of co-benefits during the design stage. The Climate, Community, and Biodiversity Standard (CCB) and Forest Stewardship Council Standard (FSC) (see "Standards" section) are two such frameworks. Particularly with regard to biodiversity, CCB requires net positive biodiversity impacts within the project zone and over the course of the project lifetime, evaluation and mitigation of negative biodiversity impacts outside of the project area and monitoring of biodiversity changes over time. FSC, pertinent to projects with a forest management component, contains mandates to conserve biological diversity and its associated values, water resources, soils and unique and fragile ecosystems and landscapes. FSC also requires that management activities in high conservation value forests maintain or enhance the attributes that define such forests. Verification to strict standards such as these not only ensures the consideration of environmental co-benefits in carbon projects, but can elicit a price premium for the carbon benefits they generate (Neef, et al., 2009).

CASE STUDY

Ankeniheny–Zahamena–Mantadia Biodiversity Conservation Corridor and Restoration Project

Madagascar, though only covering 0.4% of the world's land surface, is viewed as one of the most important areas for biodiversity conservation. The number of endemic species (those found nowhere else in the world) is incredibly high due to 160 million years of evolutionary isolation; with species-level endemism well above 90 percent for many taxonomic groups (Goodman and Patterson, 1997; Jenkins, 1987; Langrand, 1997;—cited in Schmidt and Alonso 2005). The most spectacular and unique of Madagascar's fauna are the lemurs; 72 kinds of lemurs exist in the country with 12 of these found within the project area. The project will restore and improve habitat for threatened lemur species such as the ruffed lemur (*Varecia variegata*), the Diademed sifaka (*Propithecus diadema*), and the most endangered of all the lemurs, the giant bamboo lemur (*Prolemur simus*).

Project Location

Threat to the area, as well as conservation value and biological richness, were key factors which helped Conservation International (CI) to prioritize the location of the project. Three previously established Madagascar national parks existed in relative isolation from one another, with the area in between them (which connected species movement between the parks) under threat of conversion. Thus, the choice to locate the project in the corridor not only presented an opportunity to reduce carbon dioxide emissions from slash-and-burn agriculture in the area, but also to maintain connectivity between the parks. A Rapid Biological Assessment led by CI prior to project initiation to determine the location and variety of plants and animals in the proposed project area ultimately confirmed its biological richness. The study found 18 species of insectivore mammals, six species of bats, 89 species of birds, 51 species of reptiles, and 78 species of amphibians present in the corridor (Schmidt and Alonso, 2005). The management plan for the newly created protected area indicates that 2,043 species of plants have been identified in the corridor, 68 percent of the national total (MEF, 2009).

Project Design

The project will monitor biodiversity over time, to track the establishment of plants and animals into the new corridor created through reforestation and to measure how successful

© Haroldo Castro/CI

the restoration efforts actually are. It is hoped that as wildlife such as birds and lemurs begin to move between re-connected forest fragments, they will assist in the distribution of plant seeds, further facilitating the re-establishment of native forest. For the REDD project component, a participatory biodiversity patrolling and monitoring system is being tested in some villages of the corridor. With this system, residents of local villages patrol the area of forest under their responsibility while recording both observed pressures on biodiversity and the relative abundance of indicators, such as the presence of particular species. The participation of communities in such monitoring will decrease the cost in the long run, train local residents in new skills, and is anticipated to give communities an increased sense of ownership with regard to the project. Preliminary results obtained to date suggest that it is one of the few approaches that enable long-term sustainable and cost-effective monitoring of the whole corridor.

© Russell A. Mittermeier/CI

Environmental Standards

The project is being designed to align with guidance provided in the Climate, Community and Biodiversity (CCB) standard and it is expected that the project will be validated under CCB at the same time that it goes through Voluntary Carbon Standard (VCS) validation.

LESSONS learned AND takeaways

REDD projects that are designed to maximize both carbon and environmental benefits help ensure the integrity of project benefits.

- REDD projects can be designed to assure environmental co-benefits in both the choice of location and activities undertaken. Projects, such as Mantadia, specifically located in corridors which connect fragmented landscapes, help re-establish or protect movement of species. Similarly, projects can be undertaken in areas identified as endangered or critical habitat for species of concern, which often overlap with areas of high-carbon potential, as visible in carbon maps. By enhancing environmental co-benefits such as biodiversity, projects can be more robust and resilient to potential threats, including the deleterious effects of climate change on forests (Stickler, et al., 2009).

Standards exist that can help ensure environmental co-benefits in forest carbon projects.

- Interventions such as non-native and/or monoculture tree plantations, which focus solely on carbon benefits, lose the opportunity to maintain or enhance biodiversity or other benefits that can strengthen the overall environmental integrity of such projects. Carbon project standards vary in the emphasis placed on environmental and community co-benefits. Project developers who wish to go one step further to include and demonstrate environmental co-benefits may use standards specifically designed to ensure them, such as CCB or FSC. Indeed, CCB principles are being used in the Mantadia project design and it is planned for the project to undergo certification to this standard. Project-level standards can provide a good basis for developing best practices at the national level and some standards, such as CCB, are working to scale up their scope to accommodate national level activities.

SECTION 8

Scale and Scope

© Mark Godfrey/TNC

Two critical policy issues being discussed in the design of incentives for REDD are the appropriate scale and scope of the mechanism. REDD activities can be undertaken on various scales, from project level to state or provincial level to national scale. The manner with which technical issues such as baselines, measuring and monitoring, leakage and permanence are dealt with can vary according to scale. As scale increases, many REDD activities are more cost-effective at achieving carbon benefits sufficient to reduce the worst impacts of climate change, and some transaction costs associated with REDD projects become less expensive.

The scope of activities that should be included within REDD mechanisms under discussion also varies widely. At one end of the spectrum is a view that would only recognize efforts to avoid complete forest conversions (e.g., oil palm development). Other proposals incorporate incentives to reduce forest degradation (which, when caused by logging, may include use of Improved Forest Management). Still others, dubbed "REDD Plus," address the full range of activities that cause or prevent emissions of terrestrial carbon (Avoided Deforestation and Forest Degradation, as well as Enhancement of Carbon Stocks, Sustainable Management of Forests and Conservation of Forests).

Yet, it is not necessary that these various levels of scale and scope be mutually exclusive. One approach that is being discussed currently, the "nested approach,"[35] would allow crediting of sub-national activities as countries moved to national scale accounting, as long as the country on a whole achieves net emissions reductions—see Figure 23 (TNC and Baker & McKenzie, 2010). This approach has the potential to address many of the drawbacks of pure national or pure sub-national approaches by accounting for in-country leakage, engaging national governments, and taking advantage of certain economies of scale, while also motivating sub-national actors to participate in REDD Plus and attracting greater private investment.

Scale

For a variety of reasons, there is an emerging consensus in the international community that it is important to develop nation-wide REDD strategies, accounting frameworks and MRV systems. The advantages of moving to national efforts are seen as three-fold: 1) magnitude of impact, 2) the ability to employ policy tools, and 3) efficiencies in addressing technical issues including leakage and permanence.

To avert the worst impacts from climate change, scientists tell us that we will need to address every major cause

35 First articulated by Lucio Pedroni, Michael Dutschke, Charlotte Streck and Manuel Estrada Porrua. See: Pedroni, L., M. Dutschke, C. Streck and M. Estrada, 2009. Creating incentives for avoiding further deforestation: the nested approach. *Climate Policy*, 9:207-220.

of emissions (IPCC, 2007b). As deforestation and land use change emit about 15 percent of total global greenhouse gas emissions (van der Werf, et al., 2009; Canadell, et al., 2007), this is a major source that cannot go unaddressed. While individual projects can credibly reduce emissions, their impact on the atmosphere is still relatively small. Much larger scale efforts—in the range of millions of hectares—will be needed to achieve reductions commensurate with the billions of tons of emissions caused by this sector each year.

The causes of land use change, including deforestation, are many and variable, and some are driven significantly by government policy and action. Such factors are difficult for project developers to affect or control at the individual project level. By engaging governments in REDD programs that span entire political jurisdictions, and eventually whole countries, it is possible to address underlying policy, enforcement and institutional issues within the purview of government entities.

While individual projects can credibly deal with technical challenges such as baselines, leakage and permanence, developing the carbon accounting methodologies to do so over small areas can be complex, as revealed by the project examples in this document. Nation-wide programs, especially for measuring and monitoring forest carbon, can achieve significant efficiencies through economies of scale while enabling leakage and permanence to be more easily captured and processed.

Carbon monitoring based on remote sensing data and field measurements becomes less costly per unit area as scale increases. There are efficiencies to be gained in analysis of satellite imagery, which relies on the same techniques and skills whether analyzing forest cover data spanning one hectare or one million hectares. Likewise, there are significant economies of scale in the number of sampling plots needed to produce statistically robust carbon measurements across large areas. The development of baselines also has the potential to become simpler and less costly per unit area in determining "business as usual" at the national scale. While project-scale REDD activities generally must employ forward-looking spatial projections of land use change in order to capture frontier movements arriving from outside the project boundaries, historical baselines derived from recent deforestation rates tend to capture many of the spatial characteristics and frontier phenomena present within a country and have been shown to be credible predictors of future trends (Griscom, et al., 2009).

© NASA

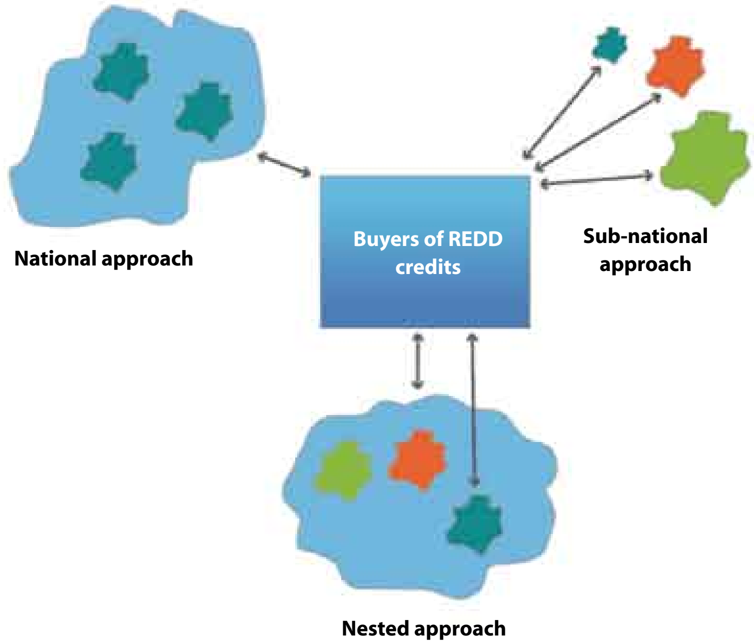


FIGURE 23 Possible crediting scales of a RE DD Plus Mechanism. Adapted from: Angelsen, A., C. Streck, L. Peskett, J. Brown, and C. Luttrell. 2008. What is the right scale for REDD? In: Moving Ahead with REDD: Issues, Options and Implications.

When it comes to leakage and permanence, there are also advantages to larger-scale efforts. While individual REDD projects can employ measures to prevent, estimate and deduct for leakage, doing so credibly often involves complex measures such as economic modeling of commodity markets well outside the control of project developers. National-level carbon accounting and forest monitoring would enable more efficient means to capture and account for leakage than is possible through individual projects. National REDD programs can function like diversified project portfolios, comprised of a variety of different efforts on the ground and at the policy level. Such programs, which span a range of activities and geographies within a country, help mitigate risks of losses that might occur from localized disturbances such as fire or pests, as well as management changes that may be confined to certain policies or places. By monitoring results across the entire portfolio, losses due to impermanence in any particular project would be reflected in nation-wide emissions numbers.

Nevertheless, implementing nation-wide programs is not without challenges. While some developing countries may have transparent systems for benefit sharing already in place, others lack the institutional capacity and legal safeguards to ensure that a centralized REDD Plus regime would equitably allocate incentives to local actors (Costenbader, 2009). As countries work to build these programs, sub-national activities (especially those undertaken across entire political jurisdictions that can serve as microcosms of the challenges at a national scale) provide important learning opportunities for countries to test options for building national capacity and institutions. Therefore, several proposed policy frameworks (including the aforementioned "nested approach") recognize the role of sub-national activities at least as part of a transition phase and support an important on-going role for sub-national activities, even after countries establish national carbon accounting frameworks. Some see the opportunity for private investment in concrete sub-national activities as critical to attracting the level of funding needed to substantially affect land use change and reduce deforestation.

Scope

As illustrated in the preceding sections, there are different technical challenges to measuring and accounting for carbon benefits from different types of forest carbon activities and, today, the methodologies applied to different types of projects (REDD vs. IFM vs. AR, for example) are often distinct. Nevertheless, on the ground, incorporating a range of forest carbon strategies within a single project makes sense both in terms of an integrated approach to landscape conservation and in substantially improving the overall project outcomes.

In many cases, forest degradation catalyzes subsequent deforestation (Griscom, et al., 2009). Therefore, strategies that alleviate drivers of degradation (strategies including reduced impact logging, forest certification, sustainable fuelwood management and improved forest governance) can help to prevent eventual deforestation. To address the underlying causes of deforestation, some REDD projects also include a reforestation component. Planted trees can provide an alternative wood source to local communities for fuel, building products and income, in effect reducing the pressure to clear primary forest for these purposes. Similarly, in areas with active commercial timber operations, Improved Forest Management might be employed to decrease forest degradation where logging continues, while other areas might be set aside for protection as high conservation value forests. Still others may be replanted to ensure long-term sustainability of the forest. In forest carbon efforts that span large regions with a range of land use categories and practices, more complex and multi-faceted approaches will be needed to address economic, environmental and social goals.

There are a multitude of possible frameworks for addressing the scale and scope of REDD (and REDD Plus) mechanisms being circulated by governments, NGOs and private organizations. Policy discussions within the United Nations Framework Convention on Climate Change and national policy development forums will flesh out the exact shape of REDD mechanism(s) to come. Meanwhile, sub-national activities functioning at a district or state level, can give a glimpse into what larger-scale and broader-scope efforts might look like.

ABOVE, CLOCKWISE FROM LEFT: © Bridget Besaw; © Scott Warren; © Adriano Gambarini

CASE STUDY

The Berau Forest Carbon Program

Large-scale forest carbon programs are needed to achieve the most significant climate change mitigation impacts. TNC is in the process of developing the Berau Forest Carbon Program in the district of Berau, on the island of Borneo, Indonesia, to address the drivers of deforestation and degradation on a regional scale using a novel approach. The program, which spans an entire political jurisdiction—a district the size of the country of Belize—takes an integrated approach to address forest-based emissions by employing a comprehensive set of strategies to address land use and deforestation. It offers a microcosm of the challenges of "scaling up" REDD efforts from isolated site-based efforts to larger landscapes characterized by a variety of different land-use types and governed by different policies. Thus, this pilot program will provide important insight into how larger-scale mechanisms can be structured and carried out on the ground in the future.

Berau—where degradation is a major source of emissions and where strong programs on forest management, certification, and timber tracking currently exist—also provides a useful laboratory for testing technical approaches to measuring and monitoring emissions from degradation, as well as the policy issues that must be addressed and the practicalities of working on the ground. An advanced system of mapping and estimating emissions from forest degradation is being developed in Berau, and Reduced Impact Logging[36] and other strategies to reduce emissions from degradation are being built on years of relationships and experience working with timber concessionaires.

As Berau seeks economic development for its people, its forests face multiple threats from legal and illegal logging, clearing for oil palm, timber plantations and coal mining. These drivers are destroying the forests of Indonesia faster than anywhere else on earth, producing 80 percent of Indonesia's carbon emissions and placing it third among the world's top emitters of greenhouse gasses. In 2007, the Government of Indonesia launched a national REDD strategy development process. The district of Berau, spanning 2.2 million hectares, 75 percent of which is still covered by forest, is working to become the first district within Indonesia to implement an integrated set of strategies to measurably conserve forests and reduce the amount of carbon it emits into the atmosphere.

FIGURE 24 The district of Berau is located just adjacent to areas of high deforestation. Cartography: J. Kerkering.

Developed in collaboration with local communities, government entities at various levels, the private sector and international NGOs, including TNC, the Berau Forest Carbon Program will involve on-the-ground conservation, financial incentives, scientific monitoring, community involvement programs and new governance structures to bring at least 800,000 hectares of forest under effective management while reducing carbon emissions by some 10 million tons over five years. The hope is that the success of Berau's program may also spur other districts in Indonesia and other tropical forest nations to do the same.

To stop the growing threat deforestation poses to Berau's economy, communities, and the climate in general, the Berau Forest Carbon Program will work at two levels. On the one hand, the program will build the capacity of local government and local communities to engage in and support sustainable land use planning, including enhanced information management and decision-making processes. These cross-cutting efforts will be also be paired with specific site-level activities to reduce forest loss and emissions from certain types of land use.

The project will expand upon existing work with eight of Berau's 13 timber concessions to implement Reduced Impact Logging practices—such as directional felling, logging trail

36 "Reduced Impact Logging" are logging techniques that result in significantly less damage to the surrounding forest and forest ecosystem. Examples of RIL include directional felling, trimming of inter-crown vines, and careful road planning.

siting and cutting of vines which connect trees—that reduce forest degradation and carbon emissions while also maintaining jobs and wood production. The program will develop a model approach for redirecting planned oil palm plantations away from healthy and undisturbed forests to already degraded areas. Strengthened management of existing but weakly enforced protected areas will help reduce carbon losses from illegal activities while ensuring the long-term health of critical habitat for key species such as orangutans, and the maintenance of ecosystem services such as flood prevention and clean drinking water. The measurement of impact from all of these efforts will be linked in an integrated carbon accounting and carbon monitoring framework that spans the entire district. Finally, a benefit sharing mechanism is envisioned to equitably distribute income to key stakeholders in the project, including communities and governments.

It is hoped that the successful implementation of the strategies undertaken in Berau will set the stage for larger-scale programs in other tropical developing nations. The project is being designed with every effort to allow it to dovetail with international climate change policies and crediting mechanisms as they develop. Such programs, which employ multiple forest carbon strategies across a large political unit, hold significant potential to achieve widespread and lasting carbon benefits from the forest sector.

© Bridget Besaw

LESSONS learned AND takeaways

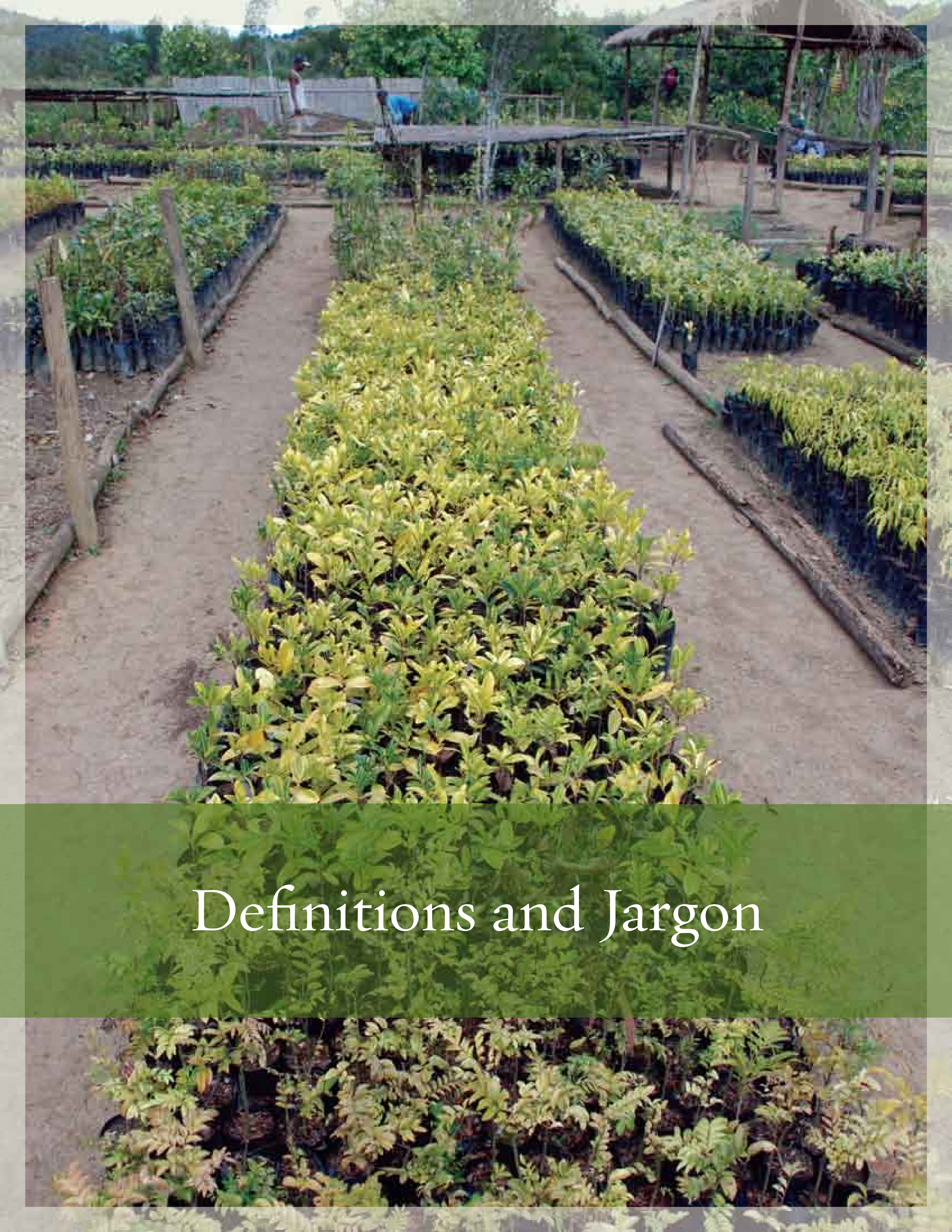
REDD projects that are broad in scale and scope provide the most significant potential for climate change mitigation through the forest sector.

- The advantages of moving to national efforts are seen as three-fold: 1) magnitude of impact, 2) the ability to employ policy tools, and 3) efficiencies in addressing technical issues including leakage and permanence. Given its geographic reach, the Berau project is able to work with the regional and national governments in Indonesia to help create the necessary institutions and capacities to affect large-scale change. The inclusion of strategies such as Reduced Impact Logging in the project design allows for the accrual of carbon benefits without significantly affecting timber supplies, effectively lessening the chances of leakage. Programs such as this are necessary to give a glimpse into the form that national scale efforts might take in the future.

Including forest degradation in the project baseline is often critical since degradation can cause substantial forest emissions.

- Emissions from degradation can play an important role in some areas where logging, fuel-wood collection and/or fire are prevalent. Furthermore, degradation often catalyzes subsequent deforestation. Strategies that employ Reduced Impact Logging techniques, forest certification, sustainable fire and fuel-wood management and improved forest governance can help to alleviate these drivers of degradation and eventual deforestation, thereby improving permanence of the climate benefits from the project. Since degradation makes up a large component of the forest carbon emissions from Berau, efforts are being made within the project to track it through advanced satellite image analysis and address it via components of the Improved Forest Management plan.

RIGHT: © Olaf Zerbock/CI



Definitions and Jargon

Activity-Shifting Leakage—Occurs when a project directly causes carbon-emitting activities to be shifted to another location, cancelling out some or all of the project's carbon benefits. See "Leakage."[37]

Afforestation—The establishment of forest on land that has been without forests for at least 50 years.[38]

Allowance—An authorization to emit a fixed amount of a pollutant (e.g. one ton of CO2e).[39]

Annex I—The 38 industrialized countries and economies in transition, as well as the European Union, listed in the Kyoto Protocol, which were committed to return their greenhouse gas emissions to 1990 levels by the year 2000.[40]

Baseline—The reference scenario or state against which change is measured. A 'current baseline' represents observable, present-day conditions. A 'future baseline' is a projected future set of conditions excluding the driving factor of interest. Alternative interpretations of the reference conditions can give rise to multiple baselines.[41]

Biodiversity—The total diversity of all organisms and ecosystems at various spatial scales (from genes to entire biomes).[42]

Biomass—The total mass of living organisms in a given area or volume; dead plant material can be included as dead biomass.[43]

Bioprospecting—The methodical search for novel pharmaceutical (and other) products from plants and microorganisms.

Biotrade—Those activities of collection/production, transformation and commercialization of goods and services derived from native biodiversity (genetic resources, species and ecosystems), under criteria of environmental, social and economic sustainability.[44]

Buffer—The amount of carbon credits, determined by risk analysis or the rules of a particular standard, which are set aside and not commercialized to ensure validity of carbon credits from a project in the event of leakage or impermanence.

Business-as-usual ("BAU")—The pre-intervention land use and emissions profile for a forest carbon project area. Also referred to as "baseline."

Cap and Trade—A system which involves the buying and selling of emission allowances, in which the total number of allowances is strictly limited or 'capped' by a regulatory authority at the desired level of emissions.

Carbon Accounting—The tracking of changes in carbon pools associated with human-induced sources and sinks of greenhouse gas emissions.

Carbon Benefits—The quantity of emissions avoided or carbon sequestered above the business-as-usual scenario, after appropriate deductions are made for leakage and impermanence. Usually measured in tons of carbon dioxide equivalent (tCO2e).

Carbon Offset—In the context of a cap and trade system, carbon offsets are emission reduction credits that are generated through activities in sectors not regulated under the cap.

Carbon Pools—Carbon-containing parts of a forest ecosystem, including above-ground biomass, below-ground biomass, dead wood, litter and soil.

37 Land Use, Land-Use Change and Forestry. IPCC, 2000—Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.) Cambridge University Press, UK. pp 375.

38 Land Use, Land-Use Change and Forestry. IPCC, 2000—Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.) Cambridge University Press, UK. pp 375.

39 U.S. Environmental Protection Agency. "Allowance Trading Basics." Clean Air Markets. 14 Apr. 2009. 2 July 2009. <http://www.epa.gov/airmarkt/trading/basics.html>

40 Glossary of Climate Change Acronyms." UNFCC. 2 July 2008. <http://unfccc.int/essential_background/glossary/items/3666. php>

41 "Appendix I: Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

42 "Appendix I: Glossary". IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

43 "Appendix I: Glossary". IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

44 Biotrade Website- Definitions and Concepts: <http://www.biotrade.org/docs/biotrade-definitions.pdf>

Carbon Stocks—The quantity of carbon in a carbon pool.[45]

Carbon Stock Enhancement—A component of a REDD Plus strategy that could include both the restoration/improvement of existing but degraded forests and increase of forest cover through environmentally appropriate afforestation and reforestation.

Carbon Carrying Capacity (CCC)— Defined as the mass of carbon able to be stored in a forest ecosystem under prevailing environmental conditions and natural disturbance regimes, but excluding human induced disturbance.[46]

Compliance (Regulatory) Market—The market for carbon credits used to reach emissions targets under a regulatory regime.

Conservation Easement—A legal agreement between a landowner and a conservation organization or government agency that permanently limits a property's uses in order to protect the property's conservation values.[47]

Decompose—The breaking-down of substances into constituent elements or parts.

Deforestation—Conversion of forest to non-forest (below 10% crown cover).[48]

Driver—The cause of an action (in this particular case, deforestation).

Ecosystem—The interactive system formed from all living organisms and their physical and chemical environment within a given area. Ecosystems cover a hierarchy of spatial scales and can comprise the entire globe, biomes at the continental scale or small, well-circumscribed systems such as a small pond.[49]

Forest–Land spanning more than 0.5 hectares with trees higher than five meters and a canopy cover of more than 10 percent, or trees able to reach these thresholds in situ. It does not include land that is predominately under agriculture or urban land use.[50]

Forest Carbon—Generally refers to the carbon stored in forests; usually in reference to climate change mitigation projects which aim to increase carbon sequestration in or decrease carbon dioxide emissions from forests.

Forest Degradation—Occurs when a forest is reduced below its natural capacity, but not below the 10 percent crown cover threshold that qualifies as deforestation.[51]

Forest Type—Refers to a discrete forested area and the species that make up that area (e.g., redwood, evergreen, etc.).

Frontier Deforestation—That which is predicted to occur at some point during a project crediting period in an area with historically low deforestation rates but the potential for future incursion, settlement and/or infrastructure development.[52]

Greenhouse Gases—Gaseous constituents of the atmosphere, both natural and human- caused, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth's surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapor, carbon dioxide, nitrous oxide, methane and ozone are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine and bromine containing substances.[53]

---

45 Food and Agriculture Organization of the United Nations. "Terms and Definitions for the National Reporting Tables for FRA 2005." 2005. FAO Corporate Document Repository. 2 July 2009. <http://www.fao.org/docrep/007/ae156e/AE156E03.htm#P236_10121>46 Gupta, R.K. & Rao, D.L.N. 1994. Potential of wastelands for sequestering carbon by reforestation. Current Science, 66, 378–380.

46 Gupta, R.K. & Rao, D.L.N. 1994. Potential of wastelands for sequestering carbon by reforestation. Current Science, 66, 378–380.

47 Triangle Land Conservancy. "Glossary of Land Conservation Terms and Techniques." Triangle Land Conservancy. 24 Nov. 2008. 2 July 2009. <http://www.triangleland.org/landowner/glossary.shtml>

48 Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

49 "Appendix I: Glossary". IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

50 Land Use, Land-Use Change and Forestry. IPCC, 2000—Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.) Cambridge University Press, UK. pp 375.

51 In the context of the Kyoto Protocol, as stipulated by the Marrakesh Accords, cf. paragraph 1 of the Annex to draft decision-/CMP.1 (Land Use, Land-use Change and Forestry) contained in document FCCC/CP/2001/13/Add.1, p.58.

52 Voluntary Carbon Standard (VCS) Guidance for Agriculture, Forestry and Other Land Use Projects. Released November 18, 2008b..

53 Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

High Grading—A harvesting technique that removes only the biggest and most valuable trees from a stand and provides high returns at the expense of future growth potential.[54]

Improved Forest Management (IFM)—Forest management activities which result in increased carbon stocks within forests and/or reduce GHG emissions from forestry activities when compared to business-as-usual forestry practices.

Landsat—The world's longest continuously acquired collection of space-based moderate-resolution (30 meter) land remote sensing data.[55]

Leakage—The unexpected loss of anticipated carbon benefits due to the displacement of activities in the project area to areas outside the project, resulting in carbon emissions. Leakage can negate some or all of the carbon benefits generated by a project. Although not often acknowledged, leakage can also be positive, if best practices are adopted outside of the project area and gain widespread use.[56]

Lidar—Lidar (Light Detecting and Ranging) is a remote sensing technology that uses laser scanning to collect height or elevation data.[57]

Litter–Plant residues on the soil surface that have not yet decomposed (e.g. fallen leaves).[58]

Market Leakage—Occurs when a project changes the supply-and-demand equilibrium, causing other market actors to shift their activities. See "Leakage."

Methodology—A detailed approach to determining a project baseline, greenhouse gas sources and sinks, specific additionality tests and planned monitoring processes under a standard, specific to the particular project type and circumstance.

Mosaic Deforestation—Occurring where population pressure and local land use practices produce a patchwork of cleared lands, where forests are accessible and where the agents of deforestation and degradation typically are present within the region containing the area to be protected.[59]

Non-Annex I—Refers to countries, mainly developing nations, that have ratified or acceded to the United Nations Framework Convention on Climate Change and are not included in Annex I of the Kyoto Protocol.[60]

Performance Period—Period of time in a regulatory greenhouse gas mitigation scheme during which countries are required to reduce emissions by a specific amount. For example, the Kyoto Protocol has a performance period of 2008-2012 during which signatories to the Protocol must reduce emissions by 5 percent against 1990 emissions levels.

Permanence—Refers to how robust a project is to potential changes that could reverse the carbon benefits of the project at a future date.

Photosynthesis—The process by which plants take carbon dioxide from the air to build carbohydrates, releasing oxygen in the process.[61]

Pixel—The smallest discrete component of an image or picture.

Radar—Short for 'radio detection and ranging,' radar sends out short pulses of microwave energy and records the returned signal's strength and time of arrival.[62]

Real—With regard to carbon markets, the assurance that credited carbon benefits actually occurred.

Reduced Impact Logging (RIL)—Logging techniques that result in significantly less damage to the surrounding forest and forest ecosystem. Examples of RIL include directional felling, trimming of inter-crown vines, and careful road planning.

---

54 North Carolina Forestry Association Website: <www.ncforestry.org/docs/Glossary/term.htm>

55 USGS Website: <http://landsat.usgs.gov/about_project_descriptions.php>

56 IUFRO. "Carbon in Forests Multilingual Glossary of carbon-related forest terminology." 2 July 2009. <http://iufro-archive.boku.ac.at/silvavoc/carbonglossary/main.php?type=aph >

57 "Glossary of Terms." Ordnance Survey Ireland. 2009. 2 July 2009. <http://www.osi.ie/en/alist/glossary-of-terms.aspx>

58 U.S, Environmental Protection Agency. "Glossary of Climate Change Terms." Global Warming. 2000. 2 July 2009. <http://yosemite.epa.gov/oar/globalwarming.nsf/content/glossary.html>

59 Voluntary Carbon Standard (VCS) Guidance for Agriculture, Forestry and Other Land Use Projects. Released November 18, 2008b. < http://www.v-c-s.org/docs/Guidance%20for%20AFOLU%20Projects.pdf>

60 IPCC Glossary of Climate Change Acronyms: <http://unfccc.int/essential_background/glossary/items/3666. php#N>

61 Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

62 USGS Online Glossary: <http://landsat.usgs.gov/tools_glossary_R.php>

Reducing Emissions from Deforestation and Degradation (REDD)—Activities that reduce the conversion of native or natural forests to non-forest land, often coupled with activities that reduce forest degradation and enhance carbon stocks of degraded and/or secondary forests that would be deforested in the absence of the project activity.[63]

Reference Area—As pertaining to a forest carbon project, a larger area with similar conditions, agents and drivers used for comparison over time.

Reforestation—The establishment of forest on land that has not had tree cover for at least 10 years.[64]

Remote Sensing—Instruments that record characteristics of objects at a distance, sometimes forming an image by gathering, focusing and recording reflected light from the sun, or reflected radio waves emitted by the spacecraft.[65]

Resolution—A measure of the amount of detail that can be seen in an image.[66]

Scale—The relative physical size/reach of forest carbon activities.

Scope—The range of forest carbon activities included in a project.

Source—Any process, activity or mechanism that releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol into the atmosphere.[67]

Sequestration—The process of increasing the carbon content of a reservoir/pool other than the atmosphere (in this case specifically referring to uptake by trees and soil).[68]

Standard—Rule or code mandating or defining product performance. In this particular case, referring to sets of rules set forth for projects within the voluntary carbon market.[69]

Sink—Any process, activity or mechanism that removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas or aerosol from the atmosphere.[70]

Sustainable Management of Forests—The management of forest areas designated for the production of timber in such a way as to effectively balance social, economic and ecological objectives.

Validation—A process by which an independent third-party organization, which has been certified to evaluate projects according to a specific standard, thoroughly reviews the design, methodologies, calculations and strategies employed in a project, ensuring the project follows the rules of the chosen standard.

Verification—The periodic independent review and ex-post determination of the monitored reductions in anthropogenic emissions by sources of greenhouse gases or increases in carbon stocks (carbon benefits) that have occurred as a result of a project activity during the verification period.[71]

Voluntary Carbon Market—Unregulated market for carbon credits.[72]

63 "Voluntary Carbon Standard—Guidance for Agriculture, Forestry and Other Land Use Projects (VCS 2007.1, 2008)." VCS Association. Available at: www.vc-s.org.

64 Land Use, Land-Use Change and Forestry. IPCC, 2000—Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.) Cambridge University Press, UK. pp 375.

65 USGS Online Glossary: <http://landsat.usgs.gov/tools_glossary_R.php>

66 USGS Online Glossary: <http://landsat.usgs.gov/tools_glossary_R.php>

67 Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

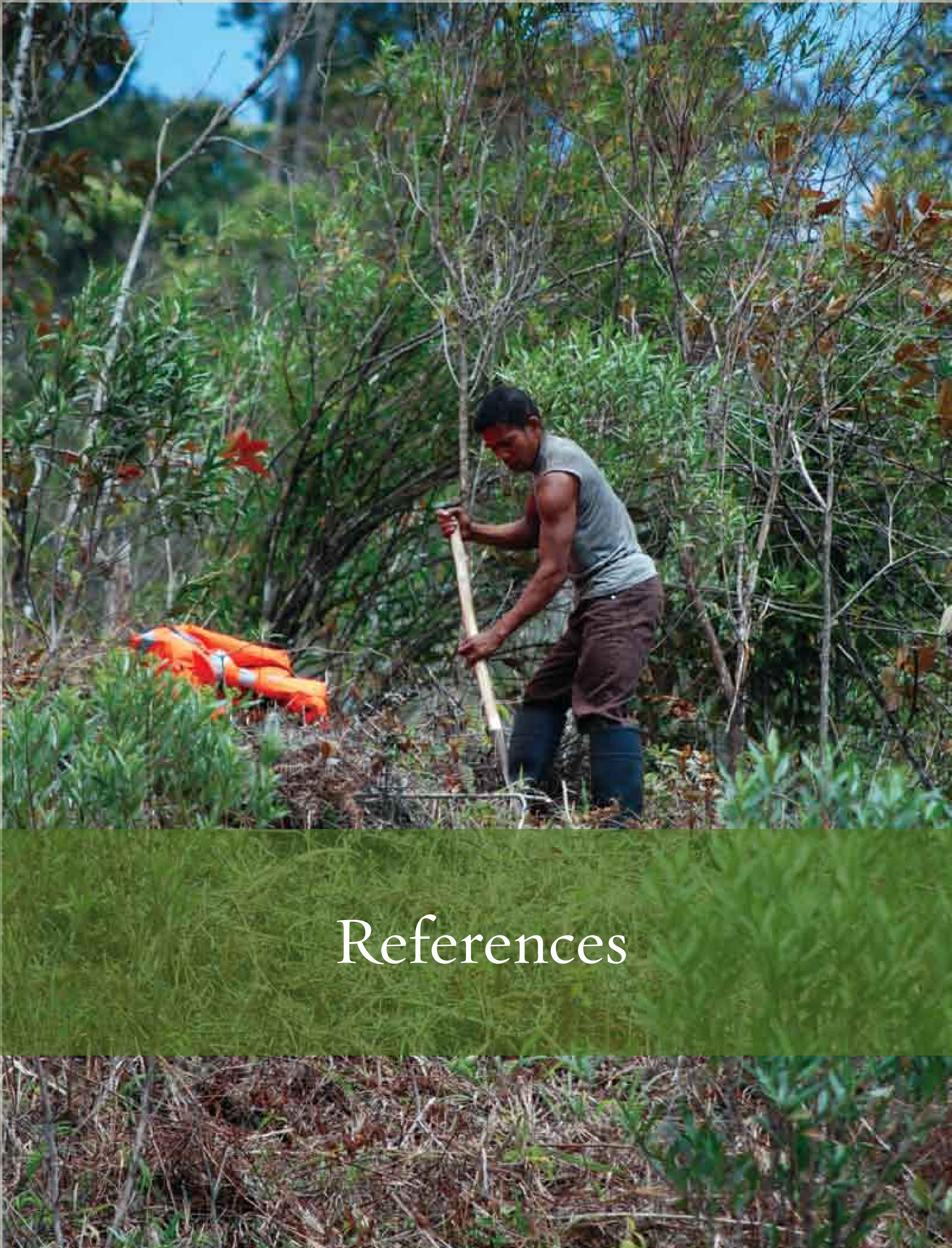
68 "Appendix I: Glossary". IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

69 Verbruggen, Aviel. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg3.pdf>

70 Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

71 "Appendix I: Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

72 "Glossary." Carbon Counter. 2007. 2 July 2009. <http://www.epaw.co.uk/carbon/glossary.html>



References

African Development Bank. 2003. Poverty and Climate Change: Reducing the Vulnerability of the Poor through Adaptation. <http://www.oecd.org/dataoecd/60/27/2502872.pdf>

Alencar, A., D. Nepstad and M. Carmen Vera Diaz. 2006. Forest Understory Fire in the Brazilian Amazon in ENSO and Non-ENSO Years: Area Burned and Committed Carbon Emissions. Earth Interactions 10 (6).

"Appendix I: Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg2.pdf>

Asner, G.P., D.E. Knapp, E.N. Broadbent, P.J.C. Oliveira, M. Keller and J.N. Silva. 2005. Selective logging in the Brazilian Amazon. Science 310: 480-482.

Asquith, N.M., M. Vargas Rios and J Smith. 2002. Can forest protection carbon projects improve rural livelihoods? Analysis of the Noel Kempff Mercado Climate Action Project, Bolivia. Mitigation and Adaptation Strategies for Global Change 7: 323- 337.

Baede, A.P.M. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg1.pdf>

Biotrade Website. "Definitions and Concepts." <http://www.biotrade.org/docs/biotrade-definitions.pdf>

Brown Sandra, David Shoch, Tim Pearson and Matt Delaney. 2004. "Methods for Measuring and Monitoring Forest Carbon Projects in CA." Winrock International: Arlington VA, for the Regents of California/ California Institute of Energy Efficiency.

Cairns, M. A., S. Brown, E. H. Helmer and G. A. Baumgardner. 1997. Root biomass allocation in the world's upland forests. Oecologia 111:1–11.D.

Calderón Angeleri, Natalia. Livelihood Impact Assessment: NK- CAP, Bolivia, November 2005. Annex 6 of PDD.

California Climate Action Registry (CCAR). 2007. Forest Project Protocol version 2.1. <http://www.climateregistry.org/tools/protocols/project-protocols.html>

Campbell, Robert Wellman, ed. 1997. "Rondônia, Brazil: 1975, 1986, 1992." Earthshots: Satellite Images of Environmental Change. U.S. Geological Survey. This article was released 14 February 1997. <http://earthshots.usgs.gov>

Canadell J.G., C. Le Qué, M.R. Raupach, C.B. Field, E.T. Buitenhuis, P. Ciais, T.J. Conway, N.P. Gillett, R.A. Houghton, G. Marland. 2007. Contributions to accelerating atmospheric CO_2 growth from economic activity, carbon intensity, and efficiency of natural sinks. PNAS Early Edition10.1073/pnas.0702737104.

Clark Laboratories. 2008. Land Change Modeler software package. <http://www.clarklabs.org/products/Land-Change-Modeler-Overview.cfm>

Clean Development Mechanism (CDM) website July, 17 2009: <http://cdm.unfccc.int/Projects/projsearch.html>

Clean Development Mechanism (CDM). Reforestation or afforestation of land currently under agricultural use: Version 4, AR-AM0004. <http://cdm.unfccc.int/UserManagement/FileStorage/KYBDLQFMI6R20X58OGH3Z71N9TSU4A>

Clean Development Mechanism (CDM). Tool for the demonstration and assessment of additionality in AR CDM project activities: Version 2, EB 35, annex 17.
<http://cdm.unfccc.int/methodologies/ARmethodologies/tools/ar-am-tool-01-v2.pdf>

Climate Change Philanthropy Action Network. "Climate Change Glossary." CCPAN. 2007. 2 July 2009. <http://www.climate-philanthropists.org/basics>

Cortez, Rane, et al. 2009. Introductory Course on Reducing Emissions from Deforestation and Degradation (REDD): A Participant Resource Manual.

Costenbader, J. 2009. *Legal Frameworks for REDD: Design and Implementation at the National Level.* International Union for Conservation of Nature and Natural Resources (IUCN).

Eliasch Review. 2008. Climate Change: Financing Global Forests. Crown Copyright.

Environmental Protection Agency (EPA). EPA Analysis of the American Clean Energy and Security Act of 2009 H.R. 2454 in the 111th Congress. June 23, 2009.
<http://www.epa.gov/climatechange/economics/pdfs/HR2454_Analysis.pdf>

Fundación Amigos de la Naturaléza (FAN). 2006. Project Design Document for Noel Kempff Mercado Climate Action Project. <http://conserveonline.org/workspaces/climate.change/ClimateActionProjects/NoelKempff/NKPDD/PDDZip/view.html>

Food and Agriculture Organization for the United Nations (UNFAO). 2002. "Degradation." FAO Corporate Document Repository. 2 July 2009. <http://www.fao.org/DOCREP/005/Y4171E/Y4171E21.htm#TopOfPage>

Food and Agriculture Organization for the United Nations (UNFAO). 2005. Global Forest Resources Assessment 2005. Rome, Italy.

Food and Agriculture Organization of the United Nations (UNFAO). 2005. "Terms and Definitions for the National Reporting Tables for FRA 2005." FAO Corporate Document Repository. 2 July 2009. <http://www.fao.org/docrep/007/ae156e/AE156E03.htm#P236_10121>

Gerwing, J.J., J.S. Johns and E. Vidal. 1996. Reducing waste during logging and log processing: Forest conservation in eastern Amazonia.. Unasylva—An international journal of the forestry and food industries, FAO—Food and Agriculture Organization of the United Nations. Vol. 47, No. 187. <http://www.fao.org/docrep/w2149E/w2149e05.htm>

"Glossary." Carbon Counter. 2007. 2 July 2009. <http://www.epaw.co.uk/carbon/glossary.html>

"Glossary of Climate Change Acronyms." UNFCC. 2 July 2009. <http://unfccc.int/essential_background/glossary/items/3666.php>

"Glossary of Terms." Ordnance Survey Ireland. 2009. 2 July 2009. <http://www.osi.ie/en/alist/glossary-of-terms.aspx>

Goodman, S.M. and B.D. Patterson (eds). 1997. Natural change and human impact in Madagascar. Smithsonian Institution Press. Washington DC.

Griscom, B., D. Ganz, N. Virgilio, F. Price, J. Hayward, R. Cortez, G. Dodge, J. Hurd, S. Marshall and B. Stanley. 2009. "The Missing Piece: Including Forest Degradation in a REDD Framework." TNC draft report.

Gupta, R.K. & Rao, D.L.N. 1994. Potential of wastelands for sequestering carbon by reforestation. Current Science, 66, 378–380.

Hamilton, Katherine, Milo Sjardin, Allison Shapiro, and Thomas Marcello. 2009. Fortifying the Foundation: State of the Voluntary Carbon Markets 2009. Ecosystem Marketplace and New Carbon Finance, Washington, D.C.

Hamilton, K., U. Chokkalingam and M. Bendana. 2010. State of the Forest Carbon Markets 2009: Taking Root & Branching Out. Ecosystem Marketplace, Washington, D.C.

Houghton, J.T., G.J. Jenkins, and J. J. Ephraums. (eds.). 1990. IPCC First Assessment Report. Cambridge, England: Cambridge University Press.

Houghton, R.A. 2005. Tropical Deforestation as a Source of Greenhouse Gas Emissions. In: Tropical Deforestation and Climate Change 2005. Amazon Institute for Environmental Research.

Intergovernmental Panel on Climate Change (IPCC), 2007a. Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (Eds.)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Intergovernmental Panel on Climate Change (IPCC), 2007b. Summary for Policymakers. In: Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, [Core Writing Team, Pachauri, R.K. and Reisinger, A. (Eds.)], Geneva, Switzerland.

Intergovernmental Panel on Climate Change (IPCC). 2007c. Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, [Core Writing Team, Pachauri, R.K. and Reisinger, A. (Eds.)], Geneva, Switzerland.

Intergovernmental Panel on Climate Change (IPCC). 2007d. Summary for Policymakers. In: Climate Change 2007: Mitigation. Contribution of Working Group III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [B. Metz, O.R. Davidson, P.R. Bosch, R. Dave, L.A. Meyer (Eds.)], Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Intergovernmental Panel on Climate Change (IPCC) Glossary of Climate Change Acronyms: <http://unfccc.int/essential_background/glossary/items/3666.php#N>

International Union of Forest Research Organizations (IUFRO). "Carbon in Forests Multilingual Glossary of carbon-related forest terminology." 2 July 2009. <http://iufro-archive.boku.ac.at/silvavoc/carbon-glossary/main.php?type=aph>

Jenkins, M.D. 1987. Madagascar: an environmental profile. IUCN, Gland.

Land Use, Land-Use Change and Forestry. IPCC, 2000—Robert T. Watson, Ian R. Noble, Bert Bolin, N. H. Ravindranath, David J. Verardo and David J. Dokken (Eds.) Cambridge University Press, UK. pp 375.

Langrand, O. and L. Wilme. 1997. Effects of Forest Fragmentation on Extinction Patterns of Endemic Avifauna on the Central High Plateau of Madagascar. In Goodman, S.M. and B.D. Patterson (eds). 1997. Natural change and human impact in Madagascar. Smithsonian Institution Press. Washington DC.

Lynch, O.J. 1995. Involving local people in the management and harvesting of non-wood forest products. In: Beyond Timber: Social, economic and cultural dimensions of non-wood forest products in Asia and the Pacific. Proceedings of a regional expert consultation. 28 November–2 December 1994. Bangkok: FAO/RAP.

Martin, N., D. Shoch, T. Pearson and A. Dushku. 2004. Feasibility Study for an Avoided Deforestation Project in the Makira Region of Madagascar. November 24, 2004, Winrock International.

Ministère d'Environnement, Forêts et Tourisme (MEFT), U.S. Agency for International Development (USAID), and Conservation International (CI). 2009. Evolution de la couverture de forêt naturelle à Madagascar, 1990-2000-2005.

Myers, Erin C. "Climate Change and Forestry: A REDD Primer" Forest Carbon Portal. 19 May 2008. 2 July 2009. <http://www.forestcarbonportal.com/article.php?item=20>

Myers Madeira, Erin C. "Policies to Reduce Emissions from Deforestation and Degradation (REDD) in Developing Countries." Resources for the Future. Dec. 2007. <http://www.rff.org/RFF/Documents/RFF-Rpt-REDD_final.2.20.09.pdf>.

Neef, Till, Lisa Ashford, Jeff Calvert, Claire Davey, Joanna Durbin, Johannes Ebeling, Tilde Herrera, Toby Jansen-Smith. 2009. The Forest Carbon Offsetting Survey. Ecosecurities in partnership with Conservation International, Climate Community and Biodiversity Alliance and Climate Biz. <http://www.ecosecurities.com/Registered/ECOForestrySurvey2009.pdf>

Nelson, Andrew and Kenneth M. Chomitz. 2009. Protected Area Effectiveness in Reducing Tropical Deforestation: A Global Analysis of the Impact of Protection Status. The World Bank, Washington D.C.

North Carolina Forestry Association Website: <www.ncforestry.org/docs/Glossary/term.htm>

Paltsev, Sergey. The Kyoto Protocol, Regional and Sectoral Contributions to Carbon Leakage. The Energy Journal, Volume 22, Number 4, 2001.

Pedroni, L. 2008. Methodology for Estimating Reductions of GHG Emissions from Mosaic Deforestation. Prepared for the BioCarbon Fund. RED-NM-001 / Version 01, 4 July 2008.

Pimentel, D, L.E. Buck *et al.* 1997. Forests and food security. *Human Ecology* Vol. 25 (1).

Putz, F.E., P.A. Zuidema, M.A. Pinard, R.G.A. Boot, J.A. Sayer, D. Sheil, P. Sist, Elias and J.K. Vanclay. 2008. Improved tropical forest management for carbon retention. PLoS Biol 6: e166. doi: 10.1371/journal.pbio.0060166.

Robertson, Nina and Sven Wunder. 2005. Fresh tracks in the forest: assessing incipient payments for environmental services initiatives in Bolivia. CIFOR, Bogor, Indonesia. This study cites three project impact studies, conducted by Milne et al. (2001), Asquith et al. (2002) and Boyd (in May et al. 2003; and 2004).

Roy, D.P., L. Boschetti, C.O. Justice, and J. Ju. 2008. The collection 5 MODIS burned area product—Global evaluation by comparison with the MODIS active fire product. Remote Sensing of Environment 112: 3690-3707.

Schmidt, J. and Alonso, L.E. (eds.). 2005. A rapid biological assessment of the Mantadia-Zahamena corridor, Madagascar. RAP Bulletin of Biological Assessment No. 32. Conservation International. Washington D.C.

Société Générale de Surveillance (SGS). 2005. Validation and Verification of the Noel Kempff Mercado Climate Action Project.

Société Générale de Surveillance (SGS) and Scientific Certification Systems (SCS). 2007. Initial verification of California Climate Action Registry conservation-based forest management project for The Conservation Fund's Garcia River Forest Project. California. <https://thereserve1.apx.com/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=193&IDKEY=akjalskjf098234kj28098sfkjlf098098kl32lasjdflkj909j266147>

Sohngen, B. and S. Brown.2004. 'Measuring leakage from carbon projects in open economies: a stop timber harvesting project in Bolivia as a case study,' Canadian Journal of Forest Research 34, 829–839.

Souza C., and D. Roberts. 2005. Mapping forest degradation in the Amazon region with Ikonos images. Int. J. Remote Sensing 26: 425–429.

Stern, N. 2006. Stern Review: The economics of climate change. London: UK Treasury. Available from: <http://www.hm-treasury.gov.uk/independent_reviews/stern_review_economics_climate_change/sternreview_index.cfm>

Stickler, C.M., D.C. Nepstad, M.T. Coe, D.G. McGrath, H.O. Rodrigues, W.S. Walker, B.S. Soares-Filho, and E.A. Davidson. 2009. The potential ecological costs and co-benefits of REDD: a critical review and case study from the Amazon region. *Global Change Biology* 15:2803–2824.

The Conservation Fund (TCF). 2006. Garcia River Forest Integrated Resource Management Plan. Larkspur, California. pg. 82.

The Conservation Fund (TCF). Climate Action Reserve Forest Project Annual Monitoring Report. 29 April 2009. Publicly available document: <https://thereserve1.apx.com/mymodule/ProjectDoc/Project_ViewFile.asp?FileID=748&IDKEY=liquwesdfmnk0iei23nnm435oiojnc909dsflk9809ad lkmlkfi1031492>

The Nature Conservancy (TNC) and Baker & McKenzie LLP. 2010. A Nested Approach to REDD Plus: Structuring effective and transparent incentive mechanisms for REDD+ implementation at multiple scales. In Press.

Triangle Land Conservancy. "Glossary of Land Conservation Terms and Techniques." Triangle Land Conservancy. 24 Nov. 2008. 2 July 2009. <http://www.triangleland.org/landowner/glossary.shtml>

United Nations Declaration on the Rights of Indigenous Peoples (DRIPs). Adopted by the General Assembly 13 September 2007.<http://www.un.org/esa/socdev/unpfii/documents/DRIPS_en.pdf>

United Nations Environment Programme World Conservation Monitoring Centre (UNEP-WCMC). 2008. Carbon and biodiversity: a demonstration atlas. Eds. Kapos V., Ravilious C., Campbell A., Dickson B., Gibbs H., Hansen M., Lysenko I., Miles L., Price J., Scharlemann J.P.W., Trumper K. UNEP-WCMC, Cambridge, UK.

United Nations Framework Convention on Climate Change (UNFCCC) website July, 17 2009: <http://unfccc.int/essential_background/convention/items/2627.php>

United Nations Development Group (UNDG). 2008. UNDG Guidelines on Indigenous Peoples' Issues.<http://www2.ohchr.org/english/issues/indigenous/docs/guidelines.pdf>

U.S. Agriculture and Forestry Greenhouse Gas Inventory: 1990-2005. Global Change Program Office, Office of the Chief Economist, U.S. Department of Agriculture. Technical Bulletin No. 1921. 161 pp. August, 2008. <http://www.usda.gov/oce/global_change/AFGGInventory1990_2005.htm>

U.S. Environmental Protection Agency (USEPA). "Allowance Trading Basics." Clean Air Markets. 14 Apr. 2009. 2 July 2009. <http://www.epa.gov/airmarkt/trading/basics.html>

U.S. Environmental Protection Agency (USEPA). "Glossary of Climate Change Terms." Global Warming. 2000. 2 July 2009. <http://yosemite.epa.gov/oar/globalwarming.nsf/content/glossary.html>

U.S. Geological Survey (USGS) "Online Glossary." 2 July 2009. <http://landsat.usgs.gov/tools_glossary_R.php>

U.S. Geological Survey (USGS) Website: <http://landsat.usgs.gov/about_project_descriptions.php>

van der Werf, G. R., D. C. Morton, R. S. DeFries, J. G. J. Olivier, P. S. Kasibhatla, R. B. Jackson, G. J. Collatz and J. T. Randerson. 2009. CO2 emissions from forest loss. Nature Geoscience 2: 737-738.

Verbruggen, Aviel. "Annex I Glossary." IPCC Fourth Assessment Report. 2007. <http://www.ipcc.ch/pdf/glossary/ar4-wg3.pdf>

Voluntary Carbon Standard (VCS) 2007.1. Released November 18,2008a.<http://www.v-c-s.org/docs/Voluntary%20Carbon%20Standard%202007_1.pdf>

Voluntary Carbon Standard (VCS) Guidance for Agriculture, Forestry and Other Land Use Projects. Released November 18, 2008b. <http://www.v-c-s.org/docs/Guidance%20for%20AFOLU%20 Projects.pdf>

Walker, S.M., T.R.H. Pearson, N. Harris and S. Brown. 2009. Terrestrial Carbon Measurement Standard Operating Procedures. Winrock International.

A collaboration of The Nature Conservancy, Conservation International and Wildlife Conservation Society

The Nature Conservancy
Protecting nature. Preserving life.™

CONSERVATION INTERNATIONAL

WILDLIFE CONSERVATION SOCIETY

The Nature Conservancy
4245 North Fairfax Drive, Suite 100
Arlington, Virginia 22203 USA
+1 (703) 841-5300

nature.org

Conservation International
2011 Crystal Drive, Suite 500
Arlington, VA 22202 USA
+1 (703) 341-2400

conservation.org

Wildlife Conservation Society
2300 Southern Boulevard
Bronx, New York 10460 USA
+1 (718) 220-5100

wcs.org

Printed on recycled paper using vegetable-based inks and 100% wind power.