Learning to Manage Land Sustainably with Climate Change Mitigation Co-benefits:

Lessons from the Sustainable Land Management and Climate Change Mitigation Co-benefits (SLM-CCMC) Project

ISBN: 978-92-807-3850-6

Job number: DEW/2348/NA

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Cover photograph: Anna Pepper (annapeppersa@gmail.com)

Suggested citation

United Nations Environment Programme (2021). Learning to Manage Land Sustainably with Climate Change Mitigation Co-benefits: Lessons from the Sustainable Land Management and Climate Change Mitigation Co-benefits (SLM-CCMC) Project Nairobi.

www.unep.org

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Acknowledgements

The United Nations Environment Programme (UNEP) would like to thank the authors, reviewers and the steering committee for their contribution to the preparation of this report. The authors and reviewers have contributed to the report in their individual capacities. Their affiliations are mentioned for identification purposes only.

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Thanks also to the Project Steering Committee:

Eleanor Milne, Keith Paustian, Mark Easter, Hanspeter Liniger, Tatenda Lemann, Jeffrey Herrick, Meghan Mize, Edoardo Zandri, Maarten Kappelle, Victoria Luque Panadero

Design, layout and printing

Pouran Ghaffarpour (Publishing Services Section, UNON, Nairobi, ISO 10041:2004 certification.)

Financial and organizational support

The work described in this publication includes work conducted under a Global Environment Facility (GEF) co-financed project, 'Sustainable Land Management and Climate Change Mitigation Co-benefits (SLM-CCMC)'. It includes the work of project partners (Chapters 1 and 2 with partners listed below) and work carried out with other GEF-funded projects who used SLM-CCMC project tools (these projects are described in Chapter 4, listed below). The work of these associated GEF projects goes beyond the scope of the SLM-CCMC project and the work that is described in this publication.

Please refer to partner and project websites for more information on the significant and ongoing work.

Project Resources

CBP – Online tools for agriculture, forestry and land management projects to estimate the impact of their activities on climate change mitigation (carbon stock changes and greenhouse gas (GHG) emissions) plus training videos, tutorials and power points., please visit www.carbonbenefitsproject.org and The Carbon Benefits Platform on YouTube The Carbon Benefits Platform - YouTube

WOCAT – an online global database of sustainable land management (SLM) approaches and technologies, please visit wocat.net

LandPKS – a mobile app and online system for storing, accessing and sharing data, information and knowledge, please visit landpotential.org

- GEF Project Case Studies described in Chapter 4
- The Community-Based Integrated Natural Resources Management Project (CBINReMP) in Ethiopia, GEF agency: IFAD, GEF project ID: 3367.
- Multiplying Environmental and Carbon Benefits in High Andean Ecosystems, and its correspondence (Ecuador and Peru), GEF agency UNEP, GEF project ID GFL-5060-2711-4C61.
- Scaling up Sustainable Land Management and Agrobiodiversity Conservation to Reduce Environmental Degradation in Small Scale Agriculture in Western Kenya. GEF Agency: UNEP, GEF Project ID: 5272.
- Securing multiple ecosystems benefit through SLM in the productive but degraded landscapes of South Africa. GEF agency UNDP, GEF project ID 5327.

Acronyms and Abbreviations

AFD-CFT	Agence Française de Développement Carbon Footprint Tool
AFOLU	The Agriculture Forestry and Other Land Use
AGRA	The Alliance for a Green Revolution in Africa
CACILM 2	Integrated natural resources management in drought-prone and salt-affected agricultural production landscapes in Central Asia and Turkey
CAT-AR	Carbon Assessment Tool for Afforestation and Reforestation
CBA	Cost-benefit analysis
CBINReMP	The Community-Based Integrated Natural Resources Management Project
CBP	Carbon Benefits Project
CBP SA and DA	The Carbon Benefits Project Simple and Detailed Assessment tools
CCAFS	Climate Change, Agriculture, and Food Security Mitigation Options Tool
CIHEAM	International Centre for Advanced Mediterranean Agronomic Studies
CONDESAN	Consorcio para el Desarrollo Sostenible de la Ecorregion Andina
CSU	Colorado State University
DPSIR	The Driver-Impact-Response Analysis
EDF	Environmental Defence Fund
EX-ACT	Ex-Ante Carbon-Balance Tool
FAO	The United Nations Food and Agricultural Organisation
GCF	Green Climate Fund
GEF	Global Environment Facility
GEF5	Global Environment Facility 5
GHG	Greenhouse gas
GIS	Geographic Information System
ICRAF	World Agroforestry Centre
ID	Identification
IFAD	International Fund For Agricultural Development
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	Intergovernmental Panel on Climate Change
ISBN	International Standard Book Number
ISRIC	World Soils Information
KALRO	Kenya Agricultural and Livestock Research Organization
LandPKS	Land Potential Knowledge System
LDN	Land Degradation Neutrality
NDCs	Nationally Determined Contributions
NGO	Non-Governmental Organisation
PBSO	Peacebuilding Support Office
SDGs	The Sustainable Development Goals
SILC	The Sustainability Innovation Lab at Colorado
SLM	Sustainable Land Management
SLM-CCMC	Sustainable Land Management and Climate Change Mitigation Co-benefits
UEA	University of East Anglia
UN Women	The United Nations Entity for Gender Equality and the Empowerment of Women
UNCCD	United Nations Convention to Combat Desertification
UNDP	United Nations Development Programme
UNDPPA	United Nations Department of Political and Peacebuilding Affairs
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change

UNSD	The United Nations Statistical Division
USAID	The United States Agency for International Development
USDA-ARS	The United States Department of Agriculture - Agricultural Research Service
WB	World Bank
WOCAT	World Overview of Conservation Approaches and Technologies

Foreword

Land is more than an environmental resource. We rely on land for every aspect of our existence, meaning land-use change and its impact on ecosystem services have serious consequences for human wellbeing. Indeed, land-use change is the primary transmission pathway for emerging infectious diseases, and with the rate of land conversion accelerating globally, future land use decisions will form the foundation of our efforts to 'build back better' in the wake of both the COVID-19 pandemic and the accelerating impacts of climate change.

The recent report *Preventing the Next Pandemic: Zoonotic diseases and how to break the chain of transmission* (a joint effort by UNEP and the International Livestock Research Institute) identifies ten practical steps that governments can take to prevent future zoonotic disease outbreaks, three of which explicitly refer to the critical role of sustainable land management:

1. Incentivizing sustainable land management practices and developing alternatives for food security and livelihoods that do not rely on the destruction of habitats and biodiversity;
2. Supporting the sustainable management of landscapes and seascapes that enhance sustainable co-existence of agriculture and wildlife;
3. Operationalizing the One Health approach in land use and sustainable development planning, implementation and monitoring, among other fields.

The Global Environment Facility (GEF) funded Sustainable Land Management and Climate Change Co-benefits (SLM-CCMC) project focuses on the importance of the linkages between sustainable land management and climate change mitigation efforts and employs and improves on technical tools to document these co-benefits. This joint and participatory effort has resulted in a tailored set of tools that land managers can easily apply to help realize the climate change mitigation co-benefits of SLM practices and choose the most adequate and effective SLM practices to support sustainable development.

To fully understand the broad impacts of this project will take time and reflection, and this publication takes a first step to diving into the lessons learned from the project. Firstly, the tools involved in the SLM-CCMC project partnership are summarized – the Carbon Benefits Project (CBP) carbon accounting tools, the WOCAT database of sustainable land management technologies and approaches, and the LandPKS mobile app – followed by an overview of the linkages in the toolset and a summary of the enhancements and trainings that have taken place so far.

The SLM-CCMC project had a global impact. The CBP tools alone have been used in over 160 countries and WOCAT now documents over 1600 SLM technologies. This impact will continue to grow as the benefits of using an integrated toolset materialize. The toolset shows the potential for a larger platform of linked tools and datasets, with an expanded network of partners and tools, which could address multiple ecosystem services, alleviate the burden of multiple reports, and move us closer to the realisation of multiple global environmental benefits through the sustainable management of land.

Sincerely,
Johan Robinson, UNEP GEF

Executive Summary

Sustainable land management (SLM) is crucial to many ecosystem services. However, SLM is not normally aimed at climate change mitigation, meaning these co-benefits are often underestimated or go unreported.

The Sustainable Land Management and Climate Change Mitigation Co-benefits (SLM-CCMC) project used and improved on carbon and greenhouse gas accounting tools to make it easier for SLM practitioners to estimate the climate change mitigation co-benefits of sustainable land management activities.

This report presents the results from this Global Environment Facility (GEF) project which ran from 2016 - 2020. It was funded under the Land Degradation portfolio and built on the achievements of two previous GEF projects[1]. One of the main achievements of the project was the linkage of the Carbon Benefits Project (CBP) tools for greenhouse gas (GHG) accounting to the World Overview of Conservation Approaches and Technologies (WOCAT – a database of sustainable land management practices). This approach saves users time and effort, allowing them to import SLM technologies into the CBP tools and estimate how they contribute to climate change mitigation. It also paves the way for future a global database of carbon friendly land management practices.

The SLM-CCMC project had three components: 1. Training and outreach, 2. Enhancement of existing tools and 3. Comparative analysis of GHG accounting tools. In Component 1, more than 350 people (41% women) were trained to estimate the GHG impacts of SLM projects using the CBP tools and to document SLM practices in the WOCAT database. In addition, several trainees went on to implement their own CBP training activities. In Component 2, in addition to the linkage between the CBP and WOCAT, several enhancements were made to the CBP tools. These included improving mapping features in the tool, development of a feature to submit reports to GEF agencies and to aggregate reports from multiple projects. In addition, WOCAT produced a new version of its technologies questionnaire to make it compatible with the CBP. The project also worked with LandPKS a mobile phone data gathering app. At the time of publication, the toolset has been used in over 160 countries, with over 1500 registered users and more than 2000 distinct projects. Component 3 carried out a comparative analysis of GHG accounting tools for the Agriculture Forestry and Other Land Use (AFOLU) sector. It produced a manual for managers of SLM projects to choose the most appropriate tools and developed an online e-learning module[2].

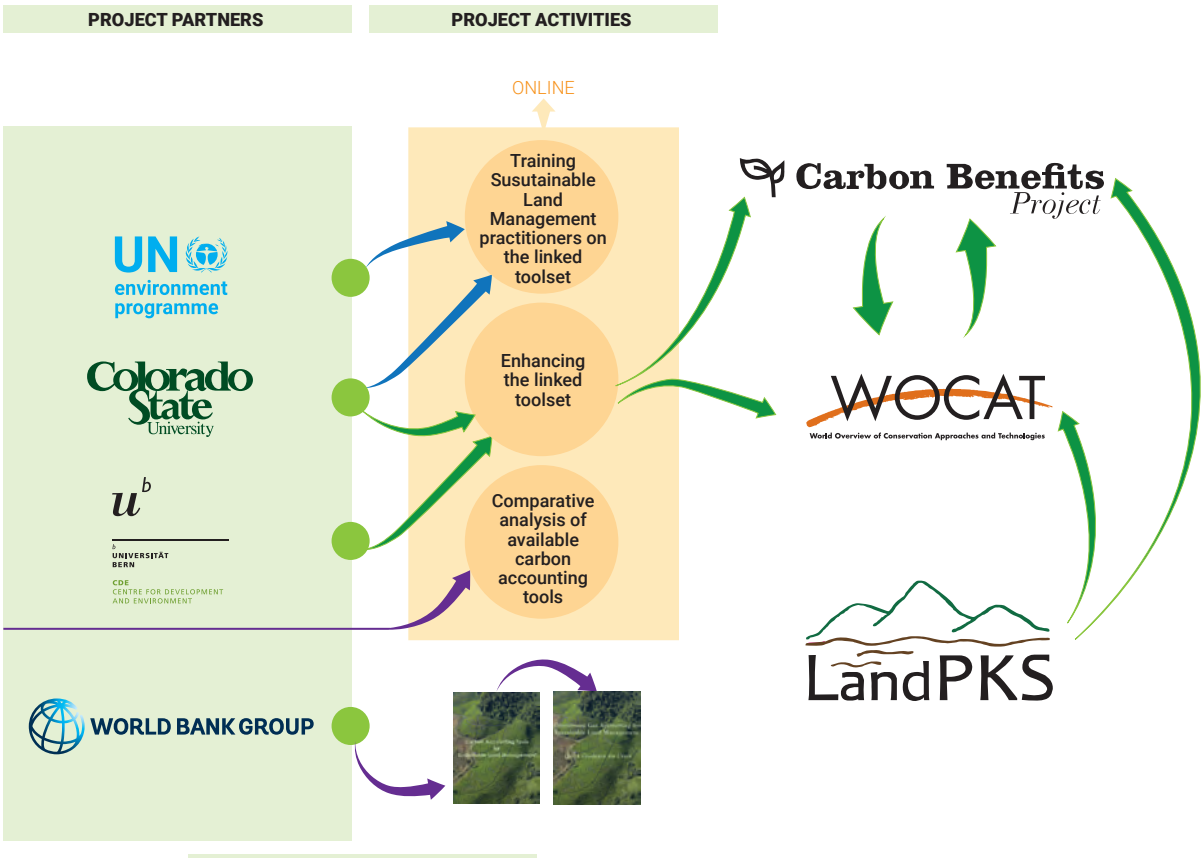
The SLM-CCMC project worked in depth with four GEF projects to help them use the tools to estimate the climate change mitigation potential of their activities. The UNEP 'Scaling up SLM in Western Kenya' project carried out an analysis of SLM practices which had already been tried in Western Kenya using the CBP tools to identify technologies which had carbon as well as economic benefits and could be scaled up. For example, the results showed that agro-forestry techniques can sequester about 0.18 t C ha^{-1} yr^{-1} in woody biomass.The UNDP 'Securing multiple ecosystems benefit through SLM in South Africa' project used the CBP tools to estimate carbon benefits at two sites and found that restoration of native vegetation in the Baviaanskloof could sequester a modest but steady 0.39 tonnes of carbon dioxide equivalents per hectare of land per year (t CO_2e ha^{-1} yr^{-1}). In the high Andes in Ecuador the UNEP 'EcoAndes' project considered the carbon benefits of a range of projects from forest protection to exclusion of livestock on over grazed

1 GEFSOC and CBP
2 https://olc.worldbank.org/content/greenhouse-gas-accounting-tools-sustainable-land-management-self-paced

lands. They found that across all sites in Ecuador the benefits represent an average of 12.69 t CO_2e ha^{-1}. Sustainable management practices related to conservation agreements and the restoration of natural vegetation had the greatest impact on increasing carbon/GHG benefits.

The SLM-CCMC project sought to make it easier for land managers to realize the climate change mitigation co-benefits of SLM practices. This included improving access to and application of suitable scientifically robust cost-effective quantification tools which are easy to use. The linked toolset produced by the project provides a starting place for a much larger platform of linked tools and datasets which could address multiple ecosystem services, taking the burden of multiple reports away from land managers, and moving us closer to the realisation of multiple global environmental benefits.

I. Introduction



Humanity is dependent upon the land for a wide range of ecosystem services from provisioning (timber and food production) and regulating (nutrient cycling and water filtration) to cultural services such as providing a sense of place and well-being. The way that we use and manage our land is therefore fundamental to our continued existence as a species.

Sustainable land management (SLM) is defined as 'the adoption of land-use systems that through appropriate management practices enable land users to maximize the economic and social benefits from the land while maintaining or enhancing the ecological support functions of the land resources' (TERRA Africa 2009). SLM is crucial to many ecosystem services including the maintenance and increase of food production and the improvement of livelihoods (Sanz, ***et al.*** 2017). While these provisioning services are often the focus of SLM practices, SLM can also provide important co-benefits such as the regulation of water availability and carbon stored in biomass and soils. Improving upon the carbon storage abilities of land is becoming increasingly important as the role of land use and management in climate change mitigation is promoted. However, since SLM is typically not aimed at climate change mitigation, these co-benefits are often underestimated or go unreported. The Sustainable Land Management and Climate Change Mitigation Co-benefits (SLM-CCMC) project used and improved on carbon and greenhouse gas accounting tools to make it easier for SLM practitioners to estimate the climate change mitigation co-benefits of sustainable land management activities.

Land management practices including agriculture, forestry and land use along with land use change account for approximately 30% of global

anthropogenic GHG emissions (Intergovernmental Panel on Climate Change [IPCC] 2019). It is therefore widely acknowledged that the way in which land is used and managed has a major role to play in the mitigation of global climate change (IPCC 2019, IPBES 2018, UNEP 2019). Quantifying the climate change mitigation benefits of land activities can allow land managers to report co-benefits to funding agencies, mobilize new funding, potentially engage in carbon markets and, most importantly, enhance land activities to improve benefits over time.

Land-based activities could help attain 25% of the progress needed to achieve the 1.5°C goal of the Paris Agreement (United Nations Framework Convention on Climate Change [UNFCCC] 2015 (Roe ***et al.*** 2017). Therefore, SLM is one of the best available strategies we have to combat climate change, particularly given the positive impact SLM has on livelihoods and other ecosystem services. However, SLM will continue to be underutilized without the proper quantification of benefits. The unique toolkit in SLM-CCMC not only allows users to quantify carbon and GHG benefits, but also links users to a global database of existing SLM methodologies ((World Overview of Conservation Approaches and Technologies [WOCAT] 2020 Chapter 3.1). Through this resource, land managers can improve the climate benefits realized in SLM.

II The SLM-CCMC Project

The SLM-CCMC project aimed to create an environment which will make it easier for land managers to realize the climate change mitigation co-benefits of SLM practices. The project was funded by the Global Environment Facility (GEF) under the Land Degradation portfolio and ran between 2016 and 2020. It built on the achievements of two previous GEF funded projects -The GEFSOC Project (Milne et al. 2007) which developed a national scale tool for estimating changes in soil organic carbon, and The Carbon Benefits Project (Milne et al. 2010), which developed landscape scale tools for estimating the greenhouse gas (GHG) impacts of land management activities. The project worked with existing tools and databases (such as the UNCCD approved WOCAT database) for SLM and GHG reporting to improve on these resources and build capacity in their use. The project took an innovative approach to link tools together, embedding GHG accounting into databases and initiatives supported by the UN conventions and interacting with a range of initiatives such as 4 per 1000.

The project had three components:

1. Training and outreach
2. Enhancement of existing tools
3. Comparative analysis of GHG accounting tools

The first component provided training and outreach on choosing appropriate sustainable land management practices and estimating their impact on climate change mitigation. This addressed a need for capacity building in this area through hands-on training workshops and active outreach. (Section 3.1).

To capitalize on the climate change mitigation co-benefits of SLM, land managers, project officers and others require tools that can be used in a variety of soil, climate and land-use conditions with varying amounts of data and levels of expertise. This is particularly true in developing countries where access to data can be variable, demanding flexibility. They also require tools which make use of newly emerging technologies such as mobile phone apps and data sharing techniques. The second component addressed this requirement by improving on existing tools and databases and linking them together to create an emerging platform of tools.

Lastly, in Component 3, the comparative analysis of available GHG accounting tools guides practitioners to choose appropriate tools for specific applications and objectives.

This report considers the use and potential impact of the SLM-CCMC project outputs and activities. Four chapters describe project activities and provide examples of project impact. First, the strategic

linkages in the toolset are explained, including an overview of each tool. Next, each of the three main project components are described. Then, in-country case studies demonstrate the tools in practice and finally, the toolkit is presented in the global context showing how the tools can be used by a range of global initiatives for climate action.

III Global Context

Being able to estimate how land management practices affect net GHG emissions (carbon stored in soils and plants, and GHG emissions from fertilizer use and livestock) is important to farmers and land managers. It provides an indication of the long-term sustainability of their activities. Coupled with economic and social analysis, this can help land managers make sensible sustainable decisions about the future of their landscapes. The SLM-CCMC project provides tools, training and support to help land managers achieve this. Project and landscape scale assessments are also vital to many global initiatives which work to understand the role of land use and land use change in tackling global environmental issues.

Supporting GEF global impact

The SLM-CCMC project was funded by the Global Environment Facility (GEF), the global mechanism of the United Nations conventions. Understanding how the many projects supported by the GEF contribute to global climate change mitigation is important for the GEF. It not only to shows how GEF serves as a funding mechanism for the UN Framework Convention on Climate Change, but also how that support contributes to the achievement of the Sustainable Development Goals (SDGs), particularly SDGs 13 Climate Action and SDG 15 Life on Land (Box 1 The SLM-CCMC project and the SDGs).

Relevance to national climate change reporting

Reporting on potential climate change mitigation impacts is essential for GEF and Green Climate Fund (GCF) projects and includes alignment under the 2030 Agenda for Sustainable Development, the SDGs, the Paris Agreement and the nationally determined contributions (NDCs). In addition all of these frameworks require diversity, including gender diversity in those realizing and reporting on these benefits. The landscape scale results produced by the SLM-CCMC toolkit are highly relevant to the development of and reporting on NDCs. National scale action on climate change requires a robust understanding of local level activities. For land management, an understanding of the potential impact of different proposed land management activities in varying soil, climate and socio-economic conditions is needed to make national scale policy decisions. The SLM-CCMC toolkit can provide landscape scale assessments to help inform a targeted national scale response.

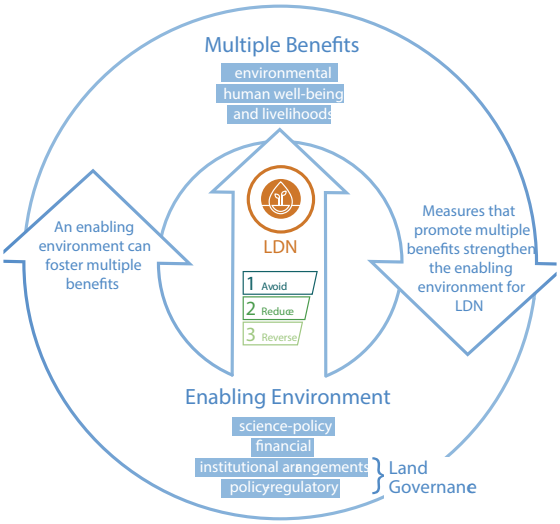
Box 1 The SLM-CCMC project and the SDGs

Sustainable Development Goals (SDGs) envisage, in part, "a world where all life can thrive" (A/70/1). Sustainable land management is key to ensuring life flourishes in terrestrial ecosystems. Under the 2030 Agenda, countries across the globe are committed to achieving the SDGs, which presents the need to measure incremental progress. The SLM-CCMC project offers a comprehensive toolkit that allows land managers to attain these measurements both in progress toward SDG 15 Life on Land and SDG 13 Climate Action, by focusing on the climate change mitigation co-benefits of sustainable land management.

Relevance to UNCCD aims for land degradation neutrality

"Land degradation negatively impacts 3.2 billion people and represents an economic loss in the order of 10% of annual global gross product." (IPCC 2019) Climate change exacerbates naturally occurring processes leading to severe desertification and land degradation. Many SLM technologies exist to protect land against degradation and desertification. The United Nations Convention to Combat Desertification (UNCCD) is "the sole legally binding international agreement linking environment and development to sustainable land management" (UNCCD 2020a). The UNCCD set targets to achieve Land Degradation Neutrality (LDN), which means net zero land degradation by 2030, and is the same as SDG indicator 15.3.1. *123 countries have set voluntary LDN targets,* meaning that these countries have committed to implementing SLM and therefore have needs to measure, monitor and report on the climate change mitigation co-benefits in those SLM activities (UNCCD 2020a). SLM-CCMC provides a linked toolset which can help addresses these needs, including socio-economic tools which can be used to address gender inequalities in the uptake and implementation of SLM technologies, in line with the UNCCD's Gender Advocacy Policy.

Land Degradation Neutrality is: "A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems."



Supporting 4 per 1000

Also contributing to the goal of reaching a net-zero land degradation globe, the 4 per 1000 initiative seeks to promote the role that agriculture can play as a tool to fight climate change and support food security. Similar to how SLM-CCMC highlights the climate change mitigation co-benefits of SLM, 4 per 1000 stresses that agricultural practices adapted to local conditions can be practical solutions to climate change. The name stems from increasing carbon content in soils by 0.4% as a means to significantly reduce the amount of carbon dioxide in the atmosphere. This initiative brings agriculture as a climate solution to the global stage. Through collaboration with 4 per 1000, SLM-CCMC has expanded its global network. The Carbon Benefits Project (CBP) tools are amongst those recommended the 4 per 1000 initiative for project reporting.

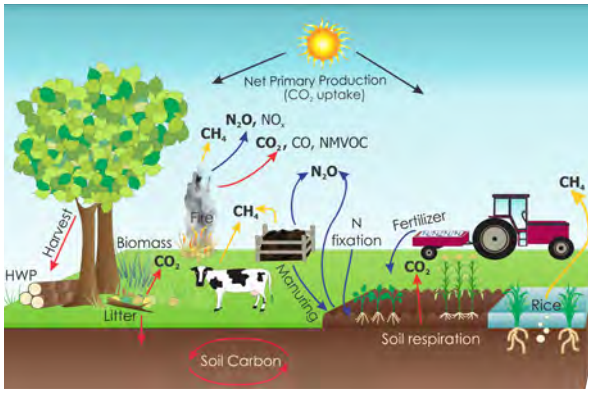
The UNCCD framework stresses the important role played by women in regions affected by desertification and/or drought, particularly in rural areas of developing countries, and the importance of ensuring the full participation of both men and women at all levels. It calls for national action programs that increase participation of local populations and communities, including women, farmers and pastoralists, and delegation to them of more responsibility for management. *"Since its inception the UNCCD has recognized the role of women in ensuring sustainable livelihoods and by encouraging the equal participation of women in capacity building."* (UNCCD 2020b)

Chapter 1: The Carbon Benefits Project Tools

History of the Carbon Benefits Project

The Carbon Benefits Project (CBP) provides tools for agriculture forestry and land management projects to estimate the impact of their activities on climate change mitigation. The tools capture changes in carbon stocks (in plants and soils) and GHG emissions associated with land use and management including emissions from livestock (Figure 1.1). The tools allow different land management scenarios to be compared with each other so a business as usual situation can be compared with one or more interventions (such as introducing trees, changing agricultural management, avoiding deforestation etc. The tools were developed under a GEF co-financed project which was implemented by UNEP by a female led team with tool development led by Colorado State University (CSU). Partners included University of East Anglia (UEA), World Soils Information (**ISRIC)**, GEF project partners from Africa, South America and China, and World Agroforestry Centre (**ICRAF).** The GEF identified a need for user-friendly tools which could be used by land managers, program officers and others who did not have expertise in GHG accounting but did have information on land use and management. The tools were released in 2013 and have been used in more than 150 countries to date.

Figure 1.1 Source and sinks of greenhouse gas emissions in the agriculture and land use (Infographic created by Amy Swan, IPCC 2006)



The tools:

The CBP GHG accounting tools are online and completely free to use. Users simply go to www.carbonbnefeitsproject.org and choose the 'Access Tools' tab then register for an account. Being online, the tools are available anywhere and do not require any specific software for access.

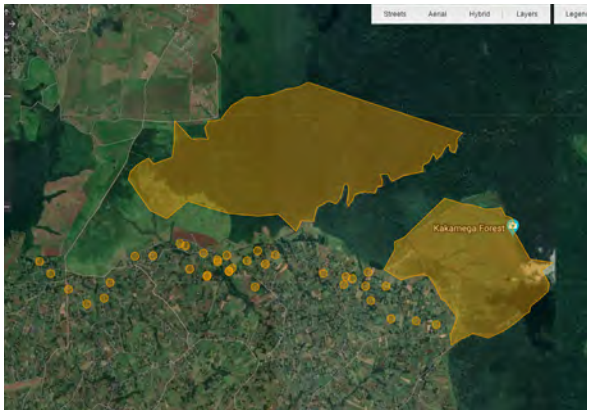
The Project Description Module

One of the unique features of the CBP toolset is its ability to deal with multiple spatial areas at the same time. The tools start with a map (Figure 1.2) where users can define different areas where they are working. These can be points or polygons and can be located in multiple landscapes, regions or even countries. Users can either draw on a map or upload point or Geographic Information System (GIS) files.

The Simple Assessment

The Simple Assessment provides a simple way of estimating the impact of land use and management activities on carbon stocks and greenhouse gas emissions.

Figure 1.2 Screenshot of the Carbon Benefits Project page where users can enter project areas



It could be useful for:

- Ex-ante analysis for project proposals
- Projects with limited data, time, or resources
- A quick report to a funding agency or other interested party

The Simple Assessment is most useful to land management projects involving relatively few land use/management changes on a small area or on relatively few combinations of soil type and climate. Users choose land use and management options from dropdown menus making it quick and easy to use. Results are related back to a map and further broken down by different land use, land management, soil and climate types.

The Detailed Assessment

The Detailed Assessment provides a more detailed analysis of the impact of projects on carbon stocks and GHG emissions. It is suitable for projects where there is a reasonable focus on climate change mitigation and/or multiple land management changes on areas with several combinations of soil type and climate. Users can build their own cropping systems and crop, grass, and forestland types for a more detailed analysis. Users also have the option to improve carbon and GHG balance estimates by inputting project specific information (from field measurements or local data sets). Results are again related back to a map and further broken down by land use, land management, soil type, and climate.

Table 1.1 Extract table form the CBP summary report showing net GHG balance in the UNFCCC format for a sample project in Kenya

Greenhouse Gas Source and Sink Categories	Baseline Scenario (2018 – 2028) Emission and Removals				Project Scenario (2018 – 2028) Emissions and Removals				Carbon Benefits		
	CO2	CH4	N2O	GHGs	CO2	CH4	N2O	GHGs			
	Tonnes CO2 equivalent				Tonnes CO2 equivalent				Total tCO2e	tCO2e/ ha	tCO2e/ ha/yr
Agriculture											
Enterica Methane		0				213			213	0.21	0.02
Manure Management		0	0			4	104		108	0.11	0.01
Rice Cultivation		0				0			0	0	0
Agricultural Soils	0	0	45		0	0	306		261	0.26	9.03
Prescribed Burning of Savannas		0	0	0		0	0	0	0	0	0
Field Burning of Agricultural Residues		0	0	0		0	0	0	0	0	0
Other	0	0	0	0	0	0	0	0	0	0	0
Land Use Change and Forestry											
Forest and other Woody Biomass	6787				-65238				-72025	-71	-7.1
Forest and Grassland Conversion	629744	0	0	0	0	0	0	0	-629744	-624	-62
Abandonment of Managed Lands	0				0				0	0	0
CO2 Emissions from Soil	13712				-2344				-16056	-16	-1.6
Other	0	0	0	0	0	0	0	0	0	0	0
Total	650243	0	45	0	-67582	217	410	0	-717243	-710	-71

Both the Simple and Detailed Assessments produce a 'Summary Report' which give the overall 'Carbon Benefit' of the project. The report shows how land management affects all the different sources and sinks of greenhouse gases compared to a business-as-usual scenario. These are displayed in two tables using both the UNFCCC (Table 1.1) and IPCC formats. In addition, both tools produce an Excel workbook with detailed data for all sources and sinks displayed by project activity area, climate region, soil type etc. for further analysis.

Socioeconomic tools:

After finding out how land management practices impact carbon and GHG emissions, users can then use the CBP socio-economic tools to see if the practices make sense economically and socially. This is important as practices which are good for carbon may not be economically viable or socially acceptable. The CBP socio-economic tools include two tools:

The Cost-Benefit Analysis

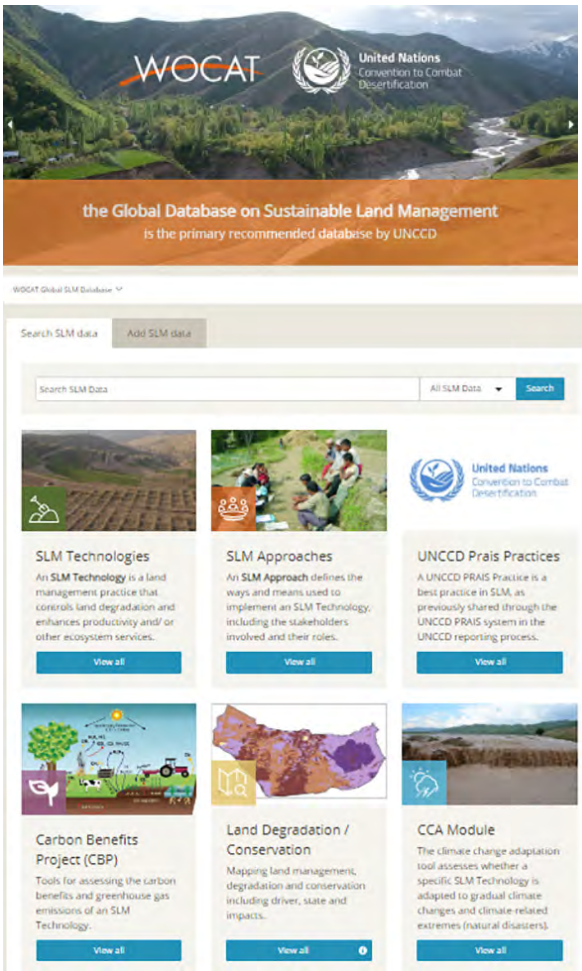
The Cost Benefit Analysis allows the users to compare the set up and recurring costs of different land management practices. For example, money for seeds/seedlings, fertiliser, labour etc. Users can then explore the economic barriers to switching to carbon-friendly practices.Drivers-Pressures-State-Impact-Response (DPSIR)

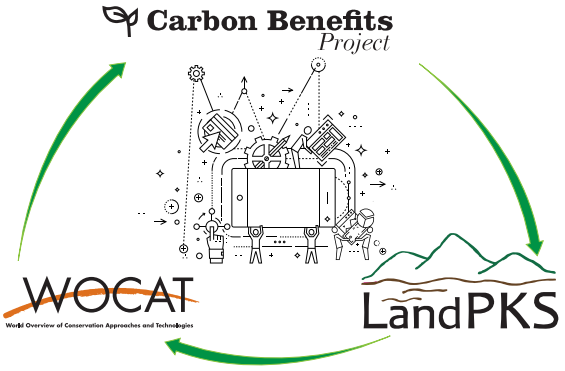
The Driver-Impact-Response Analysis (DPSIR) (Rapport and Friend, 1979) is a qualitative analysis which helps identify the main drivers and barriers to the adoption of different land management practices including ensuring SLM projects are working with the correct gender groups. Identifying those responsible for the implementation and maintenance of land management practices is key if they are to be sustainable. Often times farming and other land management activities are carried out by women yet they are excluded from land ownership, the DPSIR can be used to determine if working with the correct gender groups is being considered and if it presents a barrier to the adoption of a practice. It also helps users formulate possible responses to overcome barriers.

Chapter 2: Linkages Between the CBP Tools and other Tools

The World Overview of Conservation Approaches and Technologies (WOCAT) is a global network on Sustainable Land Management (SLM) that designs and promotes solutions for a faster dissemination and uptake of SLM across the globe. It builds on 25 years of experience, a global network of partners at all levels, a widely recognized SLM knowledge platform and toolset, an outstanding capacity for informing the implementation of SLM, and a wide array of capacity building tools and methods for different target audiences.

Figure 2.1: WOCAT tools, methods and output for the documentation of SLM experiences





WOCAT aims are *"to improve land resources and ecosystems and people's livelihoods as well as facilitating cost-effective investments in – and scaling up of – SLM, gradually reducing land degradation."* To reach this, it has developed a well-accepted framework and standardised tools and methods for documentation, monitoring, evaluation and dissemination of sustainable land management (SLM) knowledge for evidence-based decision making and scaling up of SLM (Figure 2.1).

WOCAT is active at multiple scales. At the **global level** it strives to increase the visibility of land issues, SLM and land degradation, at **regional level** it catalyzes mainstreaming SLM and LDN and enhancing capacities in identifying appropriate solutions at farm and landscape level and at the **national and local levels** it supports partner institutions in countries to design, acquire and implement SLM projects and programmes.

WOCAT was established in 1992. In 2014 the Global SLM Database, with more than 2000 documented SLM practices (technologies and approaches) from all over the world, became the primary recommended database by the UNCCD for the reporting of SLM best practices (WOCAT 2020).

The WOCAT SLM database includes information on individual Technologies which cover physical

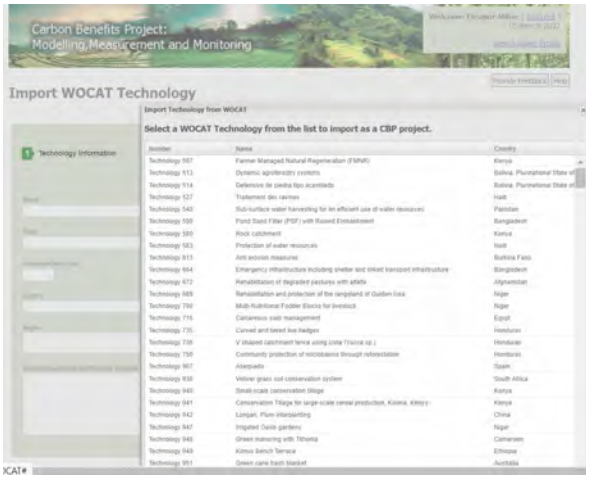
practice on the land that controls land degradation (e.g. contour cultivation, conservation agriculture, stone bunds etc), and Approaches, which are ways and means to implement one or several SLM Technologies (e.g. farmer field schools, community based natural resource management, integrated watershed management, participatory land use planning and payment for ecosystem services). The SLM Technology data includes information on land ownership, land and water use rights and gender and age of land users involved. All technologies are linked to specific locations and documented by local teams of SLM specialists (including land users) with different backgrounds and experiences. The objective of documenting and assessing SLM practices is to compile and produce, share and spread valuable knowledge in land management, evaluate and analyse data, produce knowledge products, all in support of awareness raising, capacity building, evidence-based decision-making and sound planning for scaling up identified good practices, thereby contributing to preventing and reducing land degradation and to restoring degraded land. The database also includes Approaches where land users document how the technologies are implemented. The SLM Approach Questionnaire contains direct questions on the impact of the SLM Approach on gender equality, empowerment of women and girls, and encouragement of the next generation of land users to engage in SLM.

The Database is linked to the CBP Tool, which enables the user to import WOCAT technologies into the CBP to carry out a GHG assessment of selected technologies with little additional information.

WOCAT's linkage with the CBP tools through the SLM-CCMC project

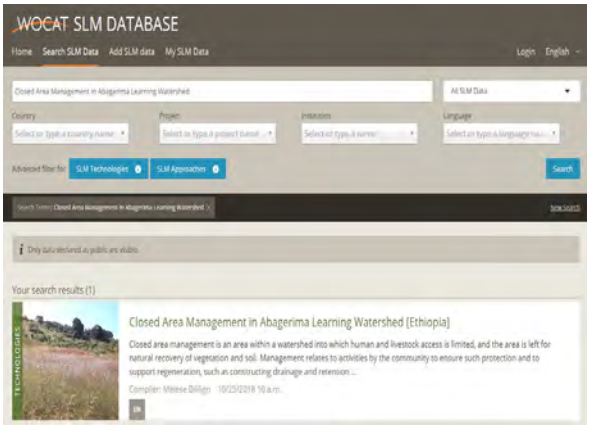
Through the SLM-CCMC project, WOCAT has been linked to the Carbon Benefit Project (CBP) tool so that users can now upload an existing SLM technology from WOCAT to the CBP tools to create a new GHG assessment for the technology (Figure 2.2). This typically completes about 60% of the information needed to generate a CBP report, with the user completing the rest in the CBP system.

Figure 2.2 WOCAT linkage page on CBP site



For example, the WOCAT entry "Closed Area Management in Abagerima Learning Watershed" in Ethiopia (part of an International Fund for Agricultural Development GEF project, Figure 2.3) details how a range of technologies including, restricting grazing, constructing drainage and retention features, selective bush removal, regular grass cutting and tree planting were introduced to restore productivity in the watershed. The CBP report shows that these technologies together had an overall GHG benefit of 1,345 t CO2 e over 6 years. Once completed, GHG assessments created using the CBP tool can be made available in the WOCAT database alongside the technology entry.

Figure 2.3 WOCAT entry page for GEF project in Ethiopia



Land Potential Knowledge System (LandPKS)

What is LandPKS?

The Land Potential Knowledge System (LandPKS) is a mobile phone app which can be used to help farmers discover the potential of their land and monitor changes over time. It can be used for soil identification, land cover and soils health monitoring, land management and farm record keeping and more. LandPKS helps land managers understand how different types of land climate combinations have different potentials, production and resilience. This understanding can help foster adaptive land management.

With the app, managers can connect to cloud-based storage, global databases and models and share data, information and knowledge (LandPKS 2020). The app consists of input modules LandInfo, Land Cover and Land Management.

LandInfo – for rapid soil characterization and identification and accessing FAO and digital soil and soil-specific management information. Currently available in the United States only.

LandCover – for vegetation monitoring including rangeland monitoring, natural resource conservation and agroecosystem monitoring.

LandManagement – on-farm record keeping including crops, fertilizer, lime, irrigation, rainfall, erosion control, weed and pest control, tillage and more.

Who developed the App?

The app was developed by the United States Department of Agriculture - (Agricultural Research Service (USDA-ARS) Jornada Experimental Range in cooperation with the Sustainability Innovation Lab at Colorado (SILC) at the University of Colorado Boulder (CO) and New Mexico State University with primary support from the United States Agency for International Development (USAID). The goal is to support farmers, ranchers, gardeners, land-use planners, and other natural resource managers with open-source tools that allow them to easily access knowledge and information, and to collect, share, and interpret their own soil, vegetation cover, and management data.

Collaboration with the SLM-CCMC project

During development of the LandPKS Land Management module, the LandPKS team worked with the Carbon Benefits Project team. They developed a land management module for their mobile phone app using input from the CBP team on parameters to include. LandPKS can be used to make it easier to collect data to improve CBP predictions. These data include management practices (including, tillage, irrigation, yields, etc…) and soil texture. It also allows soil carbon to be recorded, along with a number of soil health indicators.

Chapter 3: Strengthening and Mainstreaming the Toolset Among Potential Users

3.1 Training and Outreach

The SLM-CCMC project included an extensive training component aimed at building capacity to estimate, track and report the climate change co-benefits of sustainable land management practices (using the CBP tools) and to choose appropriate SLM practices and to document new ones (using the WOCAT database). In later training events, the linkage between CBP and WOCAT was also covered. The training programme held **16 events between 2017 and 2020 and trained a total of 353 people of which 41% were women and 59% men**. Trainees included GEF and other managers of land management projects, staff from GEF agencies (UNEP, United Nations Development Programme (UNDP), World Bank (WB), the United Nations Food and Agricultural Organisation (FAO), IFAD etc.) people from government ministries (both national and local), academics and those working in private companies dealing with land management. Thirteen of the training events took place face to face and a further 3 took place online. Face to face events took place in four continents – Africa, Asia, Europe and South America. Online participants came from these four continents plus Eurasia and Australasia (Figure 3.1 – map). Events were organised and run by the CBP and WOCAT teams from Colorado State University and The University of Bern and UNEP. Details of training events are shown in Table 3.1.

Figure 3.1: Map showing the global distribution of training events

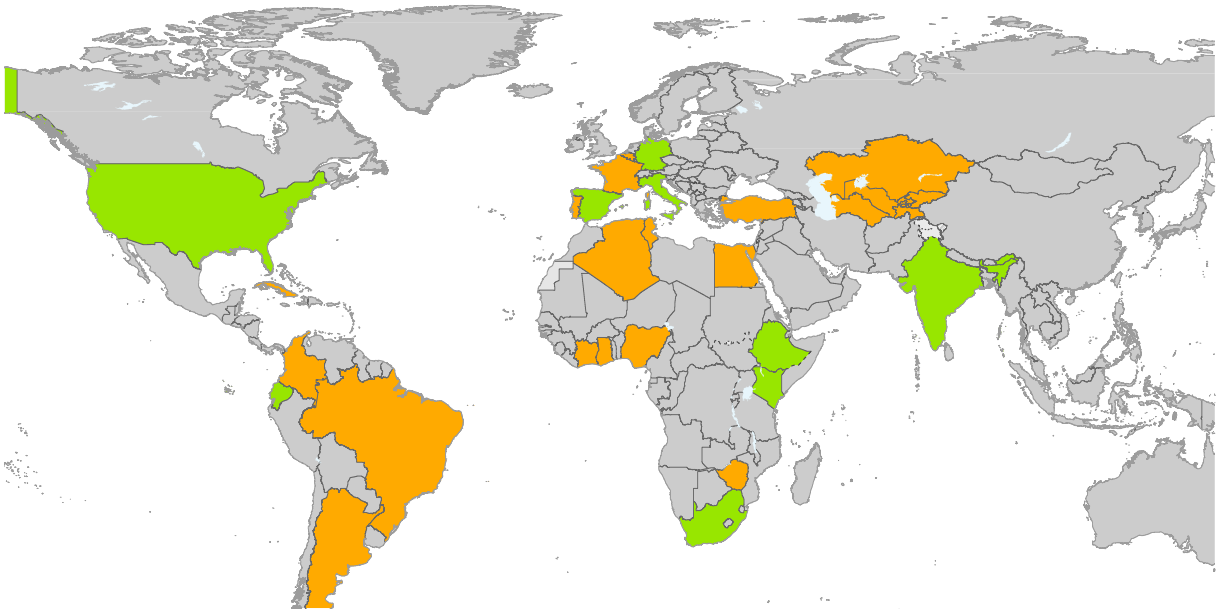


Table 3.1 Details of training events organized by the SLM-CCMC project

Workshop location	Date	Host	Number of trainees	Gender	
2017				M	F
Quito, Ecuador	March	CONDESAN	24	16	8
WB, Washington DC, USA	June	World Bank	7	4	3
Addis Ababa, Ethiopia	September	Ethiopian Gov/ USAID	30	26	4
IFAD, Rome, Italy	October	IFAD	15	7	8
2018					
Addis Ababa, Ethiopia	January	Ethiopian Gov/ USAID	30 NB	26	4
Nairobi, Kenya	February	KALRO	14	10	4
Zaragoza, Spain	March	CIHEAM	35	20	15
Bonn, Germany	Sept	UNCCD	18	8	10
Bahir Dar, Ethiopia	October	Uni of Bern, WOCAT	10		
2019					
Addis Ababa, Ethiopia	July	Colorado Uni, LandPKS	10		
Online (USA)	July	EDF	10	5	5
Delhi, India	September	EDF	20	13	7
Nairobi, Kenya	November	UNEP	24	10	14
Online (Kenya)	December	UNEP	10	5	5
2020					
Online (Tajikistan)	May	FAO CACILM 2	97		
Online (Spain)	October 2020	CHIEAM	29	14	15

NB Same participants as the 2017 workshop

Right: Participants at the learning how to estimate net greenhouse gas emissions from land management projects using the CBP tools in Quitto, Ecuador, March 2017.

Left: The Western Kenya project team at the CBP training event February 2018. More details on how they used the tools to choose appropriate carbon friendly land management practices are given in Section 4.

Right: CBP-WOCAT training event, Delhi, 9-11th Sept 2019. Co-hosted by the Environmental Defence Fund. Participants included GEF and non-GEF project managers from the Indian sub-continent and Asia.

Left: Maarten Kappelle, Head of Thematic Assessments Unit, Science Division , UNEP presenting training certificates to participants at the CBP WOCAT training event in Nairobi, Kenya 2019. Left to right: Justus Ekuwom, Maarten Kappelle, Cecilia Muriuki, Lutta Alphayo and Rebecca Karanja. Participants included GEF Agency staff, GEF project managers, academics and government employees.

Lessons Learned from the Trainings

The SLM-CCMC project had an original target of holding 6 training sessions during the project lifetime. The final number of events held was 16. The project responded rapidly and proactively to the high demand for training on the individual tools and, later, the linked toolset. Demand for training remains high and the SLM-CCMC team continue to respond to these on a case by case with the requesters covering training costs. A recommendation would be to put in place a long-term funding strategy to provide training on the SLM-CCMC tools to GEF, UN agencies and other projects.

Several trainees went on to train others, requesting resources for training. In response a 'Resources' page was set up on the CBP website (www.carbonbenefitsproject.org) in addition to a CBP You tube channel and materials were added to the WOCAT website. An important lesson learned was the need to have training materials available in different languages as rapidly as possible. Therefore, a future recommendation would be to seek funding to translate the training materials into as many languages as possible in a preemptive manner.

Of the 16 training events held, four were online. The first was in response to a request from the Environmental Defence Fund (EDF), the second was to accommodate several trainees who had been unable to attend a face -to-face event, and the last two were in 2020 when Covid restrictions prevented travel. The feedback collated from the sessions was positive in all cases and a wider group of people were trained, increasing accessibility. A future recommendation (and indeed a necessity) is therefore to move trainings online where possible and to continue to make recorded training sessions publicly available on the CBP YouTube channel and on other platforms. However, this needs to be accompanied by long term support for the project team to provide follow up once training session have finished.

Future Expectations

Regular trainings on using the linked toolset are ongoing and equip land managers with the tools needed to identify, track and report on appropriate sustainable land management practices. In addition, several trainees have gone on to become trainers, organising their own events and programs using the resources available from the CBP (www.carbonbenefitsproject.org) and WOCAT (www.WOCAT.net) websites. Certain training resources are available in four languages (English, French, Spanish and Russian) with plans to add more. The tools themselves are available in English, French, Spanish, Portuguese, Russian and Chinese.

3.2 Enhancing the Toolkit

In addition to creating a linked toolkit to help realize the climate change co-benefits of land management practices, the SLM-CCMC project also made several enhancements to the existing tools. The CBP tool enhancements included the following:

Enhanced Mapping Features

The CBP user starts with a map (Figures 3.2 and 1.2) where they draw or upload the areas where their project is working. They can now also choose to see the location of national parks (which are the focus of many projects) and livestock climate regions.

Sharing tree and crop information with other users

Users of the CBP can use standard information on tree, forest and crop types provided by the system ***or*** they provide their own. For example, a project in Ethiopia created a Teff crop, a grain crop commonly grown in Ethiopia as it was not listed in available in the CBP system. They now have the option to share this information with other users through a new database.

Submitting a report to a funding agency

An option has been added so users can now submit a GHG assessment report for their project to UNEP (Figure 3.3). Other GEF agencies are also being added.

Querying and analysing multiple reports

Designated GEF agency program officers can look up multiple reports from the projects they are working with (Figure 3.4). This feature allows the carbon/GHG benefit of different types of GEF projects who have used the CBP to be analysed, by country, project size, focal area and source of emissions (agriculture or land use change and forestry).

Figure 3.2 The CBP mapping page showing Protected Areas in Zambia

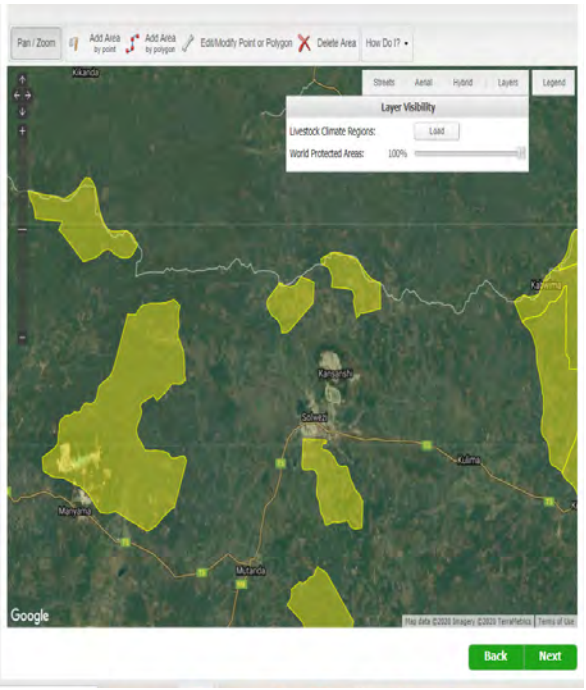


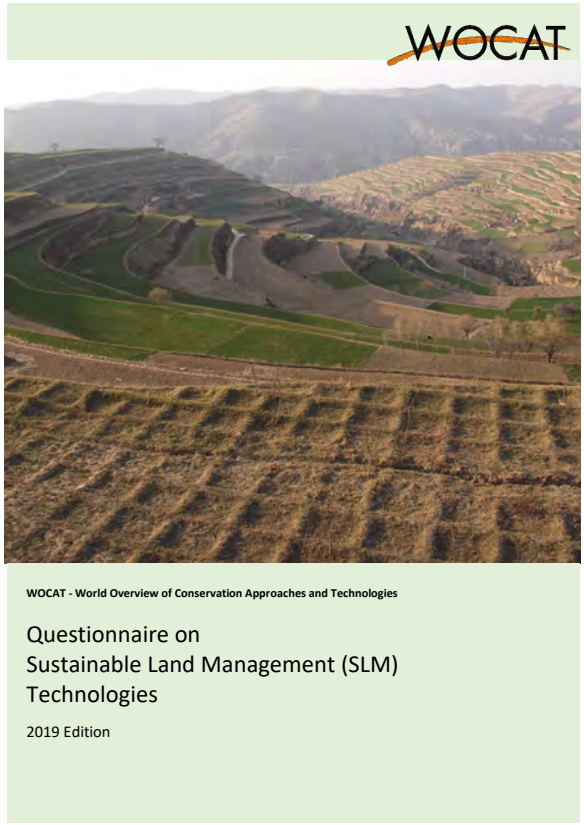
Figure 3.3 Feature allowing project managers to submit a report to a GEF agency

Share Report with GEF Agency

- ❑ United Nations Development Programme (UNDP)
- ❑ United Nations Environment Programme (UNEP)
- ❑ World Bank (WB)
- ❑ African Development Bank (AfDB)
- ❑ International Finance Corporation (IFC)
- ❑ Asian Development Bank (ADB)
- ❑ European Bank for Reconstruction and Dev (EBRD)
- ❑ Inter-American Development Bank (IADB)
- ❑ International Fund for Agricultural Dev (IFAD)
- ❑ UN Industrial Development Organization (UNIDO)
- ❑ Conservation International (CI)
- ❑ Development Bank of Latin America (CAF)
- ❑ Development Bank of Southern Africa (DBSA)
- ❑ Foreign Economic Cooperation Office, Ministry of Environmental Protection of China (FECO)
- ❑ Brazilian Biodiversity Fund (FUNBIO)
- ❑ International Union for Conservation of Nature (IUCN)
- ❑ West African Development Bank (BOAD)
- ❑ World Wildlife Fund (WWF-US)

Figure 3.4 New Aggregate report feature for designated GEF agency Programme Officers

Figure 3.5: The new WOCAT questionnaire



Enhanced woody biomass calculations

The CBP tools calculate carbon stock changes in forests, perennial croplands, agroforestry trees and trees in grasslands and settlements. More flexibility was given to the user to describe when trees are added and taken away.

WOCAT tool enhancements

To harmonize WOCAT and the CBP tools, a new edition of the WOCAT Technologies Questionnaire was created (https://qcat.wocat.net/en/configuration, Figure 3.5) with adapted crop, forestland and grassland types, additional questions on the initial land use and more drop down options. This allowed WOCAT and the CBP tools to be linked as outlined in Section 2.

3.3 Comparative Analysis

The third component of SLM-CCMC was implemented by the World Bank with support from FAO and input from CSU. The component carried out a comparative analysis of GHG accounting tools for the Agriculture Forestry and Other Land Use (AFOLU) sector and produced two outputs: 1) A full manual and quick guidance for GEF and other managers of SLM projects to choose the most appropriate tools to measure carbon/GHG benefits and 2) An online e-learning module. Both outputs help users choose the appropriate tool for their needs and circumstances.

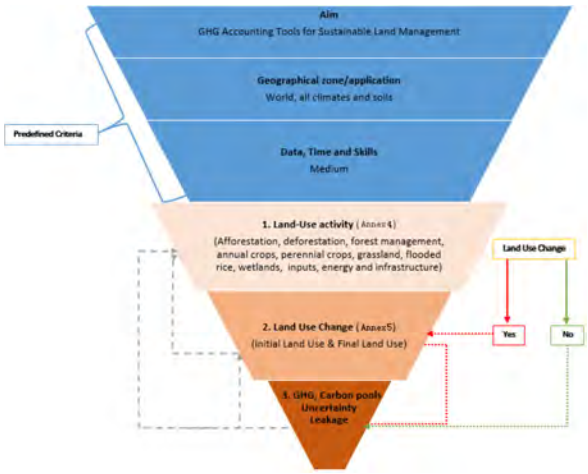
For the analysis, the authors used the criteria below to choose an initial list of tools:

1. Availability – whether the tools are freely available online
2. Geographical coverage – the continental regions where the tools are mostly applicable
3. Activities scope – the possibility to cover multiple and a wide range of SLM activities
4. Data requirements – accessibility of the information needs to run the tools, particularly in low income countries
5. Time requirements – how long it takes to conduct an analysis
6. Skills requirements – the level of background knowledge required to use the tools

Ten commonly used GHG accounting tools were initially identified. These were then shortlisted to five:

- The Carbon Benefits Project Simple and Detailed Assessment tools developed by the GEF-funded 'Carbon Benefits Project' (CBP SA and DA)
- Agence Française de Développement Carbon Footprint Tool (AFD-CFT)

Figure 3.6: Step-by-step process for selecting a GHG calculator from the World Bank comparative analysis report



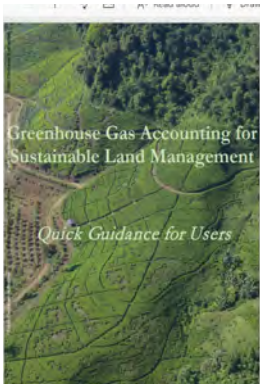
- Forest Carbon Calculator (USAID Agriculture, Forestry, and Other Land Use [AFOLU] Carbon Calculator)
- Carbon Assessment Tool for Afforestation and Reforestation (CAT-AR)
- Ex-Ante Carbon-Balance Tool (EX-ACT)
- Climate Change, Agriculture, and Food Security Mitigation Options Tool (CCAFS)

The tools were tested against data sets for 18 projects covering a wide range of sustainable land management practices in Africa, Latin America, Asia, Middle East and Europe. This information in conjunction with the criteria given on the previous page, were used to provide guidance on the selection of GHG accounting tools and how to utilize them as part of the project document design.

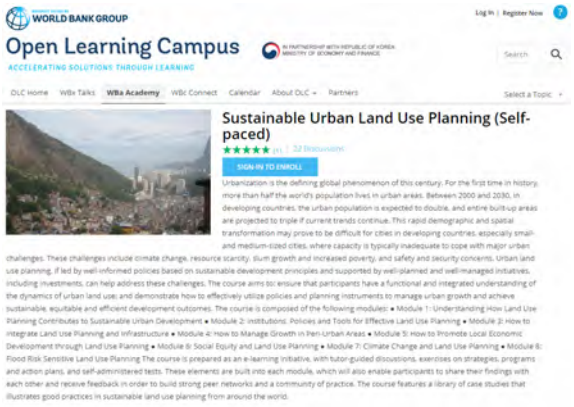
The comparative analysis equips decision-makers and practitioners with the information necessary to make an informed decision about which GHG assessment tool is most suitable for their use. Furthermore, it shares information about the availability of GHG accounting tools, which allowed for further development of existing tools. The CBP team used this information and later enhanced the leakage capabilities of the CBP tool, among other enhancements, described in the previous section 3.2.

The guidance document is available online at https://openknowledge.worldbank.org/handle/10986/31062 (Full Manual)

https://openknowledge.worldbank.org/handle/10986/31063 (Quick Guidance)



The e learning module can be accessed from the Open Learning Campus of the World Bank, which is a free resource for anyone who registers. It is available at : https://olc.worldbank.org/content/greenhouse-gas-accounting-tools-sustainable-land-management-self-paced



Chapter 4: Showcasing the SLM-CCMC Toolkit at the Landscape Level: Case Studies

DISCLAIMER: Each of the case studies described below are GEF-funded projects with project activities and achievements that extend beyond those described below. The SLM-CCMC worked with these projects in a mutually beneficial manner that allowed the CBP tools to be deployed in these projects and for the projects to gain knowledge from the use of the tools and expert consultation provided by SLM-CCMC. Please see the following resources for more information on the GEF projects:

- The Community-Based Integrated Natural Resources Management Project (CBINReMP) in Ethiopia, GEF agency: IFAD, GEF project ID: 3367.
- Multiplying Environmental and Carbon Benefits in High Andean Ecosystems, and its correspondence (Ecuador and Peru), GEF agency UNEP, GEF project ID GFL-5060-2711-4C61.
- Scaling up Sustainable Land Management and Agrobiodiversity Conservation to Reduce Environmental Degradation in Small Scale Agriculture in Western Kenya. GEF Agency: UNEP, GEF Project ID: 5272.
- Securing multiple ecosystems benefit through SLM in the productive but degraded landscapes of South Africa. GEF agency UNDP, GEF project ID 5327.

For all projects GHG benefits are expressed as tonnes of CO_2 equivalents per hectare. A negative number shows removal from the atmosphere (sequestration in soils and biomass or avoided emissions) a positive number shows emissions to the atmosphere.

KAKAMEGA FOREST Region, KENYA

KAKAMEGA-NANDI LANDSCAPE IN WESTERN KENYA – By Kennedy Were and George Ayaga

Introduction and context

In the GEF Project 'Scaling up sustainable land management and biodiversity conservation to reduce environmental degradation in small scale agriculture in Western Kenya', proven sustainable land management (SLM) and agro-biodiversity conservation technologies are being scaled up to avert, reduce and reverse the widespread land degradation problem in small-scale agriculture across the Kakamega-Nandi landscape in western Kenya. Such land management interventions have the capacity to maximize returns on farmers' investments in them, as well as to deliver multiple environmental benefits, including climate change mitigation by reducing GHG emissions and sequestering carbon (C) both in soils and biomass.

The Project in collaboration with Colorado State University (USA) is using the CBP modelling system, to model and forecast the potential C stock changes and GHG emissions attributed to the various SLM activities being undertaken across the productive agricultural landscapes in Kakamega, Vihiga and Nandi Counties.

Left: The Project CBP modelling team at a consultation workshop in Busia, Kenya.

Stakeholders

The project is being executed by Kenya Agricultural and Livestock Research Organisation (KALRO) on behalf of, and in conjunction with, the Alliance for a Green Revolution in Africa (AGRA). The project is a UNEP GEF co-financed project. Work with the CBP tools has been led by Dr Kennedy Were from KALRO and carried out by a Western Kenya CBP project team. The project is working with farmers and villagers including women farmers and women headed households in Kakamega, Vihiga and Nandi Counties.

Additionally, the CBP's cost-benefit analysis (CBA) is being used to assess the profitability of investments in specific SLM interventions.

KAKAMEGA FOREST Region, KENYA -cont.

KAKAMEGA-NANDI LANDSCAPE IN WESTERN KENYA – By Kennedy Were and George Ayaga

Project Activities

The Western Kenya project initially carried out an analysis of SLM practices which had already been tried and tested in Western Kenya (of which there have been many). The CBP tools were used as part of the process to identify potential SLM technologies which could be scaled up. They were then used to report on the ongoing C and GHG benefits of the technologies. SLM practices chosen included conservation agriculture for a maize legume rotation and agro-forestry techniques (i.e., alley cropping, woodlots, wind breaks and riparian buffers).

Conservation agriculture in the Western Kenya project – Maize under a dense cover crop (left) and maize being established under total soil cover (right). Photos by George Ayaga.

Results

Preliminary scenario analysis using the CBP tools has indicated that the various SLM technologies being scaled up by the Project in western Kenya have potential C and GHG benefits. For example, the results showed that agro-forestry techniques (i.e., alley cropping, woodlots, wind breaks and riparian buffers) can sequester about 0.18 t C ha-1 yr-1 in woody biomass. Similarly, the use of appropriate type and amounts of fertilizer (i.e., Mavuno at the rate of 187.5 kg ha-1), organic manuring, reduced tillage, cover cropping, retention of crop residues, intercropping, liming, and improved seeds can collectively sequester about 0.19 t C ha-1 yr-1, as well as mitigate nitrous oxide (N2O) emissions. Moreover, avoided deforestation ascribed to adoption of the SLM practices and participatory forest management and protection can sequester about 0.18 t C ha-1 yr-1.

These results could present a worthwhile opportunity to augment farmers' incomes by trading the amounts of C sequestered through the various SLM technologies at the existing global C markets. Apart from carbon-friendliness, using the CBA tool of the CBP modelling system, the Project has also established that the different SLM technologies being implemented can yield sufficient profitability in the long-term. For instance, agroforestry (i.e., alley cropping with avocado trees) can have a net return of about 33,000 USD/3.7 million KES ha-1 over a period of 10 years discounted at the rate of 7% per annum. The economic sense that this makes can contribute immensely to wider adoption and investment in agroforestry by the small-holder farmers in the project area.

In a nutshell, the CBP tools are proving invaluable in ensuring that the SLM actions being taken against land degradation by the Project across the Kakamega-Vihiga-Nandi landscape not only offer multiple environmental benefits, but also benefit livelihoods.

TWO CONTRASTING SITES In The Eastern Cape, SOUTH AFRICA

By Rebecca Powell and Eleanor Milne

Introduction and context

The GEF UNDP project 'Securing multiple ecosystems benefit through SLM in the productive but degraded landscapes of South Africa' has been working in four degraded South African landscapes since 2017. The project has been building the capacity of rural communities and selected government departments for the adoption of SLM. Estimating how SLM practices are likely to affect climate change mitigation is a key part of this work. A collaboration with the SLM CCMC project was set up at the proposal stage and two test case sites in the Eastern Cape chosen for carbon tracking and reporting using the Carbon Benefits Project tools. The first site, Machubeni, is in one of the poorest provinces in South Africa. Land use is primarily grazing with some cultivated croplands. The project is working with villages to restore degraded grazing lands and introduce conservation agriculture in smallholdings and gardens many of which are cultivated by women providing a crucial source of food and income.

Replanting 'spekboom' in degraded thicket areas of the Baviaanskloof-Photo by Anna Pepper

The second site is in the Baviaanskloof is part of the unique Albany Thicket Biome. Here the project is working to restore native vegetation which has a high potential for carbon sequestration in this semi-arid area, due to the efficiency of certain thicket species to capture and store carbon from the atmosphere and the dense network of lateral roots produced by these species. One plant of particular interest in this regard is Portulacaria afra or 'spekboom', which is predominantly used in the re-vegetation of severely degraded thicket areas.

In the two contrasting sites, the CBP tools have been successfully used to estimate the impact of the SLM practices on carbon stocks and GHG emissions throughout the project.

Stakeholders

The Project is being implemented by UNDP and the Department of Environment Forestry and Fisheries, South Africa. Work with the CBP tools has been led by Dr R. Powell from Rhodes University. In Machubeni, the project worked with five of 18 villages in the area. The Machubeni communal area is managed by a traditional council and municipal and provincial authorities. The project has worked with 'Champion Farmers' to pilot SLM practices. It has also worked with a land rehabilitation and conservation agriculture community groups which are 90% female- the project helped form these groups and train them in the respective areas. Training with the two groups and the traditional leaders included gender equity in relation to access and management of natural resources. In the Baviaanskloof, activities are being carried out by Living Lands, a local NGO in conjunction with Rhodes University and UNDP.

Project Activities

In Machubeni project activities include:

- Conservation agriculture for at least 60 home garden farmers.
- Rotational resting-grazing across at least 1300 ha
- Fodder growing with at least 20 lead sheep farmers
- Erosion control and agrograssing interventions across at least 50 ha

Replanting 'spekboom' in degraded thicket areas of the Baviaanskloof-Photo by Anna Pepper

In the Baviaanskloof the project is restoring the native Albany Thicket in two communal farms, Sewefontein and Tchnuganoo. Degraded lands are being replanted with spekboom using earthen ponds that are brush packed with branches from a locally abundant tree for further protection and water retention.

TWO CONTRASTING SITES In The Eastern Cape, SOUTH AFRICA

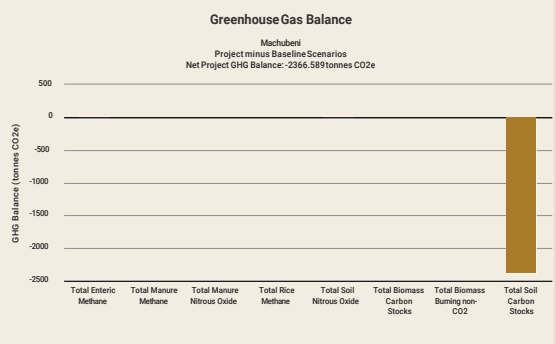
By Rebecca Powell and Eleanor Milne

Results

For both sites, the CBP tools were used to estimate the climate change mitigation benefits of scaling up the project activities across the larger project site over a four-year period. In the Baviaanskloof, information on the unique growth rates and plant architecture of spekboom were used to make estimates very site specific by creating site specific emission factors in the CBP Detailed Assessment.

Machubeni

The results showed that the conservation agriculture and grassland management practices introduced in Machubeni will have a small but consistently positive impact on carbon sequestration in soils not only contributing to climate change mitigation but also improved water retention and productivity.



The total GHG benefit (C sequestered or GHG not emitted) over 5 years for the 345 ha site in Sewefontein and Tchnuganoo is -674 t CO2e.

The majority is from biomass accumulation due to gradual thicket restoration. This translates as a benefit of -0.39 t CO2 e per ha per year across the entire site.

The project team are now routinely using the CBP tools for carbon and GHG tracking and reporting. Results are being used to support work by the GEF5 Project team in the Baviaanskloof to potentially earn carbon credits for Spekboom related restoration work, hopefully using a local carbon tax and standard rather than an international one.

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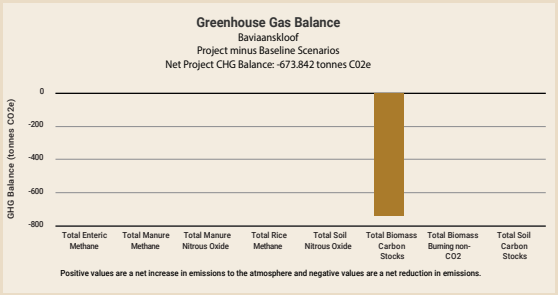
Or

Project Coordinator for the Eastern Cape landscape: Dr Rebecca. Powell r.powell@ru.ac.za

Earthen ponds with brush pack into which spekboom is planted. Photo by E. Milne

The Baviaanskloof

In the Bavianskloof, results show that the thicket restoration via spekboom planting will build up carbon stocks in the native biomass which will ultimately lead to a more productive system. The project created specific Albany Thicket types in the CBP system using data from the study sites and previous publications. These can be now be used by future researchers.



The total GHG benefit (C sequestered or GHG not emitted) over 5 years for the 6673 ha Machubeni site is -2958 tonnes carbon dioxide equivalents.

The majority is from carbon sequestration in soils due to changed cropping and grassland management practices. This translates as a benefit of -0.09 t CO2 e per ha per year across the entire site.

MULTIPLYING ENVIRONMENTAL AND CARBON BENEFITS IN HIGH ANDEAN ECOSYSTEMS

By Raúl Galeas and Francisco Cuesta

Introduction and context

The GEF-UNEP-CONDESAN project 'Multiplying environmental and carbon benefits in high Andean Ecosystems' worked to enable integrated ecosystem management in the high Andes in Ecuador and Peru between 2014 and 2018. It introduced sustainable land management (SLM) practices at five intervention sites, three in Ecuador and two in Peru. The project also worked to build capacity in the wider area and to develop tools to help implement and report on integrated ecosystem management. These included tools to support payment for ecosystem services. Intervention sites covered diverse conditions, from 'cloud forests' to grazing lands. A collaboration with the SLMCCMC project was set up at the proposal stage. The EcoAndes project choose three pilot sites in Ecuador to estimate the impact of their SLM practices on carbon stocks and GHG emissions using the CBP tools. The sites were: Pichincha –montane forest, Carchi – moorlands and eastern forest and Tungurahua – overgrazed moorlands.

High Andes in Ecuador-Photo by Raul Galeas

Stakeholders

The project was executed by CONDESAN, (an NGO with the mission of helping the populations of the Andes integrate the environment into their development strategies) and was aided by the Ministry of Environment of the Ecuadorian Government. It was a GEF project with UNEP as the implementing agency. The project worked with demonstration ranchers and farmers in 5 pilot sites in Ecuador and Peru and promoted the uptake of SLM practices to up to 55 farmers and communal areas in areas surrounding each pilot site.

Project Activities

Project activty areas in Pichinca . Activities in the pilot areas were:

Pichinca (1641 ha) - forest protection, regeneration of native vegetation on degraded paddocks, planting of fruit trees, grass planting for slope stabilization, planting of trees on banks, introduction of woodlots, establishment of a silvo-pastoral system and introduction of agroforestry.

In Carchi (76 ha) - forest and scrub protection, forest restoration, planting forest corridors, water recharge areas and riparian buffers, restoring degraded soils and introducing silvipasture.

Tungurahua (465 ha) - activities focused on protecting native moorland. This was carried out by excluding animals, planting native species in the degraded areas, restoring native vegetation and protecting water resources.

MULTIPLYING ENVIRONMENTAL AND CARBON BENEFITS IN HIGH ANDEAN ECOSYSTEMS

By Raúl Galeas and Francisco Cuesta

Results

Figure 4.1. shows the net greenhouse gas benefits of introducing the SLM practices in the 3 sites over 4 years. Potential for carbon sequestration was greatest in Carchi, where the project prevented deforestation in forest and shrub-land.

The Northern Front of Tungurahua and the Upper and Lower Zone of Pichincha had very similar responses and their values are in the same range, generating very similar benefits. The Southern Front of Tungurahua had the least benefit, and is an area where it is necessary to reinforce the practices established in the communal areas.

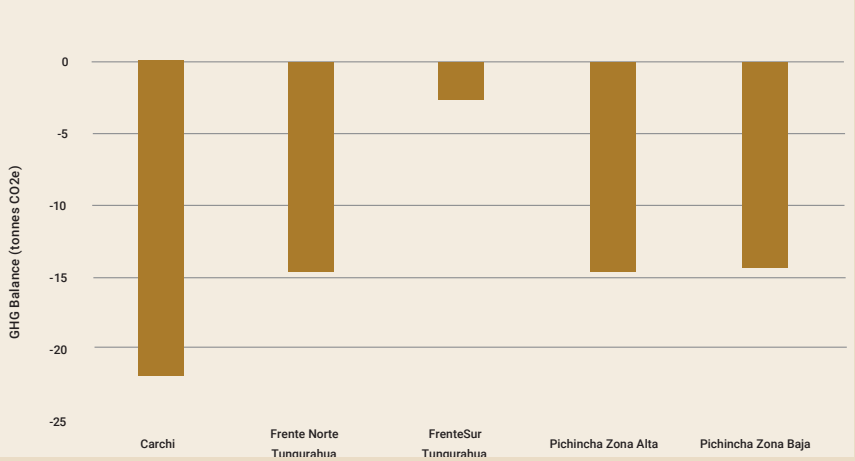


Figure 4.1. Net GHG benefits due to introduced SLM practices at each site (from Galeas in prep)

Conclusions

The implementation of Sustainable Land Management practices generates benefits in GHG removal. For study areas in Ecuador the benefits represent an average of 12.69 t CO2e/ha. Sustainable Management practices related to conservation agreements and the restoration of natural vegetation in such ecosystems are the activities that have the greatest impact on increasing the benefits in the removal of GHGs from the atmosphere.

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SLM-CCMC PROJECT ACTIVITIES IN ETHIOPIA

By Markos Wondie, Bekalu Bitew, Melese Bililign, Mark Easter, Nicolas Young, Eleanor Milne and Paul Evangelista

The SLM-CCMC project was involved in three activities in Ethiopia.
The first was a collaboration with the IFAD GEF project 'Community-Based Integrated Natural Resources Management Project (CBINReMP) in Ethiopia'. The aim of the CBINReMP was to halt the degradation of natural resources, improve grazing land and crop productivity, increase the livelihood base of the farmers and reduce climate vulnerability through integrated ecosystem and watershed management (Figure 4.2). The SLM-CCMC project worked with CBINReMP personnel in Bahir Dar towards the end of the project to provide training on CBP tools to estimate the GHG impacts at selected sites and to document project technologies in WOCAT.

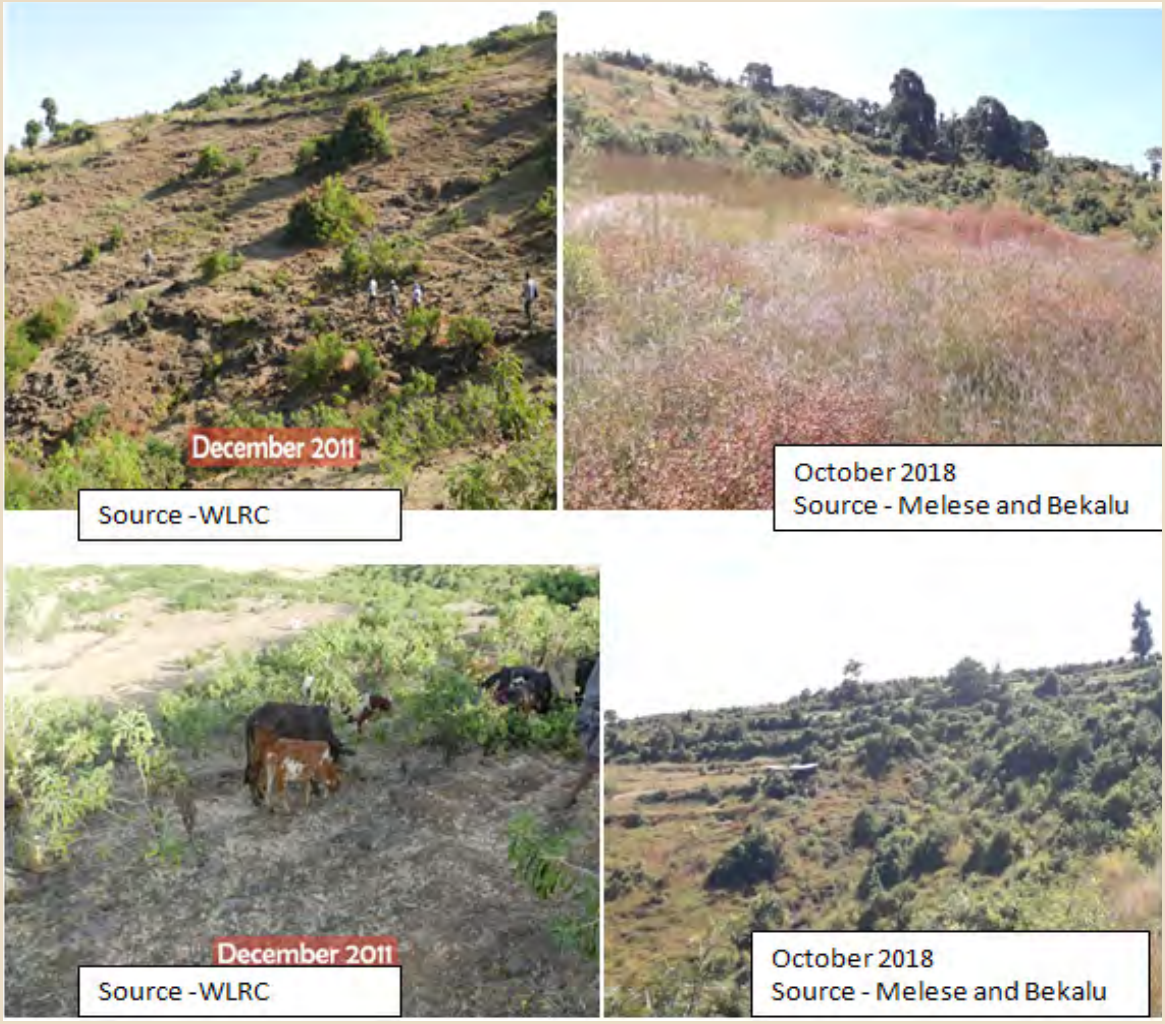

Figure 4.2 Land restoration in the Aberigma Learning Watershed, part of the CBINReMP project

In the project's Aberigma Learning Watershed, the introduction of livestock exclosures and the planting of Acacia and Gravelia led to an estimated carbon benefits of ~7 t CO2 e ha-1 yr-1.

SLM-CCMC PROJECT ACTIVITIES IN ETHIOPIA

By Markos Wondie, Bekalu Bitew, Melese Bililign, Mark Easter, Nicolas Young, Eleanor Milne and Paul Evangelista

The second activity involved a collaboration with USAID, the United States Forest Service and the Ethiopian Government to facilitate two capacity building events on 'Foundations in Greenhouse Gas Accounting for Agriculture, Forestry and Other Land Uses: Mechanisms for Measurement, Reporting and Verifications'. The SLM-CCMC team provided training on GHG accounting for the land use sector, during field sessions and training on the use of the CBP tools. This was followed by a support session six months later where participants brought their data and GHG estimates back and the CBP team provided feedback and support.

Figure 4.3 Participants at the Foundations in GHG accounting course field day

In the third activity, the SLM-CCMC team collaborated with a USDA and USAID project to use the CBP tools in conjunction with survey work to produce 'A Rapid Analysis of Greenhouse Gas Emission Mitigation Opportunities for Ethiopia'. This work produced a table of potential land-based mitigation options for the country (Evangelista et al. 2019).

Conclusions

Sustainable land management has a crucial role to play in solving the current climate crisis. SLM practices can increase carbon stored in soils and biomass and decrease GHG emissions making a significant contribution to the global GHG budget. A significant barrier to the assessment of carbon benefits resulting from SLM has been access to, and application of suitable scientifically robust cost-effective quantification tools which are easy to use. In addition, well documented datasets of SLM practices, and a means of assessing their carbon impacts are needed. The SLM-CCMC project sought to address these issues and create an environment which will make it easier for land managers to realize the climate change mitigation co-benefits of SLM practices.

Lessons Learned

1. Maximizing use of the linked toolset

The linked toolset developed by the project has provided, and continues to provide, users with the ability to plan, monitor and report on GHG co-benefits of sustainable land management activities in an accessible manner. The link between the WOCAT database and the CBP tools allows anyone who documents an SLM practice in WOCAT to estimate how that practice might impact climate change. This provides a powerful resource and will hopefully over time, lead to a comprehensive database of carbon friendly SLM practices. This will prove useful to those developing SLM projects (GEF, GCF and others), those carrying out SLM activities, the UN conventions (UNFCCC to provide input to NDCs and UNCCD for those wanting to prove contribution to LDN). Plus, it will be useful to others such as 4 per 1000, certification schemes and NGOs (such as EDF). However, long term institutional support needs to be secured for the tool network and its members. This will be crucial to maximising on the investment made by the GEF and others.

2. Training in the New Normal

The technical training program run by the SLM-CCMC project on the use of CBP, WOCAT and their linkages was very successful, exceeding expectations and built capacity to the assess the carbon benefits of SLM activities. Four training events were carried out online. Lessons were learned about what did and didn't work and how best to interact with participants during these sessions. The online sessions provided an opportunity for many attendees to take part in trainings who would not have been able to attend a face-to-face session. Accessibility was further widened by making the trainings available online, where available with translation. A future recommendation is therefore to expand the online trainings where resources become available and build up the library of online recordings in different languages. The benefits of doing this have become even more apparent recently with travel restrictions due to the corona virus pandemic. The SLM-CCMC project group continue to offer trainings on the linked toolset. Any enquiries about online or face to face trainings should be directed to the corresponding author of this report.

3. Raising awareness

The training and outreach program, plus the partnering with other existing GEF projects to support technical implementation has increased awareness of the GHG mitigation co-benefits of sustainable land management. This awareness now needs to be routinely embedded into the design of new SLM projects alongside clear guidance on how to do this. The comparative analysis of GHG tools for land management and the e-learning module developed by Component 3 of the project have made it easier to choose appropriate tools for different types of projects and activities.

4. Further emphasis on gender

The SLM-CCMC was a technical project aimed at promoting and further developing existing tools for

use in other projects. It therefore built on a legacy of existing tools in addition to working with other separate GEF projects. The activities of the projects it worked with were mainly outside of its influence on aspects other than the use of the linked toolset to report on land-based climate change mitigation potential. The SLM-CCMC project design took place following the current guidelines at the time (2012). A recent UNEP report highlights the connection between gender and environmental statistics, particularly land: "*there is a strong gender dimension in how people access land and natural resources*" (UNEP 2019). This connection demonstrates the need for gender analysis in SLM projects, and supports the need for more gender-disaggregated data, highlighted by the United Nations Statistical Division (UNSD): "**UNSD identified data needs in the gender-differentiated impact on environmental aspects such as water and firewood collection, the health impact of environmental conditions and the gender-differentiated impact of natural disasters, and on the involvement of women and men in the management of natural resources**" (UNSD 2016). As a result, a lesson learned from this project is to increase the focus on gender-disaggregated impacts in future technical projects such as SLM-CCMC which provide tools for GEF SLM projects.

The Future

Finally, and most importantly, the SLM-CCMC project provides a starting place for a much larger platform of linked tools and datasets which could address multiple ecosystem services, taking the burden of multiple reports away from land managers, and moving us closer to the realisation of multiple global environmental benefits.

There is scope for the larger platform of linked tools, datasets and resources to continue to grow beyond this project's lifetime, and to build on the lessons learned from this project. Resources are being sought for further improvements for the tools including integration with tools for other ecosystem services and data sources (including remotely sensed data) translation of resources and tools into more languages, enhancements to the linkages, and new connections with upcoming resources in SLM including WOCATs project on 'Gender responsive SLM technologies and approaches'. In addition, the team continues to respond to request for trainings and outreach. As a result of this project, the CBP and WOCAT technical teams at Colorado State University and The University of Bern are working together in an increasingly integrated manner, continuing to explore ways of providing a holistic toolset for land-based solutions to our current climate emergency.

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