AGL/MISC/37/2004

A review of carbon sequestration projects

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LAND AND PLANT NUTRITION SERVICE
LAND AND WATER DEVELOPMENT DIVISION
FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

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Contents

List of tables

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Preface

This document aims to review projects on carbon sequestration implemented in different regions of the world. It has been prepared within the framework of a FAO-Global Mechanism (GM) joint programme on *Carbon Sequestration Incentive Mechanisms to Combat Land Degradation and Desertification*.

The ongoing programme started at the beginning of 2002 with the aim of collecting, assessing and elaborating information materials concerning the use of carbon sequestration in drylands. Although few studies and projects have been conducted in these areas, the various projects that have been implemented in other agro-ecological regions of the world can provide useful information for the development of carbon sequestration projects in drylands.

The specific objectives of the programme are:

- to provide information, decision support and policy options for the use of carbon (C) sinks in transferring C from the atmosphere to soils and biomass, thus making the articles of the Kyoto Protocol and other C trading initiatives operational,
- to provide capacity building and training on the identification of optimal land use and land management options that would indicate realistic win-win options to sequester C, enhance land productivity to combat land degradation and desertification, and improve food security in dryland areas and,
- to enable the Global Mechanism to bring to member countries, the Global Environmental Facility, United Nations Framework Convention on Climate Change and relevant institutions, convincing arguments on the carbon sequestration potential in drylands that can be used for the development of projects to improve land use management in this area.

The programme is being implemented in collaboration with carbon sequestration expertise from universities, research institutions and departments of Agriculture and Environment of the Ministries of Agriculture, Science, Technology and Environment of governments of several countries.

The main output of the programme is a knowledge base with information materials for enabling policy support to ongoing negotiations and further funding for cooperation programmes aiming at enhancing carbon sequestration and reversing desertification.

This document reviews past and ongoing projects on carbon sequestration as part of the knowledge base. It is hoped that this document will prove useful for the Clean Development Mechanism and for funding agencies, planners and administrators by contributing with project factual information that could serve as an example for the elaboration of further future projects.

Acronyms and abbreviations

AIJ	Activities Implemented Jointly
BCF	BioCarbon Fund
CCC	Convention on Climate Change
CCD	Convention to Combat Desertification
CER	Certified Emission Reduction
CDM	Clean Development Mechanism
COP	Conference of the Parties
C	Carbon
CS	Carbon Sequestration
ERU	Emission Reduction Units
ET	Emission Trading
FAO	Food and Agriculture Organization of the United Nations
GHG	Greenhouse Gases
GEF	Global Environmental Facility
GM	Global Mechanism
IBRD	International Bank for Reconstruction and Development
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
KP	Kyoto Protocol
LULUCF	Land Use, Land-use Change, and Forestry
NGO	Non Governmental Organization
PCF	Prototype Carbon Fund
PKB	Prototype Knowledge Base
SBSTA	Subsidiary Body on Scientific and Technological Advice of the Conventions
SOM	Soil Organic Matter
UN	United Nations
UNCCD	United Nations Framework Convention to Combat Desertification
UNCBD	United Nations Framework Convention on Biological Diversity
UNFCCC	United Nations Framework Convention on Climate Change
VER	Voluntary Emission Reductions
WB	World Bank

Chapter 1
Introduction

At the moment, the political and funding agenda for climate change mitigation is awaiting for future key resolutions. These resolutions should include the ratification of the Kyoto Protocol (KP) by some of the main CO_2 emitting countries, the execution of the functions of the Joint Implementation (JI) and the Clean Development Mechanism (CDM), and the development of the technical guidance by the Intergovernmental Panel on Climate Change (IPCC) under the different chapters of the forthcoming report "*Good Practice Guidance for Land-Use, Land-Use Change and Forestry* (LULUCF)".

Organizations created to enforce the United Nations (UN) Conventions such as the Global Mechanism (GM) by the United Nations Framework Convention to Combat Desertification (UNCCD) (Annex I), are also trying to include aspects related to carbon sequestration (CS) in soil and biomass. Both aspects are closely linked. Climate change can have an impact on desertification whereas measures addressing desertification can be associated with soil and biomass CS processes. Financial resources are expected to be available for developing countries in order to enforce UN conventions such as the United Nations Framework Convention on Climate Change (UNFCCC) (Annex II), United Nations Framework Convention to Combat Desertification (UNCCD) and United Nations Framework Convention on Biological Diversity (UNCBD). New funds are needed for climate change mitigation and adaptation projects, particularly those directed at the mitigation of greenhouse gas emissions (GHG). In particular projects that, in addition to reversing desertification processes, can also sequester C and mitigate climate change, could be an important contribution to the future project portfolio of international mechanisms such as the GM. Therefore, it is important to learn more about the functioning of the existing CS projects with the purpose of understanding how these projects are structured, what type of methodology they use for measuring CS and to justify C credits, their environmental and social impacts and overall, to understand whether these projects can be an example of a win-win situation and could be implemented in dryland regions.

The current joint FAO/GM programme: "*Carbon Sequestration Incentive Mechanisms to Combat Land Degradation and Desertification*" has been established to prepare a compendium of factual information on win-win situations and CS in the form of a Prototype Knowledge Base (PKB) that can be used for decision support and for developing policy options. This document is part of this PKB and aims to illustrate different types of representative CS projects being carried out in developing countries, and to highlight some important issues regarding the functioning of these projects for future project development and funding agendas.

This document is the product of an intensive research of more than 60 Web sites, from which, 16 projects were selected based on two major criteria: (1) projects that represent one of the categories from the Intergovernmental Panel on Climate Change (IPCC) report 2000 (forest protection, improved forest management, reforestation and deforestation, agroforestry, multi-component and community forest and (2) the accuracy of the information provided. International negotiations and funding mechanisms are still in process, hence, the development and implementation of CS projects is still at the first stages. The projects are of recent

implementation or/and ongoing, in many cases pilot projects. The information given is based mostly on personal communication with people involved in the operation of those projects and in some cases on data obtained from Web sites.

Chapter 2
Current status of international agreements and funding regarding carbon sequestration

The ultimate objective of the UNFCCC is to achieve "*stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system*". The KP agreement was derived from the UNFCCC with the aim of establishing commitments for all developed countries (Annex B countries) to reduce their GHG emissions by about five percent by the year 2010 compared to the 1990 level of emissions (Annex III). The agreement was only achieved by allowing countries to offset their fossil fuel emissions targets by increasing biological C sinks and by trading C credits (Schulze *et al.*, 2002). The KP protocol is subject to ratification and approval by Parties to the Convention. The protocol requires a "double-trigger" before it enters into force. Article 25 of the KP states that: "This Protocol shall enter into force on the ninetieth day after the date on which not less than 55 Parties to the Convention, incorporating Parties included in Annex I which accounted in total for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I, have deposited their instruments of ratification, acceptance, approval or accession".

The KP was negotiated in 1997 and it has yet to be ratified by a sufficient number of countries[1]. At 15 May 2003, 84 Parties have signed and 109 Parties have ratified or acceded to the KP. Countries, and parties of the UNFCCC, which have not yet ratified the KP are: Australia, Croatia, Liechtenstein, Monaco, Russian Federation, Switzerland, Ukraine and the United States of America. Australia and the USA have stated that they will not join the Protocol. Thus currently there are enough **number** of ratifications, but the countries which have ratified do not account for at least 55 per cent of the total carbon dioxide emissions for 1990 of the Parties included in Annex I.For this reason, to enter into force, the KP now requires the ratification of the Russian Federation.

The KP, for its implementation, has introduced three innovative mechanisms. The mechanisms aim to reduce the costs of curbing emissions by allowing Parties to pursue opportunities to cut emissions more cheaply abroad than at home. The cost of curbing emissions varies considerably from region to region, hence, it makes economic sense to cut emissions where it is cheapest to do so, given that the impact on the atmosphere is the same. The negotiators of the Protocol and the Marrakech Accords sought to design a system that fulfilled the cost-effectiveness promise of the mechanisms, while addressing concerns about environmental integrity and equity (Annex IV and V). The KP defines three mechanisms to allow credit to be gained from action taken in other Parties:

[1] The text of the Protocol to the UNFCCC was adopted at the third session of the Conference of the Parties in Kyoto, Japan, on 11 December 1997, it was open for signature from 16 March 1998 to 15 March 1999 at United Nations Headquarters, New York. By that date the Protocol had received 84 signatures. Those Parties that have not yet signed the Kyoto Protocol may do so at any time.

- The **"Joint Implementation" (JI)** (under Article 6), provides for UNFCCC Annex I Parties to implement projects that reduce emissions, or remove C from the air, in other Annex I Parties, in return for emission reduction units (ERUs).
- The **Clean Development Mechanism (CDM),** defined in Article 12, provides for UNFCCC Annex I Parties to implement projects that reduce emissions in non-UNFCCC Annex I Parties (Annex VI), in return for certified emission reductions (CER), and assist the host Parties in achieving sustainable development and contributing to the ultimate objective of the Convention. The CDM has yet to be negotiated and agreed upon before it can become effective. Countries could use C credits obtained from the year 2000 for the purpose of meeting their assigned reduction amounts.
- The **Emission Trading (ET)**, as set out in Article 17, provides for Annex I Parties to acquire units from other Annex I Parties.

Projects that are based on LULUCF activities may be an important means of mitigating GHG emissions. The inclusion of forestry projects will put the KP into practice through the JI (for UNFCCC Annex 1 countries), and the CDM (for both UNFCCC Annex I and non-UNFCCC Annex I countries). After a lengthy process in Marrakech, in October and November 2001, it was agreed that for the first commitment period (2008–2012) (see Annex IV and V):

- The JI mechanism will only consider projects in Annex I countries directed to the following activities: afforestation, reforestation, deforestation, revegetation, forest management, cropland management, and grazing land management (see Annex VII for definitions).
- The CDM will only consider projects in non-Annex I countries implemented for afforestation and reforestation activities (see Annex VI). Avoiding deforestation, forest protection or agricultural activities will not be included. Therefore, only Annex I countries could claim C 'credits' (to be offset against their C emissions) for funding reforestation and afforestation projects in developing countries. Emission reductions achieved through reduced impact logging, enrichment planting or forest conservation projects will not be eligible, at least during the first commitment period.However on could argue that since LULUCF projects are relatively inexpensive, they are still likely to be utilized under the CDM. The annual flow of CER is limited to 119.6 Mt CO_2-equivalents without the participation of USA, an additional 58.5 Mt CO_2-equivalents could be allowed if the USA ratifies the Kyoto Protocol (Kolshus, 2001)
- Carbon sequestration (CS) in soils is an eligible activity only for Annex I countries.

Article 11 of the Convention defines a mechanism for the provision of financial resources to developing countries on a grant basis, including for the transfer of technology. The article also specifies that the financial mechanism shall function under the guidance of, and be accountable to, the Conference of the Parties (COP), which shall decide on its policies, programme priorities and eligibility criteria related to the Convention. The COP designated the Global Environment Facility (GEF) as an operating entity of the financial mechanism on an ongoing basis, subject to review over four years. The GEF is now the main funding channel for climate change projects in developing countries. At the COP-7 (Marrakech, October/November 2001) Parties adopted the Marrakech Accords whereby the COP gave additional guidance to the GEF that expanded the scope of activities eligible for funding, including in the areas of adaptation and capacity-building. COP-8 was successful in putting in place the procedures for the operation of the CDM under the KP. This enables countries to benefit financially through projects to reduce GHG emissions. CDM projects are already being undertaken in several developing countries and the market for such projects may hit several hundred millions of US dollars within a few

years. One of the issues which will need to be addressed is how to guarantee the sustainable development benefits from CDM projects and also ensure an equitable distribution of projects to the poorer developing countries. The issue of adaptation to climate change has been raised by the developing countries for some time. At COP-7, in Marrakech, three new funds were, at long last, created to support activities on adaptation in developing countries. These funds will be managed by the GEF in addition to the Trust Fund that also covers the climate change focal area. These funds are:

- **Special Climate Change Fund**: To finance activities, programmes and measures related to climate change, that are complementary to other GEF efforts, in areas of adaptation, technology transfer, capacity building, climate change mitigation, energy, transport, industry, agriculture, forestry and waste management, economic diversification and resource management, for assisting developing countries highly dependent on income from fossil fuel (like OPEC countries). This fund was established under the UNFCCC. This fund has been granted around US$450 million dollars a year starting from 2005.
- **Least-Developed Countries Fund**: To support a special work programme for last developed countries[1]. This fund is being used, in the first instance, to assist all these nations to carry out their respective National Adaptation Plans of Action. These are expected to be completed within the next year or two and will help countries identify the priority actions needed for adaptation to climate change. This fund was established under the UNFCCC and has received around US$10 million from Canada.
- **The Kyoto Protocol Adaptation Fund**: To finance concrete adaptation projects and programmes in developing countries (non-Annex I Parties) that are parties to the Protocol, including the following adaptation activities: avoidance of deforestation, combating land degradation and desertification, etc. This fund will be financed from the "share of the proceeds" on the CDM, in order of two percent of CER and other sources of funding. The Adaptation Fund is likely to enter into force under the Meeting of the Parties COP.

No specific amount to be transferred to these funds is mentioned apart from the two percent fee of the CDM to the Adaptation Fund. The European Union, Canada, Iceland, New Zealand, Norway and Switzerland made a joint statement at Bonn that they will contribute US$410 million annually to these funds from 2005 (Torvanger, 2001). These three new funds will be operated by the GEF.

The World Bank (WB) has specific programmes dealing with climate change mitigation. One of these is the **Prototype Carbon Fund** (PCF) created in 1999 (Annex IX), with the objective of mitigating climate change, promoting the Bank tenet of sustainable development, demonstrating the possibilities of public-private partnerships and offering a "learning-by-doing" opportunity to its stakeholders. The PCF mission is to pioneer the market for project-based GHG emissions reductions within the framework of the KP and to contribute to sustainable development. Through partnerships, the PCF has built strategic coalitions with both the public and private sector to mobilize new resources for sustainable development and address global environmental problems through market based mechanisms. Private companies and six governments have contributed US$145 million. Through project based mechanism, the PCF promotes assistance in projects to reduce GHG emissions and contribute to the sustainable development of developing countries.

[1] The Least Developed Countries, consisting of 46 of the world poorest countries, mostly in sub-Saharan Africa but also in Asia as well as some small island countries, have only become an effective grouping with the larger developing countries group known as the G-77/China in recent times. They were effective, though, in getting the new Least Developed Countries Fund created at COP-7 in Marrakech in 2001.

The PCF was established for the purpose of:

- demonstrating how project-based transactions in GHG emission reductions can contribute to the sustainable development of developing countries and countries with economies in transition,
- sharing the knowledge gained in the course of the PCF operations with all interested parties,
- demonstrating how the International Bank for Reconstruction and Development (IBRD) or WB can work in partnership with the public and private sectors to mobilize new resources for its borrowing member countries while addressing global environmental concerns. The operations of the PCF include the provision of project resources in the form of the purchase of ERU from projects, either directly or through intermediaries.

Moreover the WB is developing a new fund, the **BioCarbon Fund**[1] (BCF), to provide C finance for projects that sequester C or reduce GHG emissions in forest and agricultural ecosystems. The BCF will aim to deliver cost-effective C emission reductions, while promoting biodiversity conservation and sustainable development. This fund was designed to test and benchmark the market for high-quality removal of GHG in forest and agro-ecosystems. This fund will strive to create C assets that enhance biodiversity protection, help fight against desertification, and support socioeconomic development. It will support both projects currently eligible under the KP and projects that can mitigate GHG but are not yet creditable under the KP (projects that offer biodiversity, sustainable land use and development benefits). Since 2000, the WB Group, through its Prototype Carbon Fund, has pioneered the development of a project-based flexibility mechanism to generate potential GHG emission reduction credits. Today, the BCF proposes to use the successful Prototype Carbon Fund model to expand the reach of C finance to agricultural and forest ecosystems. The BCF represents an opportunity to attract private capital to biodiversity protection, soil conservation and sustainable community development. The credits are urgently needed in poor countries. Sinks maybe the only significant way for many poor nations that have small industrial sectors and limited energy use to benefit from the C finance business. The BCF will include CS and C conservation activities or a combination of these two. Particular activities will include one of the following:

- Improved forest management
- Plantations
- Agroforestry
- Prevention of deforestation
- Land degradation prevention
- Wetlands protection and restoration
- Watershed management

BCF participants are expected to contribute with US$2–3 million and it will be capitalized up to US$100 million in one or several closings. A call for contributions to the BCF would be issued in early 2003, so the BCF is expected to be operational by the fall of 2003.

[1] "BioCarbon Fund" (see www.biocarbonfund.org and Annex IX).

Chapter 3
Ongoing carbon sequestration projects

In spite of the uncertainties surrounding C offsets, particularly with regard to land use offsets, more than 150 bilateral C offset schemes have been developed to date. About 30 projects are based on forestry activities and options related to land use designed to conserve and/or sequester C, or to substitute renewable wood products for fossil fuel based products. Investor motives include anticipation of legislation, demonstration of corporate responsibility, and secured first-mover advantage (Table 1).

A Land Use, Land Use Change and Forestry (LULUCF) project can be defined as a planned set of activities within a specific geographic location that is implemented by specific sub-national or, occasionally, national institutions. There are three broad categories of LULUCF projects, each with a variety of subtypes, which were based on the IPCC (2000) report:

- **Emissions reduction through conservation of existing carbon stocks**: for example, avoidance of deforestation or improved forest management including alternative harvest practices such as reduced-impact logging or fire and pest protection.
- **Carbon sequestration by the increase of carbon stocks**: for example, afforestation, reforestation, enhanced natural regeneration, revegetation of degraded lands, reduced soil tillage and other agricultural practices which increase soil carbon, or extend the lifetimes of wood products.
- **Agroforestry, multi-component or community forestry projects** that combine several of the activities listed above.

The category "*carbon substitution*" was not included. The eligibility of these different types of CS projects (LULUCF or not LULUCF) under the KP, and many of the rules that apply to them, still have to be decided and formulated. The outcome of this policymaking process will have a large bearing on the potential (and costs) of projects as a mean of mitigating GHG emissions while contributing to sustainable development (IPCC, 2000).

IPCC (2000) establishes categories or types of projects based on their orientation and the type of funding:

Type 1. Project funding is provided by investors who are committed to offsetting their C emissions, irrespective of the status of the international climate change negotiations. Funds are provided to a central office, which seeks out, designs, and implements projects meeting investor criteria.

Type 2. Entities (e.g., electric utilities) that consider themselves likely to face emissions reduction mandates in the future are implementing their own projects.

Type 3. Project formulators identify and design projects on the basis of expected GHG and non-GHG benefits, then seek funding from donor sources. These projects are developed primarily to mobilize resources for non-climate services (e.g., biodiversity protection by a land management NGO) and to gain experience in project implementation (often reporting under the AIJ pilot program).

Type 4. Projects developed for scientific research to gain expertise on CS measurements (e.g., in unexplored geographic areas or agro-ecosystems).

The next section contains representative projects of each of the categories described above. The different projects were grouped by continent.

In addition, Table 1 includes a list of CS projects described by name, area, host country, total C offset produced and cost efficiency. Table 2 contains a list of 40 sustainable agriculture and renewable resource management projects in China and India under the three distinct mechanisms:

1. increasing C sinks in SOM and above-ground biomass,
2. avoiding C emissions from farms by reducing direct and indirect energy use,
3. increasing renewable energy production from biomass that either substitutes for consumption of fossil fuels or replaces inefficient burning of fuelwood or crop residues, and so avoids C emissions, together with use of biogas digesters and improved cookstoves.

Each project profile is presented as an individual "fact sheet" which was designed to answer the following aspects:

I.	Type of project
II.	Location
III.	Objectives
IV.	Partners
V.	Life of the project
VI.	Estimated lifetime of CO_2 benefits (Mt C)
VII.	Estimated CO_2 benefits per hectare (t C ha^{-1})
VIII.	Cost estimates and cost efficiency (US$tC)
IX.	Land area (h) and type of management proposed by the project
X.	Description of activities
XI.	Methodology for measuring CS
XII.	Projected environmental impacts
XIII.	Projected socioeconomic benefits and advocacy
XIV.	Perspectives for the future

In some cases the main source of information about the project is given at the end. In other cases, the information was based on personal communication from people in charge of the project.

TABLE 1
A selection of agriculture and forestry carbon offset projects

Project Name	Date initiated and duration (years)	C offset (1000 t C)	Estimated CO_2 Benefits per hectare (t C ha^{-1})	Area(ha)	Cost efficiency (US$/t C)	Host Country	Investor Country	Project description	Observations:
Face Malaysia	1992	4 250		25 000		Malaysia	Netherlands	Enrichment planting	Using CO_2 FIX model.
Face-Kroknose	1992/17 (lifetime 99 years)	3 080		16 000	14.25	Czeck R.	Netherlands	Park rehabilitation	Using CO_2 FIX model. Increase in recreational and tourism value. 200 labourers/ farmers involved
Face Netherlands	1992	885	177	5 000		Netherlands	Netherlands	Urban forestry	Using CO_2FIX model.
Face Rio Bravo (RBCMA)	(40 year lifetime)	2 400		14 327	3	Belize	Netherlands	Tropical forest management and protection.	Using Winrock GHG estimation and monitoring software. Forest products industry, Mayan archaeological site, conserve biodiversity and reduce soil erosion.
PROFAFOR	1994	9 660	129	25 203		Ecuador	Netherlands	Small farmers plantation forestry	Using CO_2FIX model.
Face Uganda AES-Care	1994/17 (lifetime 99 years) 1998 (35)	6 750 10 500	26 56	27 000 186 000	27.8	Uganda Guatemala	Netherlands USA	Forest rehabilitation Agroforestry	Using CO_2FIX model. Reduced soil erosion, improved water quality, reduced logging and fire degradation of park, conserving biodiversity.
AES-Oxfam-Coica	1992	15 000		1 500 000		S. America	USA	Forest Protection	
AES-Nature Conservancy	1992	15 380		58 000		Paraguay	USA	Forest Protection	
RUSAFOR-SAP	1993 (40)	79	89	450		Russia	USA	Plantation Forestry	
RIO BRAVO	1994 (40)	2 400	39	14 000 protection 46 406 forest management		Belize	USA	Forest protection and management	
Zona Huetar Norte and Sarapiquí	2000 (7)			43 000		Costa Rica	Germany		FONAFIFO-MINAE-SINAC-KfW Funds are used by FONAFIFO Program for Environmental Services Payments (PSA). KfW contributes with US$10 million & Costa Rica (through green taxes) with US$ 4 million.

TABLE 1 – A selection of agriculture and forestry carbon offset projects (Continued)

Project Name	Date initiated and duration (years)	C offset (1000 t C)	Estimated CO_2 Benefits per hectare (t C ha^{-1})	Area(ha)	Cost efficiency (US$/t C)	Host Country	Investor Country	Project description	Observations:
CARFIX	1994	2 000		91 000		Costa Rica	USA	Forest protection and management	
Ecoland/Tenaska	1995 (16)	350	146	2 500		Costa Rica	USA	Forest conservation	
Viralla River Basin Forest	1997 (25)	231	4	52 000		Costa Rica	Norway	Forest Conservation and Reforestation	Costa Rican National Power and Light Company, Consorcio Noruego, Costarican National Forestry Financing Fund
ICSB-NEP 2	1996	360		9 000		Malaysia	USA	Reduced Impact Logging	
Costa Rican Biological Reserves Sequestration Project		57 (in 20 years)		530 000		Costa Rica	USA	Forest Conservation	USAID, Ministry of Environment and Energy of Costa Rica Earth Council Foundation of USA and Costa Rica Foundation for Development of the Central Volcanic Mountain (FUNDECOR) Centre Financial Products (offset broker). Cost US$ 157 million trough carbon funds.
Noel Kempff Mercado Climate Action Project	1997-2026 (30 years lifetime)	from 7 000 to 14 000	7	634 000	9.6	Bolivia	UK/USA	Forest protection and management	www.vnf.com
KLINKI forestry	1997 (46)	1 970	328	6 000		Costa Rica	USA	Reforestation with klinki	
Burkina Faso	1997	67		300 000		Burkina Faso	Denmark	Fire wood community forestry	
PAP OCIC	1997	18 000		570 000		Costa Rica	Norway, USA	Forest conservation	
Norway-Costa Rica	1997	230		4 000		Costa Rica	Norway	Forest rehabilitation and conservation	
Tesco "green petrol	1998	n.a		n.a.		Undefined	UK	Forestry	
"Green fleet initiative	1997	n.a		n.a		Australia	Australia	Reforestation	
AES- Ilha Bananal	1998	n.a		n.a		Brazil	USA	Forest Rehabilitation	
NEW + Pacific Power	1998	69		1 041		Australia	Australia	Reforestation	

TABLE 1 – A selection of agriculture and forestry carbon offset projects (Continued)

Project Name	Date initiated and duration (years)	C offset (1000 t C)	Estimated CO_2 Benefits per hectare (t C ha^{-1})	Area(ha)	Cost efficiency (US$/t C)	Host Country	Investor Country	Project description	Observations:
Delta Electricity Peugeot-Pro Natura	1999	n.a.		n.a.		Brazil	France	Forest rehabilitation and conservation	
Scolel Te	(lifetime 30 years)	330 (in 30 years)	from 120 to 300	2 400	12	Mexico	UK/France	Agroforestry, trees in borders, improved coffee systems, natural regeneration and improved slash and burn agriculture.	230 000 tons C/ year 2 400 of individual and communal farmlands. Social, economic, environmental and C benefits. www.eccmuk.com/planvivo/carbonmodel.htm
Community Silviculture in Sierra Norte, Oaxaca		3 1 (in 30 years)		49 000	5	Mexico	Mexico	Community Forestry	CCMSS, ERA Union de Comunidades Ixtlan-Etla, Union de Comunidades Zapoteca-Chinantecas
TNC-Guaraquecaba	2000	n.a.		n.a.		Brazil	France	Forest rehabilitation and conservation	
Australian Plantations Timber	1999	3 075		25 000		Australia	Japan and others	Plantation Forestry	
East Kalimant-COPEC	n.a.	0.13 (in 40 years)		600	4	Indonesia	USA	Reduced Impact Logging	usiji@ee.doe.gov Kiani Lestari (private) and Inhutani II (paraestatal) logging concessions in East Kalimant.
Gunung Leuser Prak	n.a.					Indonesia	Netherlands	Reforestation	www.northsea.nl/JIQ/nether.htm Leuser Conservation Park in Aceh, Sumatra
SIF Carbon Sequestration Project	n.a.	1.4 (in 48 years)		7 000		Chile	USA	Reforestation	Cfix, L.L.C. (affiliate of Trillium Corporation), Washington State Working with small farmers reforestation of degraded pasturelands with *Pinus radiata* and *Eucalyptus* for commercial fibre.
Western Oregon	1997 (65)	54.5	440	127		USA	USA	Afforestation	Utility Tree USA
UNSO Arid Savanna Protection	1993	660-1000	33	25 000		Benin Sudano-Sahelian Office	U.N.	Woody savannah protection, live fences	

TABLE 1 – A selection of agriculture and forestry carbon offset projects (Continued)

Project Name	Date initiated and duration (years)	C offset (1000 t C)	Estimated CO_2 Benefits per hectare (t C ha^{-1})	Area(ha)	Cost efficiency (US$/t C)	Host Country	Investor Country	Project description	Observations:
World bank Prototype Carbon Fund	1998					International	nternational	Renewable energy and forestry	
Kilombero Forestry Plantation Project	1996 (lifetime 99 years)			12 121	3 US$	Tanzania	Norway and UK	Afforestation	
Community Based Rangeland Rehabilitation for CS	1995			2 532	375	Sudan	U.N.	Reversal of Land Degradation	
CS and Sustainable Agriculture in Senegal						Senegal	U.S.A. Denmark Switzerland	Research Project	Using biogeochemical modeling CENTURY
SOCSOM	2002					Senegal Cameroon Kenya	U.S.A.	Research Project	using the CENTURY model to estimate C stocks
Savanna Optimum				10 000		Mali, Benin Burkina/Gha-na border		Testing the C sequestering efficiency of agricultural land management systems on the West Africa savannah	
Village-Based Management of Woody Savanna and the Establishment of Woodlots for CS	1992 -1997	5 338 167	42.13	126 700		Benin	U.N.	Reduce CO2 emission from several semiarid areas by better management of forests and village lands	
Communities and Climate Change: The CDM and Village-Based Forest Restoration	2000-2001 (50 years lifetime if implemen-ted)		3.4 tC ha/year	5 000/ 10 000	Oct-15	India	U.S.A.	Generate estimates of the volume of C currently being sequestered and stored by community forest management	

TABLE 1 – A selection of agriculture and forestry carbon offset projects (Continued)

Project Name	Date initiated and duration (years)	C offset (1000 t C)	Estimated CO_2 Benefits per hectare (t C ha^{-1})	Area(ha)	Cost efficiency (US$/t C)	Host Country	Investor Country	Project description	Observations:
Identifying System for CS and Increased Productivity in Semi-arid Tropical Environments	2002					India	U.S.A.	Research Project	Using Walkley and Black method
Women for Sustainable Development Plan Vivo Forestry Project	lifetime 35 years	23		25 000 acres	345 US$ for 1 acre	India		Agroforestry project for harvest and C sequestration	This project is funded through the CER
CS in the Desertified Rangeland of Hossien Abad	1997 (lifetime 5 years)		21 (after 50 years)	9 000	187.4	Iran	U.N. Iran	Rangeland rehabilitation in Drylands	
Integrated management of peatlands for biodiversity and climate change	2002 (lifetime 3 years)					China Russia Indonesia		Research project which investigates techniques to facilitate CS in peatlands	Using Watson, Neuzil and Cecil estimates for peatlands store capacity
Assessment of soil organic C stocks and change at National scale	2002 (lifetime 5 years)					India Jordan Kenya Brazil	U.S.A. Netherlands U.K. Austria	Research Project to quantify CS potential in tropical soils	Using GIS (Geographic Information System) tools

Sources: Moura Costa P. (2002), IPCC (2000), FACE, Ministerio de Agricultura de Costa Rica, n.a. = information not available.

TABLE 2
List of 40 best practices for sustainable agriculture and renewable resource management projects and initiatives in China and India

Zero-tillage projects

- Zero-tillage of rice-wheat systems, Haryana (Peter Hobbs, CIMMYT, pers. comm)

Watershed development and soil conservation projects

- Xiji County comprehensive management of watersheds, Ningxia (Wang Ke Zhi, pers. comm)
- National pilot watersheds programme, China (Li Wenhua, 2001)
- Loess plateau soil and water conservation project, China (Li Wenhua, 2001)
- UNDP poverty alleviation and sustainable development project, Yunnan (Yao Yunsong, pers. comm.)
- Hebei Plain wheat-maize double-cropping project (Lang Weili, pers. comm.)
- East Gansu sustainable agricultural for effective use of rainfall resources (Fan Tinglu, pers. comm)
- Rural communes comprehensive watershed development, Maharashtra (Muneer Alavi and Rajashree Joshi, pers. comm.)
- Rajasthan watershed development programme (Krishna, 1999)
- EZE sustainable agriculture, Bangalore (EZE, Banglalore)
- World Neighbours dryland farming projects, India (World Neighbours)
- ActionAid watershed projects, Karnataka, Tamil Nadu, Uttar Pradesh and Madhya Pradesh (ActionAid)
- Aga Khan Rural Support Programme, Gujarat (Shah and Shah, 1999)
- Participative Integrated Development of Watersheds project, Karnataka (Fernandez, 1999)
- Indo-German watershed development project, Maharashtra (Lobo and Palghadmal, 1999)
- Society for People Education and Economic Change, Tamil Nadu (Devavaram *et al.*, 1999)
- Doon Valley Integrated Watershed Development project, Uttar Pradesh (Thapliyal *et al.*, 1999)
- KRIBCHO Indo-British Rainfed Farming Project (West) (P S Sodhi, pers. comm)
- Women Sangams of Deccan Development Society, Andra Pradesh (Sateesh and Pimbert, 1999)
- Karnataka watershed development projects (funded by DFID, Danida, KfW) (Ninan, 1998)
- Tamil Nadu watershed development projects (Gov. of Tamil Nadu, 2001)
- National Council of Development Communication (V K Dubey, pers. comm.)

Mixed sustainable agriculture and agroforestry projects

- Pawlonia agroforestry and intercopping programme, China (Li Wenhua, 2001)
- Learning by Doing cotton project, Punjab (Philippa Guest, pers. comm.)
- MS Swaminathan Research Foundation integrated intensive farming systems, Tamil Nadu (V Balaji, pers. comm.)
- N Kolar tamaraind agroforestry project, Karnataka (N H Ravindranath, pers. comm.)
- Maikaal organic cotton project, Madhya Pradesh (Myers and Stolton, 1999)
- Non-pesticidal managament, Nellore - Centre for World Solidarity (S A Shafiunnisa, pers. comm.)
- Technology assessment through Instituional Village Linkage, Karanataka (G K Veeresh, pers. comm.)
- Praja Abyudaya Samastha, Andra Pradesh (M Balavardiraju, pers. comm.)
- Ankapur village project, Nizamabad (V Balasubramanian, pers. comm.)

Irrigated rice and pest management projects

- Multiline rice cultivation, Yunnan (Zhu *et al.*, 2000)
- Paddy-rice - aquaculture systems, China (Li Kangmin, 1998, Li Wenhua, 2001)
- Rice-IPM national programme, China (Eveleens *et al.*, 1996, Mangan and Mangan, 1998)
- Rice-IPM national programme, India (Eveleens *et al.*, 1997)
- Gujarat Participatory Irrigation Management programme (R Parthasarathy, pers. comm.)

Biogas and improved cookstove projects

- National biogas programme, China (MoA, 2000, 2001, Li Wenhua, 2001)
- National biogas programme, India (Ravindranath and Ramakrishna, 1997)
- National improved cookstoves programme, China (Cui Shuhong, 1998)
- National improved cookstoves programme, India (Ravindranath and Ramakrishna, 1997, Shukla, 1998)

Source: Pretty *et al.* (2002)

LATIN AMERICA

PROJECT 1

SCOLEL TE PILOT PROJECT FOR COMMUNITY FORESTRY AND CARBON SEQUESTRATION THROUGH THE PLAN VIVO SYSTEM

I. Type of project

Community multi-component agroforestry project. Companies, individuals or institutions wishing to offset GHG emissions can purchase voluntary emission reductions (VER) via the project trust fund ("*Fondo BioClimatico*"). The project uses the Plan Vivo System to register and monitor CS activities implemented by farmers. Local promoters help farmers to draw up their own "working plans" for forestry or agroforestry systems that reflect their own needs, priorities and capabilities. These are assessed for technical feasibility, social and environmental impact, and CS potential against a number of technical specifications that have been developed with input from scientists, farmers and technicians. Viable plans are registered with the Trust Fund and are eligible to generate C services. The Trust Fund then provides farmers with financial and technical assistance to implement farm or community-scale forestry and agroforestry developments, on the basis of the C that will be sequestered.

II. Location

The project is situated in Chiapas (southern Mexico), and includes a number of ecological and cultural regions such as the Tojolobal and Tzotzil communities in the highlands and the Tzeltal and Lacandón communities in lowland regions.

III. Objectives

To sequester C in forest and agricultural systems as well as to provide sustainable livelihood among rural communities and to preserve biodiversity. The aim is to ensure that C is reliably sequestered for the long term in systems that are economically viable and socially and environmentally responsible. Mechanisms for internal monitoring and external verification are included in the project. The model is applicable on a larger scale in similar regions of Mexico and other developing countries.

IV. Partners

The project is managed jointly by the Edinburgh Centre for Carbon Management (ECCM) in the UK and a cooperative of foresters and agronomists (AMBIO) in Mexico. Forestry activities are planned and undertaken by groups and communities of small farmers affiliated to local organisations such as the "Unión de Crédito Pajal" and AMEXTRA. The project is part of Mexico official Programme of Joint Implementation to reduce climate change and is also registered with the US Initiative for Joint Implementation. Various organisations have been involved in the development of the project and associated research including "El Colegio de la Frontera Sur" (ECOSUR), the Institute of Ecology and Resource Management (IERM) of the University of Edinburgh and the National Institute of Ecology (NIE) of the Mexican Government.

V. Life of the project

30 years.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Phase I: 15, Total: 330. This project has sold 5500 and 12 000 t C every year from 1997 until today (de Jong, *pers. comm.*). Cumulative net sequestration of 150–333 Mt C total over lifetime.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

The establishment of tree plantations on areas previously used as pasture may increase C storage in vegetation by about 120 tC/ha. By growing timber and fruit trees interspersed with annual crops such as corn or perennial crops such as coffee, around 70 tC/ha can be sequestered. Where closed forests are threatened, protection can prevent emissions of up to 300 tC/ha, and where forests are degraded, careful management and restoration can increase C storage by around 120 tC/ha.

VIII. Cost estimates and efficiency

US$12/t C. US$3.4 million projected total cost, with initial phase at US$0.5 million, and public and private financing.

IX. Land area and type of management system

About 2 400 ha of individual and communal farmlands within 18 miles of the lowland Tzeltal coffee zone, and the Tojolabal highlands. The management systems are based on improved slash and burn, trees in borders, improved coffee system, natural regeneration and restoration.

X. Description of activities

The project is a pilot-level demonstration of sustainable forestry combined with agroforestry. The project has designed a system of technical assistance to farmers by producing plans for each parcel calculating C benefits and developing a monitoring protocol. The system is called the Plan Vivo System. Funds are provided to a central Trust Fund called "*Fideicomiso Fondo Bioclimático*" (FBC) which seeks out, designs, and implements projects meeting investor criteria. The project is not yet under the CDM. It counts, however, with the requirements of monitoring, verification and transparency. The project aims to ensure permanence through promoting activities that have the potential to provide long-term benefits to farmers. Farmers also agree to invest part of the harvest income in replanting trees, however it is unclear whether these mechanisms are sufficient to secure the hundred years of permanence. Given that the project is addressed to small peasant family units, FBC pays in advance for the C not yet captured and follows and monitors the subsequent reforestation, afforestation or other management activities aiming at sequestering C in the immediate future. Farmers from 18 communities are already receiving payments for environmental services depending on baselines and proposed management system.

XI. Methodology

Measurements of C fluxes are based on "*A Guide to Monitoring Carbon Storage in Forestry and Agroforestry Projects*" (MacDicken, 1997). Estimates of CS are detailed in technical

specifications for each individual forestry system, these specify minimum management requirements and evidence based on calculations of offset potential. Voluntary emission reductions currently sold by the project are calculated on the basis of average storage over 100 years. Monitoring is carried out annually in all plots. Community technicians are employed to carry out monitoring, which not only reduces the cost but also increases community involvement in the project. Community technicians are given training for this purpose and 10 percent of monitoring data is checked by the technical team for accuracy.

Carbon trading methodology: The Plan Vivo system is based on a trust fund which is a market stall where buyers and sellers of C meet. The institutional structure depends on the organizations involved but the principles of accountability, participation and pro-active roles will always apply. C trading is initiated in nine steps, from a study of the potential purchase of the C service to the implementation of offset activities on the farmer lands and the payments and monitoring to assess the progression of C storage and social benefits. The trust fund holds resources (either money or C credits) in trust for those providing these inputs (purchasers or producers respectively). The administration costs, including salaries for technical/social advisors, are included in the C price. It is possible that funds may initially be available from other sources, for example development agency funding. However, for long-term sustainability the trust fund will need to be self-financing. The trust fund statutes should state what percentage of the price paid by the purchaser will be used for administration and what percentage will go to the producer. In the Scolel Té project C is valued at US$12 per t of which US$8 goes to the producer, US$2 is used for administration and US$2 for technical services. For example, a producer with a management plan of 2 ha pine plantation has an estimated potential of sequestering 200 tC for the whole site from 1999 to 2099. After verification of monitoring targets there will be payments of US$320 (for 40 t C credited) each of the first three years and the years 2005 and 2010.

XII. Projected environmental impacts

Conservation of and increase in forest biodiversity, reduction of forest fragmentation and soil erosion. These will serve as buffer zone by slowing immigration to the forest. Currently, the deforestation of about 17 million ha per year causes annual emission to the atmosphere of 1.8 Gt C as carbon dioxide, the most important GHG. This is 25 percent of the total carbon dioxide emission due to man. However, when forests are restored or conserved they can act as sinks of carbon dioxide. Thus, fossil fuel users who contribute to the preservation or establishment of forests can reduce their net GHG emissions.

XIII. Projected socioeconomic benefits and advocacy

Growth of the local economy through sustainable agroforestry and improvement of women welfare and villagers.

XIV. Perspectives for the future

50 ha funded for initial implementation. Detailed studies at community and regional scale completed. Management, research, and financial institutions established. The Scolel té Project in Mexico is part of the Plan Vivo System developed with the academic support of the Edinburgh Centre of Carbon Management and funded by the UK Department for International Development (DFID). It created the Bioclimatic trust Funds in Chiapas and in India.

Main source:

Tipper and De Jong (1998); Witthoeft-Muehlmann (1998)

PROJECT 2

NOEL KEMPFF MERCADO CLIMATE ACTION PROJECT

I. Type of project

Funded by American Electric Power, BP Amoco and PacifiCorp to face emissions reduction through conservation of existing C stocks, forest conservation and protection (*forest protection*).

II. Location

The state of Santa Cruz, Bolivia (latitude 14.775° S to 13.485° S and longitude 61.850° W to 60.640° W) is adjacent to the area of the Noel Kempff Mercado National Park.

III. Objective

Forest conservation and emission avoidance, reduction, and mitigation.

IV. Partners

A joint project between The Nature Conservancy, Fundación Amigos de la Naturaleza (FAN), and Bolivian Government. It is funded by three US-based energy companies private sector investors: American Electric Power, BP Amoco and PacifiCorp (which have provided US$9.6 million in funding). Design and implementation of the C inventorying and monitoring programme provided by Winrock International.

V. Life of the project

30 years, 1997 through 2026.

VI. Estimated lifetime of CO_2 benefits (Mt C)

7 000–14 000.

VII. Cost estimates and efficiency

US$9.60 million for the first 10 of 30 years, including permanent endowment of US$1.5 million.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Seven.

VIII. Land area and type of management system

The project area is approximately 634 000 ha. The C offsets in this project result from the prevention of logging and conversion of forested lands to agriculture. Avoided C emissions will result from:

1. ***Averted logging:*** removal of commercial timber was halted and damage of unharvested trees was eliminated,
2. ***Averted conversion of forested lands to agricultural uses:*** loss of C in forest biomass was halted and loss of C from soil was eliminated.

IX. Description of activities

C benefits are generated through two approaches:

1. *Forest conservation and prevention of deforestation.* Logging rights were terminated on 2 million acres of government owned land, which was added to the existing national park. The project has undertaken such protection activities as hiring and training of park guards,
2. *Assurance of future forest conservation through income generating activities.* These include a park endowment fund and an effort to commercialize biological resources.

X. Methodology

Design and implementation of the C inventorying and monitoring programme by Winrock International (MacDicken, 1997). The C inventory of the area was based on data collected from a network of permanent plots, located using a differential global positioning system (DGPS)[1]. The monitoring timetable after the initial inventory is at years 3, 5, 10, 15, 20, 25 and 30. Future monitoring plans include the analysis of changes in land cover/land use from satellite data and the use of a dual camera videography system to monitor project area and any changes in logging practices in nearby concessions (a videography system may be used to monitor tree extraction rate). Data analysis and information from the above monitoring plan will enable revisions to be made to the without-project baseline, and thus produce more accurate and precise estimates of the C offsets over the length of the project.

XII. Projected environmental impacts

Project activities have contributed to the following:

1. *Biodiversity protection.* The expansion of the park has doubled the safe range for species that require large extensions of land, including the manned wolf and jagua.
2. *Soil and water quality.* The cessation of logging has averted soil erosion and future agricultural runoff into the many rivers of the park.
3. *Air quality.* Local air quality is expected to improve because logging traffic and slash-and-burn agricultural practices will diminish.

XIII. Projected socioeconomic benefits and advocacy

The project has provided the following additional local benefits:

- Local employment of park guards.
- Micro-enterprise revolving funds, which provide loans for small businesses engaged in such enterprises as heart-of-palm plantings and agroforestry.
- Assistance to local communities seeking to attain legal status as indigenous people and to secure land tenure.

[1] For more information: http://www.winrock.org/reep

XIV. Perspectives for the future

The C benefits of the project are expected to last in perpetuity because the site lies within the newly expanded national park and a permanent endowment has been established to fund protection activities beyond the 30 year life of the project. Without the project, logging concessionaires would have continued harvesting timber on the property, and much of the land in the project site would have been cleared. The project has a leakage agreement with the former timber concessionaires under which they are obligated to report on the compensatory funds they received to cease operations and to collaborate on sustainable forestry practices on their other logging concessions. The project is working with local communities to create economic opportunities that provide an alternative to encroaching on other forestlands.

Main source:
Moura-Costa (2002)

PROJECT 3

FACE FOUNDATION REFORESTATION PROJECT (PROFAFOR)

I. Type of project

Funded by the FACE Foundation to sell C credits. *Multi-component community forest project.* The most representative FACE programme.

II. Location

In the Andean region of Ecuador and in the buffer zone of the Mache-Chindul Ecological Reserve within the polygon of El Carmen, Pedernales, Cojimíes, Muisne, Atacames, Bilsa and Quinindé (northern part of the Manabí province and the southern part of the Esmeraldas province).

III. Objectives

To sequester C by establishing forests and reforesting 75 000 ha.

IV. Partners

Forest Absorbing Carbon dioxide Emission (the FACE Foundation)[1], Ministry of Environment of Ecuador and several small and large holders: Perez, Abogados, Cia. Ltda, Romero & Associates, Ernest & Young International.

V. Life of the project

PROFAFOR has forestation contracts from 1994. Not available.

VI. Estimated lifetime of CO_2 benefits (Mt)

9 660.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

129.

VIII. Cost estimates and efficiency

FACE spent approximately 7 million € in the year 2000 on the planting and management phase and on monitoring, certification and supervision. (cost of CS per ha not available).

[1] FACE has the main objective of planting and managing forests with the aim of sequestering CO_2 for the Foundation and third parties, selling the resulting credits and providing advice to third parties in relation to those activities. FACE has at its disposal CO_2 credits with a fiscal value, as per the end of the year 2000, of € 8 per credit which are liable to corporate income tax. The foundation's largest client is an electric company Bv NEA (before NV Samenwerkende Elektriciteits Productiebedrijven). FACE collaborates with organizations aimed at nature management, as well as with commercial organizations that profit from the sale of forest products. Project partners must have a proven expertise in the field of forestry. FACE finances supplementary research.
For more information: (www.efi.fi/projects/casfor).

IX. Land area and type of management system

Area planted as at the year 2001, 25203 ha. PROFAFOR selects a non-forested area appropriate for forestry, thus helping to conserve and regulate water and soil. Afforestation with native species for the Andean zone "quishuar" (*Buddleja incana*), "yagual" (*Polylepis incana*), "aliso" (*Alnus acuminata*), "sacha capulí" (*Vallea stipularis*), and "jiguerón" (*Aegiphylla ferruginea*) and non native species such as *Pinus patula*.

X. Description of activities

Farmers, community groups or NGOs interested in joining PROFAFOR send the documentation required to access the program, to be considered a beneficiary. PROFAFOR signs contracts with land owners and, as beneficiaries, they are responsible for maintaining the plantations. Beneficiary farmers join PROFAFOR, receive support from the program, gain employment, cooperate and take advantage of different tree products such as leaves for forage, wood for building houses, work tools, animal corrals, etc.

XI. Methodology

PROFAFOR uses additionality, sustainability, cost-benefit, efficiency criteria to select and develop forestation projects. Sustainability is based on maintaining biodiversity through the use of local and introduced species. Efficiency implies achieving high yields, from the point of view of CS. The sequestration of CO_2 is calculated using the CO_2FIX calculation model developed by IBN-DLO in 1993. The contract stipulates that the project partner is obliged to provide regular and accurate reports of planned and executed activities. A FACE official visits a project area at least twice a year, to inspect and discuss progress. FACE is able to follow the development of its projects by purchasing Satellite record images of the project areas every few years. By combining this data with inspections in the field and surveying points in the area, the sequestration of CO_2 can be calibrated and calculated. The MONIS (Monitoring and Information System) is used to process the extensive amount of data and make it easily accessible. MONIS also contains a GIS (Geographical Information System) based on the ArcView (tm) program. The project partners enter the data. To verify the calculated levels of CO_2 sequestration a certified person visits the project. This person scrutinizes the books, examines the planting and development of the trees, assesses the research plots, tests the algorithms, lists the risks and finally issues his statement (the Carbon Offset Verification) on the quantity of stored CO_2 that can be said to be available. FACE enters into a long-term relationship (99 years) with the forest owner, who has to ensure sustainable forest and forestry practices. FACE criteria correspond largely to those of the FSC (Forest Stewardship Council). The follow-up checks and assessments in subsequent years are conducted on a random basis.

XII. Projected environmental impacts

Contribution to the establishment of 20 000 ha of forest plantations in Ecuador highlands Andean region in the Páramo (3 700 m.a.s.l). Up to 1999 mainly pine and eucalyptus were the main species being planted. Actually, through Ecopar (a project set up to identify and propagate native species involving Loja University, the Amsterdam University and Larenstein International College), new forests are being laid out using indigenous tree species. PROFAFOR now has contracts for the production of some 20 million forest seedlings in 24 private nurseries and 17 new private nurseries for seedlings of native and exotic species.

XIII. Projected socioeconomic benefits and advocacy

There are 29 peasant organizations afforesting 6 000 ha. The project will provide employment for forest plantation workers and agricultural professionals for technical assistance in plantation establishment. Approximately 200 contracts have been signed between PROFAFOR and different beneficiaries. Peasant communities, under the supervision of technicians trained by PROFAFOR, carry out the following activities: selection of the plantation site, development of management and reforestation plans, identification of local species, plantation establishment and maintenance, preparation of progress reports before payments. The following tasks must be completed during plantation establishment: production of seedlings in the nursery, transportation of seedlings, signing and marking out the terrain, digging holes, planting, replanting, constructing fireguards.

XIV. Perspectives for the future

Up to 2001 there were 25 203 ha planted. An agreement has been signed with the Ecuadorian Ministry of Environment to plant 75 000 ha more of forest. PROFAFOR has been set up to evaluate and deal with the applications and contracts. The applications come from local farmers groups and communities who will receive a grant to cover the costs and the planting material.

PROJECT 4

REGIONAL (COLOMBIA, COSTA RICA, NICARAGUA) INTEGRATED SILVOPASTORAL APPROACHES TO ECOSYSTEM MANAGEMENT

I. Type of project

Projects on the basis of expected GHG and non-GHG benefits (*improved ecosystem management*). By focusing on the enhancement of the functioning of the entire ecosystem and its resulting increased CS, biodiversity and water quality, the project is directly in line with the objectives of GEF OP12. One of the purposes is to gain experience in project implementation (often reported under AIJ pilot programs).

II. Location

Colombia, Costa Rica, Nicaragua.

III. Objectives

- To improve ecosystems functioning of degraded pasture lands in Colombia, Costa Rica and Nicaragua, through the development of more intensive silvopastoral systems that provide global environmental services and local socio economic benefits.
- To demonstrate and measure the benefits of improvement of degraded pasture in terms of environmental, socioeconomic and global environmental benefits.
- To acquire expertise in global environmental projects.
- To develop comprehensive guidelines for sector and environmental policies in terms of land use, environmental services and socioeconomic development.

IV. Partners

World Bank/GEF, the Focal Points of Colombia, Costa Rica, Nicaragua, CATIE (Centro Agronómico Tropical de Investigación y Enseñanza), FAO (Livestock Environment and Development Initiative), CIPAV (Centre for Research on Sustainable Agricultural Production Systems), NITLAPAN (Institute of research and development of the University of Central America).

V. Life of the project

5 years (2001–2005).

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

The cost of the project is US$4.5 million (cofinancing by CATIE, CIPAV, NITLAPAN for US$0.6 million, LEAD US$0.35 million, ABC US$0.05 million and Beneficiaries US$2.9

million). The cost of the baseline scenario is US$9.7 million, the cost of GEF alternative is US$18.1 million.

IX. Land area and type of management system

Improving the ecosystem functioning through the introduction of silvopastoral systems.

X. Description of activities

Ecosystem enhancement and capacity building:

- Monitoring environmental services.
- Eco-services trust fund.
- Formulation of policies and decision support.

XI. Methodology

Key performance indicators related to the project development objectives that include:

- The increase in area of improved ecosystems functioning of currently degraded pasture land.
- Soil and water quality and biodiversity.
- The number of livestock producers, community leaders, and policy decision makers at local, regional and national levels.
- Increased numbers of families who enjoy the ecological and economic benefits of more intensive silvopastoral systems in livestock production.
- Methodologies to measure CS, biodiversity conservation, water quality in watersheds and socioeconomic aspects related to improved resources monitoring.
- Sets of policy guidelines on benefits sharing mechanisms and institutions related to global and local services provided by integrated ecosystem management.

XII. Projected environmental impacts

Significant areas with improved ecosystems functioning through the introduction of silvopastoral systems, as confirmed by soil, water and biodiversity parameters.

XIII. Projected socioeconomic benefits and advocacy

Trained stakeholders and strengthened local organizations, which will be informed on integrated ecosystem management and on the implementation of sustainable livestock production systems.

Initial information on the response at community and beneficiaries level to incentive systems to produce global environmental benefits through biodiversity conservation and global climate change. Policy guidelines to promote sustainable intensification of livestock production and specific recommendations for sector and environmental policies in terms of land use, environmental services and socioeconomic development.

XIV. Perspectives for the future

Not available.

AFRICA

PROJECT 5

THE KILOMBERO FORESTRY COMPANY LTD. A KFC[1] PLANTATION PROJECT

I. Type of project

Funded by a Tanzanian subsidiary of Tree Farm A/S of Norway to face emissions reduction. CS through increase in C stocks: *afforestation*.

II. Location

Tanzania Kilombero District that lies in the eastern part of the Morogoro Region, in south-eastern Tanzania. In the Uchindile village, Mlimba Division-Kilombero District, about 10 km from the site of the Southern Paper Mills (SPM). Located in a sparsely populated, savanna-like area at 1150-1400 m.a.s.l. altitude. Rainfall is around 1200 mm/year.

III. Objectives

The overall aim is to generate CER for export once the CDM is operational. Specific objectives are:

- To undertake a CS project through afforestation activities contributing to the reduction of GHG effect globally.
- To promote environmental conservation.
- To facilitate socioeconomic development to the community residing around the project area. It is the intention of EFC to qualify KFL as a CDM project under the KP.

IV. Partners

The Sokoine University of Agriculture (Morogoro) invites outside investors and shareholders.

V. Life of the project

Started in 1996, it can run for another 99 years.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

[1] KFC belongs to EFC (Escarpment Forestry Company) a Tanzanian subsidiary of Tree Farm A/S of Norway.

VIII. Cost estimates and efficiency

Low cost C offsets at US$3 t/C**.** Seeking US$1.05 million in new equity in the project, representing 49 percent of the total share capital. Expected to obtain US$1 500 000 in loans and US$600 000 in grants. The project offers a plantation established at a cost well below US$500 per hectare. Return on equity is forecast at 21 percent per year, when valued at 35 percent below the current prices in New Zealand.

IX. Land area and type of management system

The KFL plantation is an afforestation programme which covers an area of about 12 121 ha. To date a total of 1 420 ha of *Pinus patula* and *Eucalyptus saligna/grandis* have been planted.

X. Description of activities

The Kilombero plantation (owned 100 percent by Escarpment Forestry Company Ltd.) was established in 1997, with large scale planting starting in 1998. It has 12 121 ha of land on a 99 year lease from the Tanzanian State. 1 400 ha of forest land have been planted with eucalyptus and pine. Currently it is in the final stages for COV Certification is being undertaken by SGS forestry (UK). It has already applied for registration with the National Climate Change Focal point. It includes a planting programme of approx. 2 000 ha of forest per annum, over a 6-year period, until an area of 15 000 ha has been planted.

XI. Methodology

The KFC project is intended to create additional emissions through establishment of plantations of exotic species on natural grassland (non-forested land). The C to be claimed will be based on above and belowground biomass due to tree growth. A CS model for Tanzanian pine has been developed for the project with input from the Sokoine University of Agriculture (Morogoro). The net C storage potential of the plantation is derived by comparing with and without project scenarios (baseline with a projection for C storage below and aboveground given a committed afforestation program under a specific forest management regime).

The afforestation activities will be funded through cash generated from its shareholders as well as seeking Official Development Assistance (ODA funds) in terms of grants. However, reputable financial institutions have shown interest in the project.

A scientific methodology and a model is under development to estimate changes in C pools for the whole project life cycle as well as to establish Permanent Sample Plots (PSP) for inventorying and monitoring C offsets in the project area. However, field measurements are in process to verify the results from the model. The process of certification is in accordance with the SGS ICS Ltd Eligibility criteria. An environmental ISO standard on forest management may be established in the future.

XII. Projected environmental impacts

The establishment of forest plantations and promotion of community tree planting around the project area is expected to relieve pressure on the local forest resources by producing timber, building poles and fuel wood. Environmental benefits include cleaner air and water, reduced deforestation, soil conservation and biodiversity conservation.

XIII. Projected socioeconomic benefits and advocacy

Rural development through the creation of employment, training, access to schools, roads, water and other social amenities.

XIV. Perspectives for the future

To date, 1 400 ha have been planted with pine and eucalyptus species. The company target is to plant up to 15 000 ha each planting season by the year 2008. The KFC project will initially operate for 99 years renewing its activities depending on the prevailing condition of business.

PROJECT 6

COMMUNITY BASED RANGELAND REHABILITATION FOR CARBON SEQUESTRATION

I. Type of project

Rangelands cover an estimated 60 percent of Sudan, providing grazing for one of the largest concentrations of livestock in Africa. As much as 50 percent of rural nomadic people in Sudan depend on livestock. Grazing areas have been severely affected by drought, degrading the land and reducing its capacity to regenerate and provide sufficient fodder for livestock. Cultivation under arid conditions also leaves soil bare for most of the year increasing the risk of soil erosion. In addition rural residents are depleting forests for fuelwood, further harming the land and reducing its biodiversity. This project is focusing on one part of Sudan to test a model of *community-based natural resource management*. The project is using participatory techniques with short-term economic and long-term ecological objectives. In the project area, few environmental regulations exist and no government entity is actively promoting awareness of the environmental consequences of land deterioration. Community-based management could help address local environmental concerns.

This project shows a win-win situation: CS and reversal of land degradation. Pilot research project funded by GEF.

II. Location

Bara Province in North Kordofan State, Western Sudan.

III. Objectives

General: To test a simple model of community-based natural resource management utilizing participatory techniques with short-term economic and long-term ecological objectives. *Specifically*: To sequester C through the implementation of a sustainable, local-level natural resources management system that prevents degradation and rehabilitates or improves rangelands, and to reduce the risks of production failure in a drought-prone area by providing alternatives for sustainable production, so that out-migration will decrease and the population will stabilize.

IV. Partners

UNDP Country Office with the Range and Pasture Administration office of North Kordofan State, the Federal Range and Pasture Administration and the NEF (Near East Foundation). The NEF is a private non-profit development agency, it works directly with local institutions to help people in the Middle East and Africa.

V. Life of the project

8 years.

VI. Estimated lifetime of CO_2 benefits

- From rangeland management after 20 years: direct benefits, 10 128 tC and indirect benefits, 21 731 tC.
- From rangeland improvement after 20 years direct benefits, 3 000 tC and indirect benefits, 4 000 tC,
- From dune stabilization after 20 years 2 640 tC and indirect benefits, 8 910 tC.
- Total direct benefits: at the end of the project: 5 400 tC, after 20 years 18 383 tC. Total indirect benefits: at the end of the project: after 20 years 48 741 tC. 61 000 t C in 20 years.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

The un-discounted cost is approximately US$3.5 tC. Including the cost of the project activities the cost is approximately US$375 tC.

IX. Land area and type of management system

Total 2 532 ha (communal rangelands). All project activities were focused at the village council level for the Gawamaa tribe (agropastoralists) and the satellite camp level for the Kawahla tribe (transhumants). The project sought to reverse negative environmental trends through participatory activities such as planting trees and grass to stabilize sand dunes, creating km of windbreaks comprising two rows of trees, improving 100 ha of rangeland with native perennial grasses, and developing land use and rangeland management plans.

X. Description of activities

The project is in the process of establishing a sustainable, local natural resource management system to rehabilitate rangelands and prevent further land degradation. Project activities include:

- Development of land use and rangeland management master plans.
- Institutional building that consisted mainly of mobilizing community groups for planning and implementation of project activities.
- Training project staff on technical and administrative topics, and individuals from 17 villages in community development, natural resource management, credit systems, drought mitigation, animal production and health (through 45 training events).
- Improvement of 100 ha of rangeland with native perennial grasses, browse species and native trees.
- Stabilization of sand dunes by planting trees and grass, creation of 195 km of windbreaks comprising two rows of trees.
- Rangeland rehabilitation and improvement: Enhancement of the ecological capacity for rangeland regeneration, rehabilitation of degraded areas, testing/procurement of appropriate grass and tree species, sand dune revegetation and windbreak installation.
- Community development activities: In order to achieve long-term CS benefits, it was necessary to implement parallel activities designed to meet the short-term development needs of the local communities. A total of 39 activities were implemented: small-scale

irrigation vegetable gardens, construction/management of water wells, sheep for goat substitution program, revolving funds to finance local income generating activities, central pharmacy for human/animal medicines and a grain storage and credit program for drought preparedness.

A large portion of the project area range has already been receded. The project is promoting alternative livelihoods that reduce damage to forests. A vegetation C monitoring contract has also been established.

XI. Methodology

The CS was measured as the difference between the C status in 1998 (after two years of the project) and in 1996 (the baseline) of the rangelands. The CS by reduced fuel wood demand and by reduced construction wood demands was measured indirectly. The social impact of the project was estimated by a participatory approach.

XII. Project environmental impacts

The main environmental problems of that area are: degradation of rangelands, reducing CS, biodiversity loss and livestock and crop production. The main environmental benefits of this project are:

- Increased soil cover, reduced soil erosion and greater CS.
- Increased species diversity of plants and, in the long run, fauna, as well as healthier ecosystem.
- Sustainable management of natural resources.
- Reduction of airborne particles.

XIII. Project socioeconomic benefits and advocacy

Improved socioeconomic conditions for livestock producers, particularly the poor and women, strengthened local capacity to manage and preserve the ecosystem.

XIV. Perspectives for the future

If funding is available, NEF-Sudan could replicate this project in other areas. For NEF, a particularly important and similar area is northern Darfur where it has long-term plans for program expansion, a history of work, and strong relationships with local people. Olsson and Ardo (2002) determined in this region that increasing fallow periods will result in increased soil C content and converting marginal agricultural areas to rangeland will restore the C levels to 80 percent of the natural savannah C levels in 100 years.

Main source:
Dougherty et al. *(2001)*

PROJECT 7

CARBON SEQUESTRATION AND SUSTAINABLE AGRICULTURE IN SENEGAL

I. Type of project

Research project to gain expertise on CS strategies for improving land degradation.

II. Location

Senegal.

III. Objectives

To assess, evaluate, and quantify the environmental, ecological, and socioeconomic potential for the sequestration of C in soil in selected agro-ecological zones of Senegal as a basis for improving soil fertility and restoring degraded land. The expected results are to raise stakeholder awareness of CS and to increase agricultural production and food security.

IV. Partners

Centre de Suivi Ecologique (CSE) with the Natural Resource Ecology Laboratory (Colorado, USA), USGS/EROS Data Center (Sioux Falls, USA), the Geographical Institute of the Technical University of Copenhagen (Denmark) and the Swiss Federal Polytechnical Institute of Lausanne (Switzerland).

V. Life of the project

Not known.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

Not estimated yet.

IX. Land area and type of management system

Not estimated yet.

X. Description of activities

Using the Century model to simulate the impact of changing land use practices on CS, with sites in the North, Central and Southern parts of Senegal. The historical land use patterns have been

identified and projects have been made on how improved land usage can improve ecosystem function and C storage.

XI. Methodology

Modeling changes in C stocks with CENTURY.

XII. Projected environmental impacts

Not available.

XIII. Projected socioeconomic benefits and advocacy

Not available.

XIV. Future perspectives

Not available.

PROJECT 8

SEQUESTRATION OF CARBON IN SOIL ORGANIC MATTER (SOCSOM)

I. Type of project

Research project. SOCSOM in Africa is a prototype pilot project designed to advance our understanding of the contributions that can be attained by activities supported under the framework of the CDM or similar arrangements. This project is focused on the restoration of soil C for the improvement of agricultural productivity and sustainability.

The project is funded by USAID (the United States Agency for International Development) and started in 2002.

II. Location

Senegal, Cameroon, and Kenya.

III. Objectives

- Develop a quantitative analysis of the environmental, ecological, and economic potential for the sequestration of C in SOM of three spatially explicit sites.
- To examine the socioeconomic enabling conditions that will encourage smallholders to implement successful projects and will help define important policy issues.
- To facilitate the establishment of a National Carbon Team,
- To continue capacity building in the areas of CS and climate mitigation,
- To refine methods for using the CENTURY model to estimate C stocks in three study areas in Senegal.

IV. Partners

Centre de Suivi Ecologique (CSE), Earth Resources Observation System (EROS), Data Center (EDC) short-term expert and the Senegalese Institute for Agricultural Research (ISRA).

V. Life of the project

Not available.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

Not estimated yet.

IX. Land area and type of management system

Not known.

X. Description of activities

Experts in soil CS, biogeochemical modeling, and socioeconomic analyses will develop the study plans and simulations for each site in an intensive workshop with local experts. Teams will be formed for each site to continue data gathering and to define the biophysical potential and socioeconomic requirements. The activities will be undertaken with cooperating organizations in the country, which will develop training and educational materials, and will facilitate the capacity development of African soil scientists. Historical patterns and changes in C stocks will be evaluated. Currently, soil sampling is being carried out in three Senegalese zones.

XI. Methodology

Not available.

XII. Projected environmental impacts

Not available.

XIII. Projected socioeconomic benefits and advocacy

Not available.

XIV. Perspectives for the future

Not available.

PROJECT 9

NEAR EAST FOUNDATION (NEF) PLANS CARBON SEQUESTRATION PILOT PROJECTS IN WEST AFRICAN "SAVANNAH OPTIMUM"

I. Type of project

Carbon pilot project. Global warming mitigation while agricultural sustainability is enhanced and rural poverty reduced. *Improved agricultural land management systems.*

II. Location

West Africa: Mali, Benin and Burkina/Ghana border along the Black Volta.

III. Objectives

To test the C sequestering efficiency of agricultural land management systems on the West African Savannah. The purpose of the CS process is that if a ton of atmospheric C can be competitively removed and durably stored in a peasant farming and/or herding system, global warming can be mitigated at the same time as agricultural sustainability is enhanced and rural poverty reduced.

IV. Partners

NEF (Near East Foundation)**,** IFDC, SOS Sahel, the Global Carbon Market, Columbia Center for International Earth Sciences Information Network (CIESIN), the West Africa team of the International Fertilizer Development Center (IFDC) and its in-country counterparts.

V. Life of the project

Not specified.

VI. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

Not estimated yet.

IX. Land area and type of management system

- 10 000 agricultural ha each (seeking no less than five additional tonnes of soil and vegetative C per ha),
- Management of tropical savannahs for competitive CS alternative: the “savannah optimum,” where a balance of sun and water allow for maximum C absorption,
- Managing intensified agriculture for exporting cotton (the West African Savannah most profitable cash crop),
- Improvement of watershed or river basin management for improved rivers and recharged water tables.

X. Description of activities

Using agricultural intensification technologies (combining fertilizer, agro-forestry and/or range management in sequence and as appropriate) in savannahs. Testing appropriate agricultural intensification technologies. Organizing and gaining the confidence of involved rural communities.

XI. Methodology

NEF, its partner NGOs, IFDC and its host country colleagues will work with target communities to measure C flux and establish a baseline before extending the C-sequestering agricultural upgrade. A sampling frame and a soil and land management monitoring model will be established to certify the durable rise of C flux point per ha.

Columbia Center for International Earth Sciences Information Network (CIESIN) will monitor, the scientific practices that would best make these West African land use transformations interesting to potential buyers in a global C market and the remote sensing, metadata framework in which the implications of field measurements should be judged as reviewed, verified, and certified for an eventual C offset trade.

Columbia Center for Science and Technology in Environmental Policy (CSTEP) will develop an institutional design for the transaction chain between those farm communities organizing land use change with NGO and IFDC support, and the C buying industries of the north.

XII. Projected environmental impacts

Tropical savannahs may constitute an important CS alternative. Savannahs support denser agricultural populations than the humid tropics, because there is enough rain to grow crops but SOM is not leached out. Furthermore, soil C are exposed to direct sun unlike soils shaded by tropical forests. Thus, tropical savannah can store C in its scattered trees, bushes, grass cover, and soils.

XIII. Projected socioeconomic benefits and advocacy

Not available.

XIV. Perspectives for the future

Not available.

Main source:
*www.nearest.org/main/nefnotes/notes_details_master.asp?notes_id=21***.**

PROJECT 10

VILLAGE-BASED MANAGEMENT OF WOODY SAVANNAH AND THE ESTABLISHMENT OF WOODLOTS FOR CARBON SEQUESTRATION

I. Type of project

Benin has shown a strong commitment to issues relating to global environment and sustainable development. This project builds on that commitment by supplying the Government of Benin with the financial and technical resources necessary for them to:

- Educate target groups of peasant farmers, herders, hunters and traditional beekeepers on the crucial social, economic, and ecological role of trees in woody savannahs.
- Educate women on how to build improved, energy-saving cooking stoves.
- Engage local people in the development of rules, techniques and management plans for the sustainable, multipurpose use of forest resources.
- Empower local people to implement *sustainable forest management* plans.

II. Location

Benin, Africa.

III. Objectives

Reduce carbon dioxide emissions from several semiarid areas by better management of forests and village lands. Most households in Benin rely solely on firewood for cooking food and other energy needs. Recent studies indicate that this practice combined with slash-and-burn agriculture is deforesting the country woody savannahs at a rate of 100 000 ha a year. Already significant carbon dioxide emissions are projected to increase rapidly as the need for energy and food production grows with the country population. Benin annual per capita gross domestic product is only US$380 severely limits the options available to people. On the other hand, if energy systems and agricultural practices do not change, desertification will advance further into remaining woody savannahs, releasing their sequestered C into the atmosphere.

IV. Partners

Government of the Republic of Benin, United Nations Development Programme and the Global Environment Facility.

V. Life of the project

Five years.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

The total expected sequestration is *ca.* 5 338 167 tonnes of C.

VIII. Cost estimates and cost efficiency

Not available.

IX. Land area and type of management

Not available.

X. Description of activities

The main activities are centered around three government-owned protected forest areas covering about 176 000 ha. Eight government ministries and numerous local and national non-governmental organizations will coordinate extensive planning to maintain a sustained yield of various forest products, especially timber, which is scarce in the target area. The management plan envisioned must integrate inventory and growth data, maps of vegetation types and acreage, site conditions, and all relevant social and economic data. The plan will indicate where reforestation or other improvements are needed and which species and stands of timber may be scheduled for harvesting in the years ahead. Fire protection systems, wildlife management, and sustainable livestock-grazing schemes are also crucial components of the plan. Institutional arrangements will be specified for participation of the local population and to clarify the roles of various governmental units. The sustainable forest management activities of this project are geared toward:

- Improving the farming system, for example, by using organic matter instead of chemical fertilizers to maintain soil fertility.
- Early burning rather than late burning.
- Controlled not full site clearing, avoiding the total destruction of existing vegetation.

Although development of the management plan is now in progress, the project has already helped the majority of local people to switch to controlled early burning and controlled site clearing. More herders are now growing legume trees to feed their animals, and increasing numbers of women are using energy-saving cooking stoves. Since initiation of the project, 609098 seedlings have been planted with an average survival rate of 70 percent. As a result, 72 482 tons of C will be sequestered by the time the trees mature.

XII. Projected environmental benefits

Total eventual sequestration of about five and a half millions tons of C, containment of desertification, increased diversity and yield of products due to improved soil and agricultural practices.

XIII. Projected socioeconomic benefits and advocacy

Dramatically improved social and economic conditions in the long term. Production of wood and other products, the sustainable annual yield in the project area could be increased from two cubic meters per ha to about three cubic meters per ha in 10 years and with progressive management it is possible to have a sustainable yield of nearly seven cubic meters per ha. If markets can be found for the wood, then the net income derived from the forests could be as much as US$70 per ha. per year. The project is promoting bee keeping and alternative cash crops to cotton and encouraging the planting of grass and trees for fodder inside and outside the forests.

XIV. Perspectives for the future

Not available.

Main source:
www.gefweb.org

Asia

Project 11

Communities and Climate Change: the Clean Development Mechanism and Village-based Forest Restoration in Central India

I. Type of project

Emission reduction through conservation of existing C stocks. Research project devoted to preparation for the CDM through a case study assessment.

II. Location

The Rahatgoan forests at the Harda Division, Madhya Pradesh, Central India.

III. Objectives

To develop methodologies for monitoring and verifying field-level performance by assessing CS levels in regenerating sal (*Shorea robusta*) forests in Harda Division, Madhya Pradesh, India. The study allows India to familiarize itself with project modalities that may be financed in future through the CDM.

IV. Partners

The Harda Forest Division, Community Forestry International. Funded by: USDA (United States Department of Agriculture) Forest Service-Office of International Programs: USAID-Global Bureau.

V. Life of the project

50 years. (if implemented).

VI. Estimated lifetime of CO_2 benefits (Mt C)

From 0.4 to 0.6

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

25.4 by year 8, 41.2 by year 12 and 58.8 by year 50 (3.4 C ha/year).

VIII. Cost estimates and efficiency

10–20 US$/tC.

IX. Land area and type of management system

The Rahtgaon Range Forest and Handia Range Forest. Total of 5 000–10 000 ha. of tropical dry deciduous teak forest. Six communities have been protecting and managing these forests since 1991. The system for the forest conservation includes the following measures: restriction of fires, imposition of bans for tree felling and grazing and controlling extraction of green fuel-wood.

X. Description of activities

- Compatibility with sustainable development.
- Project boundary.
- C stock baseline.
- Additional C stock projected.
- Permanence of C stocks in the project area.
- C leakage.
- Developing a system to measure, monitor and verify changes in C stock,
- Establishment of C baseline.
- Estimation of CS and design methods for measurement, monitoring and verification.
- Determination of the CS under community-based forest protection.

XI. Methodology

Three broad sampling contexts: Unprotected Forests (control plots) that provided a baseline scenario, a total of 17 sample plots (50m x 50m) were sampled. Community protected forests (treatment plots) community-imposed use controls were established in 1991 providing scenario of potential C stock changes under project over a ten year period, a total of 18 sample plots (50m x 50m) were sampled. Protected old growth forests (site potential plots) to establish long-term biomass, C and biodiversity potential of the two forest types, four sample plots (50m x 50m). Above ground biomass and C stored per hectare were estimated utilizing conversion equations. Indicators related to the ecological part of the project: number of trees/ha, number of regeneration tree species/ha, C (Mg/ha), plant biodiversity (number of species and Shannon index). Sustainable development indicators considered for future projects: biodiversity, land reclamation or watershed protection, socioeconomic benefits (household income, community micro-credit fund, employment and flow of forest products). Projected transaction costs: 70 percent of all CER to be transferred to the community-administered apex bodies, 30 percent divided into the community, the monitoring and verifying institutions and the Forest Department. Additional funding will be required for planning, research and training. Terms of C management contract: The financing organizations will finance C sequestered at US$10 tC/year, during the first 25 years of operation, and after that it will increase to US$20 tC/year.

XII. Projected environmental impacts

Not available.

XIII. Projected socioeconomic benefits and advocacy

Not available.

XIV. Perspectives for the future

To reduce leakage, the following activities will have to be enforced: dissemination of efficient fuel wood stoves, community participation, landscape approach to monitor C stock changes. It will continue through the project “Participatory Approaches to Forest Carbon Project Identification and Implementation Phase: Methods Development”.

Main source:
Poffenberger, *et al*. (2001).

PROJECT 12

IDENTIFYING SYSTEMS FOR CARBON SEQUESTRATION AND INCREASED PRODUCTIVITY IN SEMI-ARID TROPICAL ENVIRONMENTS

I. Type of project

Research project. This project will study how C levels can be enhanced in the nutrient-poor soils of the semi-arid tropics, by means of appropriate cropping systems, and other practices such as organic and inorganic fertilizer amendments. *Improved agricultural systems*.

II. Location

India.

III. Objectives

- To identify and evaluate potential C sequestering production systems in the SAT benchmark sites and establish relationships amongst different factors with the C stock and systems productivity under semi-arid tropics,
- To evaluate and validate existing simulation models for predicting the performance of different systems for earlier sequestration.

IV. Partners

This project conducts research with three Cooperating Centers: Central Research Institute for Dryland Agriculture (CRIDA), Hyderabad, Indian Institute of Soil Science (IISS), Bhopal, and National Bureau of Soil Survey and Land Use Planning (NBSS&LUP), Nagpur. The ICRISAT is the lead centre recently qualified for implementation under the National Agricultural Technology Project (NATP) of the Indian Government.

V. Life of the project

3 years.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

Not estimated yet.

IX. Land area and type of management system

Not available.

X. Description of activities

Not available.

XI. Methodology

Total C will also be estimated by an appropriate method. Expected outcome: development of new strategies to shift land from low CS uses to high CS uses. Reversing the land use changes that might have made land areas into sources of CO_2 emission.

XII. Projected environmental impacts

Not available.

XIII. Projected socioeconomic benefits and advocacy

Not available.

XIV. Perpectives for the future

Not available.

Main source:
Velayutham, et al. *(1999).*

PROJECT 13

WOMEN FOR SUSTAINABLE DEVELOPMENT PLAN VIVO FORESTRY PROJECT

I. Type of project

It is an innovative agroforestry project in India with a similar management system to the "Scolel Te" project in Mexico. It is a project aided by the NGO "*Women for Sustainable Development*" (WSD). In this project local farmers, aided by WSD, plant fruit tree orchards on their land (mostly mango, tamarind and jackfruit) for harvest and CS.

II. Location

India, Gudibanda Taluk, about 60 km from Bangalore in the southern state of Karnataka.

III. Objectives

The aim of WSD, which is based on the principle of conscious and responsible participation of women, is to implement relevant development programmes. The aim is to assist woman to attain a minimum standard in their villages and towns and to help set up a forum for women to meet, debate and decide on matters concerning the development of their lives. In pursuance of this aim, WSD runs a prototype C marketing facility to sell the CER from the global environmental services which poor rural women and others who assist them provide. Working together, the Plan Vivo project and the NGO provide:

- sustainable income to farmers through several income streams,
- education, because the project and C is run by an NGO which offers training and advice,
- additional benefits, because the eco-friendly agro techniques made possible by the project are beneficial for both land and people.

IV. Partners

WSD and Plan Vivo. WSD is an NGO based in Karnataka, India. Its aim is to promote sustainable livelihoods for poor rural communities with a particular emphasis on women. WSD has a wide range of projects and has been helping farmers organise carbon dioxide absorbing activities in India since 1998. Plan Vivo is a C management system which enables small-scale farmers to access global C markets.

V. Lifetime of the project

35 years.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

A 35 year project period will give 23 tonnes of CS per acre. The project target is 25,000 acres. This will sequester 575 000 tonnes of C.

VIII. Cost estimates and efficiency

The total cost for one acre of dryland Mango Orchard for planting and for 5 years supervision is US$345 (or 16 560 Rupees).

IX. Land area and type of management system

Not available.

X. Description of activities

In the Karnataka region the climate is hot and dry and consequently crop yields are low. Fruit production can significantly increase farmers income, and many are willing to get involved in the mango planting scheme. Because farmers have an average annual income of less than US$100, they cannot afford to plant fruit trees without financial assistance. Expensive irrigation changes and planting tools are essential for the new plantations to be successful. Most farmers are planting trees on a one acre plot on their land, and will be able to live on the C sales from their mango plantations for the first few years. Fruit production should start about four years after plantation, and that one acre of crop will at least triple their annual income. Once the water situation, long-term viability of the plot and local ownership issues are assessed the farmer family is given the go-ahead. Thereafter the success or failure of the orchards is completely in the farmer hands. Field staff monitor the field and support the farmers. Families plant 120 hybrid mango trees and 40 other each acre. Planting fuel trees around the boundaries is also a common practice.

XI. Methodology

The minimum technical specification is: 1) 120 standing mango trees throughout the life time of the plot, 2) Minimum build up of C in soils through added manure, red sand and tank silt, and natural build up through fallen leaves and twigs. If these monitoring targets are achieved the C uptake per acre is 0.65 tC per acre year including C in soils.

XII. Projected environment impacts

Dryland mango orchards make long term ecological and economic sense in this arid and drought prone region.

XIII. Projected socioeconomic benefits and advocacy

The benefits for farmer families will be US$14,640 per family each year after six years. This is five times more than present income from groundnuts. After establishment mango trees are as prone to drought as are the annuals. There will be genuine economic, social and ecological development in the region as a result of this programme.

XIV. Perspectives for the future

Not available.

Main source:
www.climateindia.com.

PROJECT 14

IRAN: CARBON SEQUESTRATION IN THE DESERTIFIED RANGELANDS OF HOSSIEN ABAD, SOUTH KHORASAN, THROUGH COMMUNITY-BASED MANAGEMENT

I. Type of project

CS in woody biomass and in soils is a cost-effective measure to reduce atmospheric CO_2 levels. Also, surplus biomass could be used as a substitute for fossil fuels. Some woody biomass species can grow in these low rainfall areas with saline soils, although the build up of organic C in wood and soils is modest. Up to 9,000 ha of run-down land will be rehabilitated with the active participation of twelve villages in whose ownership the land will be vested. This project is meant as a catalyst for *rangeland reclamation via CS and natural resource management* throughout Iran and beyond. This project will demonstrate the means not only to increase animal fodder production, but also to expand the storage of C and provide renewable energy at the same time. It will also enhance the flora and fauna, thus increasing biological diversity and rehabilitate the ecosystem. Thus, the government is integrating global environmental protection concerns into national development activities constituting an example of a "win-win" strategy. This project will serve as a training and demonstration site to encourage rural people, with some government assistance. This project wants to demonstrate the practicability and cost-effectiveness of rejuvenating rangeland areas and making them productive, while at the same time increasing the organic C stocks in plants and soils. Therefore, additional funds to cover the incremental costs, especially the training, monitoring & evaluation costs, could demonstrate to local people and governments the practicability of such an initiative.

II. Location

Islamic Republic of Iran. Iran is a party to several environment conventions including the Convention for Climate Change (CCC) and the Convention to Combat desertification (CCD). As a result, the government has launched a wide variety of activities to reduce GHG emissions. The size of the hydrologic unit is 148 000 ha. It is situated near the Afghanistan border in eastern Iran.

III. Objectives

The main global objectives are to sequester C, to improve the ecosystem through natural regeneration by planting/seeding drought resistant grasses and shrubs, and to make the rangeland areas of Iran more productive. The purpose of this project is to demonstrate that low rainfall areas can be rehabilitated at a relatively low cost, using a mixture of woody and non-woody plants, with the active participation of the local population. Other objectives of this project are:

- To build capacity through demonstration, training and extension activities to people throughout the country so that the project can be replicated and improved.
- To promote environmental awareness.
- To enhance human resource development at the national and local levels.
- To enhance biodiversity.
- To improve flora & fauna numbers and composition and to enhance the micro-climate.

- To improve capacity of national experts and local people in rehabilitation, management and utilization of resources on degraded lands through participation and training in nursery work, establishment, maintenance, management and product marketing.
- To improve economic conditions of the local pastoral population.

IV. Partners

Stakeholders include the Office of Natural Resource Management of Birjand, the Office of Nomad Affairs, local villagers, representatives of the Village Islamic Councils (VIC), semi migratory herders, representatives of the Nomad Islamic Council, the Forest and Range Organization, the Government of I.R. Iran through the Ministry of Foreign Affairs, GEF and UNDP. The activities will be supervised by the Birjand Natural Resource Management Office (NRMO) and will be carried out by local people.

V. Life of the project

The lifetime of the project is five years, but it is envisaged that the planting of 9 000 ha will be completed after three years. Additional planting by the villagers themselves is expected to continue during the last two years and beyond.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Over a period of 20 years, an estimated 14 tonnes per hectare of additional C will be sequestered in woody biomass and soils. This could accumulate gradually to about 21 t/ha after 50 years and 30 t/ha after 100 years[1]. The average annual production of wood is estimated to be 0.64 t/ha and that of fodder, 0.20 t/ha.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

At least 9,000 ha of degraded rangelands will be converted to grazing forest-land. Through this change, the amount of additional atmospheric C, that could be stored in above and below ground biomass and in the soil, will be about 2 tonnes per hectare once the project is completed. This is anticipated to increase to about 14 t/ha. after 20 years, 21 t/ha. after 50 years and 30 t/ha. after 100 years, of which up to 90 percent will be belowground. These estimates have to be verified. Due to the prevailing arid climatic conditions and the stability of the sink, the turnover rate of C tends to be very slow and belowground C storage in roots and soil is considered to be a high quality offset. The sequestering of C does not stop at year 20, although it will slow down due to harvesting of wood. A model has been drawn up indicating the likely growth and production in the project area over a 100-year time period. The projected incremental store of C after 50 years is 20.9 t/ha. with an incremental cost of US$6.8 t./C. After 100 years, the projected C store is estimated to be 29.7 t. for an incremental cost of US$4.8 per tonne of C.

VIII. Cost estimates and efficiency

The total cost of the baseline activities of enclosure and reseeding is estimated to be US$44 per ha (without watering and weeding) or US$398 790 for 9 000 ha. The direct cost of the GEF alternative is US$106 per hectare or US$949 950 for 9 000 ha. The above cost excludes the

[1] This production will not start to flow in sizable quantities until about year 20 and there will be no income from wood sales until that period. Over a hundred-year period, if the wood is substituted for kerosene, there will be a saving of about 6.5 tonnes of carbon per 64 t. of wood at a price of about US$7.45 t. C.

training, public awareness, management and monitoring components of the project. Including these items, the total project cost is US$1 687 000, of which US$726 200 are the GEF contributions [43 percent] and the remaining US$960 000 [57 percent] will be contributed by the Government of I.R. Iran. If only seedlings and water were provided to the villagers, as is the ultimate intention, then the government contribution would be about US$28 per hectare.

IX. Land area and type of management system

The project area covers some 148 000 ha, in the desert rangelands of Hossien Abad, and supports just under 1 000 people. There are 30 villages, some have been abandoned and others only contain one or two families. The management systems are based on the rehabilitation of semi-arid areas, on training and extension activities, on public awareness and information dissemination, on a community-based management regime and on monitoring and evaluation system.

X. Description of activities

In order to achieve the project objectives the following activities will be implemented:

1. Rehabilitation of semi-arid areas. Land rehabilitation includes seedling production, ground preparation, planting, weeding, and watering for the first two years, guarding and management.
2. Training and extension. Project preparation, promotion workshops and meetings involving different stakeholders. Compile management plans for undertaking rehabilitation activity. Natural resource management training for villagers and staff of the Forest and Range Organization and some overseas training to engage the local people in establishing community-based management regimes, land ownership legalities, entrepreneurial activities, etc. Training for the local people and governmental officials on baseline surveys, such as monitoring plant growth, animal numbers, grazing patterns, soil profiles, etc.
3. Public awareness and information dissemination. This activity will be implemented to ensure that a wide range of concerned stakeholders are fully informed about the rehabilitation techniques, management mechanism and long-term economic and environmental benefits of the project.
4. Community-based management regime. This activity will aim to explore various management regimes to have the villages/households organized for the planting efforts and declare their ownership and access rights to the land.
5. Monitoring and Evaluation.

XII. Projected environmental impacts

This project fosters an increased and sustainable production of fodder, wood and other products, and a measurable increase in the area of and off-take from sheltered lands. Furthermore the protection afforded by the plantations will encourage regeneration in adjacent areas. There would also be a build-up of organic C that could reach 3-4 t/ha. after 20 years. The greatest benefits to farmers and globally will be through establishing forest-grazing areas. This project produces a measurable increase in the flora and fauna and an enhanced micro-climate. Another positive environmental impact is sand stabilization through project activities should reduce the Sistani damage.

XIII. Projected socioeconomic benefits and advocacy

This project will demonstrate how such areas can be rehabilitated and made more productive for pastoral (and arable) farming. Time and effort will be spent to train rural people, not only from the area, but also from surrounding regions, so that they are empowered, with a little government help, to rehabilitate similar semi-arid areas. Property rights, land ownership entitlements and land management options will be elucidated. The villagers with help and assistance from project staff will compile management plans, detailing the operations and timing.

XIV. Perspectives for the future

Not available.

Main source:
GEF Medium–sized Project Brief.

PROJECT 15

INTEGRATED MANAGEMENT OF PEATLANDS FOR BIODIVERSITY AND CLIMATE CHANGE "THE POTENTIAL OF MANAGING PEATLANDS FOR CARBON ACCUMULATION WHILE PROTECTING BIODIVERSITY"

I. Type of project

This project will investigate techniques for *conserving peatland areas to facilitate C accumulation* while at the same time maintaining or enhancing their biodiversity. This will include a literature review, preparation of background papers, conducting country case studies, development of management options for peatlands, regional and global workshops, preparation of a range of reports and information materials, and broad dissemination and promotion of these materials. The project will focus on the broader applications related to peatlands and reduction of net GHG emissions. To date, inadequate attention has been given to peatlands and their role for C accumulation and identification of management measures which can minimize their net contribution to GHG emissions. The project will also help implement the objectives adopted under the Convention on Biological Diversity and the Ramsar Convention on Wetlands.

II. Location

Case studies will be located in China, Indonesia and Russia. These countries have been selected as focal countries because they have extensive peatlands which form a high percentage of their wetland areas (10–70 percent).

III. Objectives

The project aims to address the capability of peatlands to act as significant C deposits, and provide recommendations on how these areas could be managed to ensure this attribute is maintained and even improved while protecting biodiversity. The project will not only identify methodologies for assessing the potential of peatlands as C stores/sinks, but also aims to identify activities that will help maintain or restore a site capacity to accumulate C.

IV. Partners

Important international stakeholders include: Convention on Biological Diversity, UN Framework Convention on Climate Change, Ramsar Convention on Wetlands, Wetlands International, International Peat Society, Global Environment Centre, The Nature Conservancy, Center for International Forest Research (CIFOR), International Mire Conservation Group (IMCG). Lead Executing agencies will be "Wetlands International" and "The Global Environment Centre" working with a range of different partners.

V. Life of the project

Thirty-six months.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Permanent.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

A recent study conducted by Wetlands International, revealed that wetlands may far exceed the capacity of forests to accumulate C. Peatlands, constitute a large C reservoir in the terrestrial biosphere. It has been estimated that northern peatlands alone contain more than 500 10^{15} G C and that CS over the last 5 000 years, at about 100 Tg/yr., equals 100 years of fossil fuel consumption and represents a reduction in atmospheric CO_2 concentration of about 40 ppm. However, estimates to date are preliminary[1].

VIII. Cost estimates and efficiency

The estimated budget is US$2 532 365 (of which 999 455 are funded by GEF grants and 1 532 910 are co-fundings).

IX. Land area and type of management system

Not available.

X. Description of activities

Planned activities to achieve outcomes are:

1. ***Global technical component:*** a literature review on C accumulation in peatlands, assessment of the impacts of peatland management practices upon C stocks and biodiversity values, review of possible peatland restoration options to maintain storage function, restore accumulation, prevent fires etc., and organize technical workshops to review and refine working papers.
2. ***Country study in Russia, Indonesia and China.***
3. ***Regional component for South-East (SE) Asia:*** gather information related to management of peatlands in SE Asia, organize regional workshops in Southeast Asia to assist in the development of a regional strategy for management options, support and promote sustainable management of peatlands.
4. ***Global outreach/capacity building and linkage to environmental convention deliberations and actions.***
5. ***Project coordination and development of a synthesis report.***

XI. Methodology

As described in X.

XII. Projected environmental impacts

Not available.

[1] Watson et al. (2000) have estimated that land use change and forestry activities, mainly tropical deforestation, account for about 1.6 Pg/yr emission of CO_2 out of the 6.3 Pg/yr from the total anthropogenic emissions. In terms of land surface, the extent of peatlands is less than one half of tropical rainforests, but peatlands contain three and a half times more carbon. Neuzil (1995) estimates that tropical peatlands store carbon at 3-6 times faster than in the temperate zone and so tropical peat deposits may represent 25–40 percent of the annual carbon storage in peatlands. Neuzil and Cecil (2000) estimate that more than 50 GtC (approximately 10 percent of the global peat carbon pool) is sequestered with rates of up to 60-145 $gCm^{-2}y^{-1}$

XIII. Project socioeconomic benefits and advocacy

The project will also assess socioeconomic aspects of peatland management. It is intended in each of the case study assessments that local peatland users (farmers, fishermen, forestry workers, local communities) as well as other stakeholders (local residents, local government agencies, etc.) will be actively involved in activities to review current uses of the peatlands and develop options for more sustainable as well as more biodiversity and climate friendly approaches.

XIV. Perspectives for the future

The activities of the project are expected to provide an up to date status report on scientific knowledge and improved understanding of management issues affecting peatlands in selected case studies countries. Guidelines on management options or interventions to enhance peatlands role in the global C balance is expected to be available.

Main source:

"Integrated Management of Peatlands for Biodiversity and Climate Change: The Potential of Managing Peatlands for Carbon Accumulation While Protecting Biodiversity" GEF Project Brief, June 2002.

INTERNATIONAL

PROJECT 16

ASSESSMENT OF SOIL ORGANIC CARBON (SOC) STOCKS AND CHANGE AT NATIONAL SCALE (A MULTI-NATIONAL, MEDIUM SIZED TARGETED RESEARCH GEF PROJECT)

I. Type of project

Research Project. Medium Size GEF Project. *Multi-focal addressing Climate Change, Biodiversity and Land Degradation.* This project will assist Brazil, India, Jordan and Kenya establish their current soil organic C stock and determine how much C would be sequestered in soil under various ecosystem management in these countries. It will develop a generic tool which can be applied to other countries and/or regions as the data necessary are assembled in a suitable format.

II. Location

India, Jordan, Kenya and Amazon-Brazil. The geographical extent of India and Brazil means that the project will need to concentrate on selected sub-regions in these countries, at least initially (for India: the Indo-Gangetic Plain, and for Brazil: Rondonia State).

III. Objectives

- To identify and use long-term experimental databases to systematically evaluate and refine modeling techniques to quantify CS potential in tropical soils.
- To define, collate and format national scale soils, climate and land use databases and to use them in the development of coupled modeling GIS tools to estimate soil C stock.
- To demonstrate these tools by estimating current soil organic C stock at country-scale (using India, Jordan. Kenya and Amazon Brazil as case studies) and to compare these estimates with the existing techniques of combining soil mapping units and interpolating point data.
- To quantify the impact of defined changes in land use on CS in soils with a view to assisting in the formulation of improved policies to optimize resource use in the four case-study countries.

IV. Partners

International Development Centre of the University of Reading (UK) with the Department of Soil science Rothamsted taking the lead, scientific agencies from Brazil, India, Jordan and Kenya, together with representatives from Natural Resources Ecology Laboratory, Colorado State University, USA, Rothamsted Experimental Station in UK, International Soil Reference and Information Centre of the Netherlands, International Institute for Applied System Analysis in Austria and UNEP.

V. Life of the project

Three years starting in 2002.

VI. Estimated lifetime of CO_2 benefits (Mt C)

Not estimated yet.

VII. Estimated CO_2 benefits per hectare (t C ha^{-1})

Not estimated yet.

VIII. Cost estimates and efficiency

US$978 000 are provided by GEF grants and US$1 024 000 are co-financing: (from donor agencies for scientific work in the USA and European countries).

IX. Land area and type of management system

Not yet published.

X. Description of activities

Not available.

XI. Methodology

Data on the variables that control soil C stabilization in soil (i.e. soil parameters, climate and land use) will be compiled in a Geographic Information System (GIS) database. Techniques for running SOC stabilization models when explicitly coupled to the GIS data will simultaneously be refined. Equilibrium levels of SOC will then be modeled for each polygon in the GIS and summed to give landscape SOC amounts. Modeled estimates will be compared with mapped estimates and an uncertainty analysis conducted with the modeled values providing an independent check on mapping methods for estimating current stocks and suitable calibration undertaken. This will allow (i) quantitative comparison with other methods, and thereby (ii) provide a framework for integrating results from modeling with the other methods. “Realistic” scenarios of land use change will be developed in close consultation with national land use planners using latest land use change modeling techniques. The model-GIS tools will then be used to undertake analyses of change in SOC levels for the given land management scenarios.

XII. Projected environmental impacts

Not available.

XIII. Projected socioeconomics benefits and advocacy

- Data from national data sources of variables relating to the control of C stocks in Brazilian, Indian, Jordanian and Kenyan soils systematically collated and formatted in standardized GIS formats and fed into national GHG inventories.
- Regional-national-scale quantities of C stored in Amazon-Brazilian, Indian, Jordanian and Kenyan soils estimated and critically compared with soil mapping methodologies, and maps of land-use and C density derived.

- Capacity building in the use of GIS-model interfaces and soil organic C stock assessment.
- Generic tools designed to help formulate national and sub-national level policy by (i) Quantifying current soil organic carbon stocks at national and sub-national levels, (ii) Analyzing the impact of land management options on C storage, GHG emissions and sequestration possibilities.
- Tools developed and demonstrated for guiding the selection of national GEF projects and monitoring their implementation at national and sub-national scale.
- Consideration by the IPCC of improved methodologies for soil organic C stocks estimation.
- Interim and final scientific findings and developments published in the peer-reviewed scientific literature, on the WWW where appropriate, and in the Final Project Report for supporting agencies.

Main source:
www.gefweb.org/Documents/Medium-Sized_Project_Proposals.

Chapter 4
Conclusions

Based on the extensive review of available literature and relevant websites, this document has examined a total of 16 projects devoted to CS throughout the developing world: four in Latin American, six in Africa, five in Asia and one international. LULUCF projects were scarce since only a small number of projects, financed by the WB and by the GEF, included the component of CS strategies. The PCF, for example, is mostly dedicated to support projects directed at the "substitution of energy" or to "emissions reduction by the energy sector". The most representative CS projects financed by GEF are included in this document.

The approach, impact and CS potential varied considerably between projects. For example, the benefits were 7 ton C/ha in the case of the Noel Kempff Mercado and 129 ton C/ha in the case of the multi-component community forest of PROFAFOR-FACE in Ecuador. Some of these projects can have an impact on one million ha (Noel Kempff) others cover less land but account for high C offsets (for example 10 500 Mt C is the offset of the agroforestry project AES-CARE in Guatemala). The cost efficiency is also different, from US$3 t C, reported by the Kilombero Forestry Company, to US$12 t C, reported by the Scolel Te. In the case of the community based rangeland project in Sudan, the un-discounted cost was US$3.5 t C, and including the project costs, US$3.75 t C.

The type of land tenure also differ between different projects. Some of these projects are driven by Forestry Companies and set up in sparsely populated Savannahs, others are carried out in national parks (Noel Kempff Mercado), ecological reserves (PROFAFOR and Costa Rica) or in communal lands and villages with more local people involved. The functioning and the structure also vary among these projects. For example, different types of population are involved in each, and they have different ways of obtaining financial support, and of distributing the benefits, and different social and environmental impacts.

Some of these projects focus their activities mainly on forest conservation and the prevention of deforestation. Others, such as PROFAFOR, are dedicated mainly to afforestation with native and non-native species, involving local people for the seedling nursery and the plantation. Other afforestation projects plant mainly *Pinus patula* and *Eucalyptus* species, such as the Kilombero Project in Tanzania. Projects like the Village-Based Forest Restoration in Central India involve local communities in a strict forest protection plan that includes measures for fire control, fining for tree felling and grazing and controlling the extraction of green wood for fuel.

There are few bilateral projects that deal with agricultural agro-ecosystems. However, these have a lot to illustrate in terms of functioning, social participation and natural resources management. Scolel Te, for example, focus its activities on agro-forestry, trees in borders, improved coffee systems, natural regeneration and restoration and improved slash and burn agriculture. There are also projects in degraded arid lands that incorporate the CS component within integrated management systems addressed at reversing desertification, such as the improvement of the management of pastoral systems and community based rangeland rehabilitation, like the Iranian project (number 14), the Sudan project (number 6), or innovative agro-forestry projects, like Women for Sustainable Development Plan Vivo Forestry Project,

(number 13). These management systems include activities related to planting trees, stabilizing dunes, creating wind breaks and improving rangelands with native perennial grasses.

Many soil management, bio-energy and other LULUCF management projects exist, but few have estimated or reported changes in C stocks or GHG emissions because they are mainly research projects. It is for this reason that they are underrepresented.

The projects described in this study demonstrate that adequate management of forest and agricultural lands have the potential for C mitigation as well as to reverse the land degradation and desertification processes. The economic gain from future CS programmes has the potential to make a significant contribution to the household economy in these agro-ecosystems. The type of project reflected by the project profiles and the 49 projects shown in Table 1) is based on its impact on the local sustainability and on the global change, (Annex VIII).

A review of 40 sustainable agriculture and renewable resource management projects in China and India under the three mechanisms (Table 2) estimated a C mitigation potential of 64.8 Mt C $year^{-1}$ from 5.5 Mha. The potential income for C mitigation is US$324 million at US$5 tC. The potential exists to increase this income by orders of magnitude, and so to contribute significantly to GHG mitigation. Most agricultural mitigation options also provide several ancillary benefits. However, there are many technical, financial, policy, legal and institutional barriers to overcome.

Issues for future projects and funding agendas

Critical issues regarding the implementation and performance of future projects for CS and rural development include:

To fulfill the dual objective of the CDM, projects must improve cost-effectiveness and promote sustainable development. The CDM could be an important mechanism for improving global cost-effectiveness in mitigating greenhouse gas emissions because of the generally high greenhouse gas intensities and low abatement costs in developing countries. However there are numerous challenges related to securing real and measurable emissions reductions and at the same time keeping transaction costs low. For CDM projects to achieve each of the two objectives is a considerable challenge, and not least when the objectives are to be fulfilled simultaneously (Kolshus *et al.*, 2001).

- Many of the projects described are waiting for the CDM to come into force. SBSTA (Subsidiary Body on Scientific and Technological Advice of the UNFCC Convention) will base its decision on a new Best Practices IPCC report to be completed by December, 2003. These rules will address methodological questions, such as baselines, leakage, additionality, permanence and definitions, including “reforestation” and “afforestation” as well as taking into account the socioeconomic and environmental impacts of the projects.
- An important issue is whether and how C sink activities will contribute to the conservation of biodiversity and the sustainable use of natural resources. The terms of reference for developing countries were to be decided by the SBSTA at its meeting in June 2002.
- Another important issue is the design of a monitoring and verification system that is able to document whether, and to what extent, the emission mitigation of a CDM project is additional compared to the relevant baseline. A key aspect is how to verify soil C projects, at what cost and with which accuracy.

- How are the projects going to demonstrate: baseline (reference scenarios), permanence of the sequestered C, non leakage, risks and socio-environmental sustainability impacts? The sustainability criteria have to be specific to the country concerned, based on its priorities, needs, and natural resources endowments. A list of sustainability criteria for evaluating non-carbon benefits of CDM projects have been proposed (Kolshus *et al.*, 2001).
- The Climate Change Convention (CCC) needs to be coordinated with the Convention of Biological Diversity (CBD) because major hotspots of biological diversity are at risk under the mandate of UNFCCC (Schulze *et al*., 2002).
- There are strong reasons for developing sequestration schemes in degraded agro-ecosystems (as discussed by Olsson and Ardö, 2002):
  1. Land degradation, particularly in the tropics, is an environmental issue as urgent as climate change, and fighting land degradation might actually be an efficient way of sequestering C in soils.
  2. Soil CS in degraded agro-ecosystems may contribute to the fulfillment of the three major environmental UN conventions: The Convention on Climate Change, the Convention to Combat Desertification and the Convention on Biodiversity.
  3. Soil CS is a way for developing countries to become active participants in the fight against climate change through win-win situations.
- Degraded agro-ecosystems (forest, agriculture, rangelands and agroforestry) might benefit significantly from the improved land management that would be part of a CS programme. There are vast areas of these agro-ecosystems in Africa and their rehabilitation is urgent.
- The Scolel Té project demonstrates how the improved management of natural forests of communal lands can be a cost-effective method for sequestering C.
- According to Fankhauser (1997), projects that pass a cost-benefit test within the range of US$5–20 tC/ha are worth undertaking.
- As soon as credits from CS become a tradable commodity, under a future emissions control regime, the supply responses to changes in prices for sequestration expressed in US$ t/C would be critical in determining the total level of C uptake achieved by the system as a whole (De Jong *et al*., 2000).
- How these measures can be implemented to contribute to poverty alleviation and the reductions of people vulnerability to disturbances related to future climate change.
- The rural poor and landless require resilient, sustainable livelihoods systems that are flexible in the short term, which invariably means dependence on multiple products. If large protected areas or plantations are managed for long term CS and storage, local people may lose access to other products such as fibre and food. C offset policy must therefore build in adequate provisions concerning local environment and social factors, with relevant local participation and powers of veto. Much of the learning from participatory forestry and protected area experience is relevant and must be incorporated into C offset policies (Bass *et al*., 2000).
- It is quite clear that the stabilisation of CO_2 in the atmosphere requires GHG emissions to be reduced far more drastically than anticipated in the Bonn Agreement. This requirement may necessitate additional tools that are not yet available in the tool box of KP (Schulze *et al*., 2002).
- The future of the CDM mechanism is linked to the future of the Kyoto Protocol. Given the right design and verification system, the mechanism can contribute to involving developing

countries in the climate process, achieve an improved level of international cost-effectiveness, and help developing countries choose a sustainable development path built on equitable, environmentally sound and energy efficient technology alternatives. In any case, fulfilling the objectives for CDM projects requires the development and application of reliable methods for assessing CDM projects impacts on sustainability (Kolshus *et al.*, 2001).

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International Tropical Timber Organization 2002:
http://www.itto.or.jp/newsletter/v11n3/18.html

The Energy and Resources Institute (TERI):
www.teriin.org/index.htm

PlanVivo System, 2002:
www.planvivo.org;
www.climateindia.com

Climate Action: Noel Kempff Mercado National Park, Bolivia
www.vnf.com/content/articles/articles/Kempff.htm

Community Forestry International
www.communityforestryinternational.org

Center for International Climate and Environmental Research - Oslo
www.cicero.uio.no

Simposio International Medición y Monitoreo de la Captura de Carbono en Ecosistemas Forestales
www.uach.cl/simposiocarbono

Rural Livelihoods and Carbon Management
www.eccm.uk.com/rurallivelihoods.pdf

BioCarbon Fund
www.biocarbonfund.org

Prototype Carbon Fund
www.prototypecarbonfund.org

Gunung Leuser Prak
www.northsea.nl/JIQ/nether.htm
www.undp.org
www.gefweb.org
www.neareast.org

Kilombero Forestry Company Ltd.
ww.tree-farm.com/kilombero

Annex I
Convention to combat desertification (CCD)

Desertification is the result of land degradation in arid, semi-arid and dry subhumid areas resulting from various factors, including climatic variations and human activities. Combating desertification includes activities which are part of the integrated development of land in arid, semi-arid and dry subhumid areas for sustainable development. (UNCCD Article 1).

On a global plane, the issue of desertification was first discussed at the UN Conference on Desertification held in Nairobi, Kenya in 1977. But due to a lack of support, both administrative and financial, attempts to efficiently tackle the problem of desertification were crippled. Therefore in 1992, the United Nations Conference on Environment and Development (UNCED) or so called Rio Earth Summit remanded the elaboration of a United Nations Convention to Combat Desertification (UNCCD). This is the only convention stemming from a direct recommendation of the Conference's Agenda 21; it was adopted in Paris on 17 June 1994 and entered into force in December 1996. It is the first and only internationally legally binding framework set up to address the problem of desertification. The Convention is based on the principles of participation, partnership and decentralization. It now has more than 180 country Parties to the Convention, making it truly global in reach. The Convention is an innovative document, which breaks new ground in international environmental law.

The Convention describes its objective as "to combat desertification and mitigate the effects of drought in countries experiencing serious drought and/or desertification, particularly in Africa, through effective action at all levels, supported by international cooperation and partnership arrangements in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in affected areas". Furthermore, the Convention adds that "achieving this objective will involve long term integrated strategies that focus simultaneously, in affected areas, on improved productivity of the land and the rehabilitation, conservation and sustainable management of land and water resources, leading to improved living conditions, in particular, at the community level".

Combating desertification is essential to ensuring the long-term productivity of inhabited drylands. Unfortunately, past efforts have too often failed, and around the world the problem of land degradation continues to worsen. This Convention aims to promote effective action through innovative local programmes and supportive international partnerships. The treaty acknowledges that the struggle to protect drylands will be a long one – there will be no quick fix. This is because the causes of desertification are many and complex, ranging from international trade patterns to unsustainable land management practices. Real and difficult changes will have to be made, both at the international and the local levels.

Annex II
Convention of cimate change (CCC)

Conference of the Parties, 7th session, Marrakech, Morocco, 29 October – 9 November 2001

The United Nations Framework Convention on Climate Change (UNFCCC) was negotiated under United Nations auspices to deal with the impacts of human activities on the global climate system. The agreement was held on 9 May 1992 in New York and came into force on 21 March 1994. The UNFCCC, also know as the Rio Convention, was created on the occasion of the largest gathering of world leaders ever: the second Earth Summit held in Rio de Janeiro, Brazil. A total of 154 countries signed the UNFCCC in Rio.

The ultimate objective of the Convention is:

> *... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner.*

To achieve this objective, all countries have a general commitment to address climate change, adapt to its effects, and report on the action they are taking to implement the Convention.

The UNFCCC Annex I lists developed-country Parties that had to adopt measures aimed at returning their greenhouse-gas (GHG) emissions to 1990 levels by the year 2000. It includes the 24 original OECD members, 11 countries with economies in transition and the European Union. The UNFCCC Annex II lists developed-country Parties which have a special obligation to help developing countries with financial and technological resources. It includes the 24 original OECD members and the European Union.

Developed countries which are parties to the UNFCCC (called "Annex 1 countries" in the wording) agree to limit carbon dioxide and other human–induced greenhouse gas emissions, and to protect and enhance greenhouse gas sinks and reservoirs. Under the Convention, developed countries (such as Canada) are to take a leadership role in reducing greenhouse gas emissions. Parties also agree to promote and cooperate in research, systematic observation and development of data archives related to the climate system, to share information, and to cooperate in education and training related to climate change. Annex 1 parties (developed countries) are required to report periodically on the measures they are undertaking to address the objective of the convention, and on their projected emissions and sinks of greenhouse gases. There are also commitments to assist developing countries that are particularly vulnerable to adverse effects of climate change, with costs of adapting to adverse effects, and to facilitate transfer of environmentally sound technologies to developing countries.

The UNFCCC itself contained no legally binding targets (for example precise emission-reduction targets), timetables or penalty system to punish the violators. The general interpretation was that developed countries should reduce their emissions to 1990 levels by the year 2000.

The convention has now 186 Parties. Eight meeting of the Conference of the Parties have taken place, as well as numerous workshop and meetings of the COP's subsidiary bodies.

Annex III
The Kyoto protocol

The Kyoto Protocol to the United Nations Framework Convention on Climate Change strengthens the international response to climate change. Adopted by consensus at the third session of the Conference of the Parties (COP-3) in December 1997, it contains new emissions targets for Annex I (developed) countries for the post-2000 period. By arresting and reversing the upward trend in GHG emissions that started in these countries 150 years ago, the Protocol promises to move the international community one step closer to achieving the Convention ultimate objective of preventing "dangerous anthropogenic interference with the climate system".

Under the KP developed countries (so-called Annex I countries) have committed to reduce their net emissions of GHG to around 5 percent below 1990 levels (although the percentage varies between countries) during what is known as the 'first commitment period' of 2008-2012. The commitment for each Annex I country takes the form of a strict budget for its total GHG emissions, called an assigned amount. Article 3 of the Protocol establishes an accounting framework for determining how emissions from different activities should count toward a country assigned amount. Most Annex I countries would have to substantially reduce their total national emissions in the years 2008 through 2012 not to exceed their assigned amounts.

The Protocol establishes a number of "cooperative mechanisms" that allow an Annex I country to fulfil its commitment through joint efforts with other countries. The rationale for these mechanisms is that the geographic location of the source of a GHG emission does not affect its effect on the atmosphere, but the costs of reducing emissions vary considerably between countries. The mechanisms are designed to allow Annex I industrialised countries, such as the United States, to achieve compliance through the most economical mix of domestic and international activities. Two of these mechanisms are established in Articles 6 and 12 of the Protocol.

Article 6 authorizes an Annex I country, or a private entity from that country, to invest in a climate change mitigation project in another Annex I country. With approval by the host country, the investing country receives "emission reduction units," which it can add to its assigned amount.

Article 12 authorizes an Annex I country, or a private entity from that country, to invest in a climate change mitigation project in a non-Annex I (developing) country through the Clean Development Mechanism. The project must contribute to sustainable development in the host country. If it is approved, the investing country can add the resulting "certified emission reduction units" to its assigned amount.

Annex IV
The Bonn and Marrakech agreements

At the fourth Conference of the parties in Buenos Aires in November 1998, the "Buenos Aires Plan of Action" – which aimed to develop a final regulatory framework for the Kyoto Protocol over the next two years – was adopted. However, the sixth conference of the parties to the Climate Convention (COP6-1) in The Hague in November 2000 failed to reach consensus on the remaining issues, and after America rejected the KP in March 2001, its future seemed bleaker than ever before. An accord was eventually reached by a number of parties, including the USA, in Bonn in July 2001 and the negotiations of the remaining rules and details continued in Marrakech in October and November 2001 (Appendix B), where the text was finalised in order to make the KP prepared to be ratified (Torvanger, 2001). The Bonn and Marrakech agreements covered four main issues:

- Compliance: Establishment of a Compliance Committee with a facultative branch, an enforcement branch, and a bureau.
- Land-use, Land use-change and Forestry (LULUCF).
- The Kyoto mechanisms: Emissions trading (ET), Joint Implementation (JI), and the Clean Development Mechanism (CDM).
- Funding for developing countries.

Mechanisms	Unit	Participants	Limits to transfer	Bankability
Domestic emissions trading	Quotas	Companies and other domestic legal entities	Depends on national design	Depends on national design
International emissions trading	Quota Assigned Amount unit (AAU)	Annex B countries Legal entities	Unlimited within and between Annex B countries. Fungible with ERU, CER, and RMU.	Unlimited
Joint Implementation	Credit Emission Reduction Unit (ERU)	Annex B countries Legal entities	Unlimited within and between Annex B countries. Fungible with CER, AAU, and RMU.	Banking limited to 2.5 percent of a Party assigned amount in Annex B
Clean Development Mechanism	Credit Certified Emission Reduction (CER)	Annex B countries and non-Annex B countries. Legal entities	Unlimited within and between Annex B countries. Fungible with ERU, AAU, and RMU. CER from sinks activities limited to 1 percent of base year times 5.	Banking limited to 2.5 percent of a Party assigned amount in Annex B
Sequestration credits in Annex B countries	Credit Removal Unit (CRU)	Annex B countries	Unlimited within and between Annex B countries. Fungible with ERU, CER and AAU.	Cannot be banked

Source: Torvanger (2001)

Annex V
The Marrakech accords

Article 3 (paragraph 3)

2. For the purposes of Article 3, paragraph 3, for Annex I countries, eligible activities are those direct human-induced afforestation, reforestation and/or deforestation activities that meet the requirements set forth in this annex and that started on or after January 1990 and before 31 December of the last year of the commitment period.

3. For the purposes of determining the area of deforestation to come into accounting systems under article 3, paragraph 3, each Party shall determine the forest area using the same spatial assessment unit as is used for the determination of afforestation and reforestation, but not larger than 1 hectare.

4. For the first commitment period, debits[1] resulting from harvesting during the first commitment period following afforestation and reforestation since 1990 shall not be grater than credits[2] accounted for on that unit of land.

5. Each party included in Annex I shall report, In accordance with Article 7, on how harvesting or forest disturbance that is followed by the re-establishment of a forest is distinguished from deforestation. This information will be subjected to review in accordance with Article 8.

Article 3 (paragraph 4)

6. A Party included in Annex I may choose to account for anthropogenic GHG emissions by sources and removals by sinks resulting from any or all of the following human induced activities, other than afforestation, reforestation and deforestation, under Article 3, paragraph 4, in the first commitment period: revegetation, forest management, cropland management, and grazing land management.

7. A Party in Annex I wishing to account for activities under Article 3, paragraph 4, shall identify, in its report to enable the establishment of its assigned amount pursuant to Article 3.7. and Article 3.8, the activities under Article 3, paragraph 4, which it elects to include in its accounting for the first commitment period. Upon election, a decision by a Party will be fixed for the first commitment period.

Article 12 (non-Annex I countries)

13. The eligibility of land use, land-use change and forestry project activities under Article 1 is limited to afforestation and reforestation.

14. For the first commitment period, the total of additions to a Party assigned amount resulting from eligible land-use change and forestry activities under Article 12 shall not exceed one per cent of base emissions of that Party, times five.

[1] Debits: where emissions are larger than removals on a unit of land.
[2] Credits: where removals are larger than emissions on a unit of land.

15. The treatments of land-use, land-use change and forestry project activities under Article 12 future commitment periods shall be decided as part of negotiations on the second commitment period.

Annex VI
The clean development mechanism (CDM)

The CDM Activity Project Cycle will consist of the following parts:

- Design
- Validation/Registration
- Monitoring
- Verification/Certification
- Issuance

The CDM structures will have a bilateral approach without excluding the possibility of countries putting forth a portfolio of projects as their priority list to the Annex B countries to choose from. The overall institutional structure would broadly consist of participating parties, brokers, respective governments, monitoring agencies, auditors and verifiers, operational entities adaptation fund, the Executive Board, the FCCC Secretariat, and the CoP/Meeting of the Parties (NoP)

Project requirements to function under the CDM

At the Marrakech meeting in 2001, the Conference of the Parties requested the Subsidiary Body for Scientific and Technological Advice (SBSTA) to develop terms of reference and definitions and modalities for including afforestation and reforestation project activities under Article 12 in the first commitment period, taking into account the issues of (FCCC/CP/2001/13/Add.1):

- non permanence
- additionality
- leakage
- uncertainties
- socioeconomic impacts
- environmental impacts
- including impacts on biodiversity and natural ecosystems

In addition, the Conference of the Parties affirmed that the following principles govern the treatment of land use, land-use change and forestry activities:

- The treatments of these activities are based on sound science.
- Consistent methodologies are used over time for the estimation and reporting of these activities.
- The aim stated in Article 3, paragraph 1 of the KP is not to be changed by accounting for land use, land use-change and forestry activities.
- The mere presence of C stocks be excluded from accounting.
- The implementation of land use, land-use change and forestry activities contributes to the conserving of the biodiversity and sustainable use of natural resources.

- Accounting for land use, land-use change and forestry does not imply a transfer of commitments to a future commitment period.
- Reversal of any removal due to land use, land-use change and forestry be accounted for at the appropriate time.

CDM QUOTAS

There is a limit of 1 percent annually (out of base emissions) on the purchase of (inexpensive) CDM quotas from afforestation and reforestation projects. Companies that want to buy such quotas must get approval from the national authority. Either the approval can be based on a "first come, first served" basis, or the national authority could establish some type of auctioning of these quotas.

All entities selling or buying CDM quotas can only do so if the authorising party is eligible to participate in the CDM mechanism. This means that both the host Party and the investing Party must be eligible to participate.

The host country is responsible for confirming whether a CDM project assists in achieving sustainable development. The lack of clear methods and criteria for evaluation of sustainability means that one project type may be accepted in one country but rejected in another country (Torvanger, 2001).

Torvanger (2001) clarifies the main trading blocks in the global GHG trading market. The "KP" is divided into three parts: the OECD (Annex II), economies in transition to a market economy (EITs, countries that are members of Annex I but not Annex II), and developing countries (G77/China, non-Annex I Parties). Figure 2 shows how various Kyoto mechanisms can be applied by a block for trading quotas with other blocks. If trading between the Kyoto Block is allowed, this can take place through the Kyoto mechanisms (ET, JI and CDM) or through American versions (US-ET, US-JI or US-CDM). In the figure it is assumed that the USA companies can only buy quotas and not able to sell quotas in the global market due to USA national target however, is not part of the KP. However, there is a possibility that American firms can sell JI credits on the global market since these are project-based. Branches of American companies situated within the Kyoto block, for instance in Europe, are allowed to participate fully in the Kyoto mechanisms.

Annex VII
Glossary of terms

Definitions related to the UNCCD

For the purposes of this Convention:

a. ***"Desertification":*** land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities.

b. ***"Combating desertification":*** includes activities which are part of the integrated development of land in arid, semi-arid and dry sub-humid areas for sustainable development which are aimed at:

   i. Prevention and/or reduction of land degradation

   ii. Rehabilitation of partly degraded land

   iii. Reclamation of desertified lands

c. ***"Drought":*** naturally occurring phenomenon that exists when precipitation has been significantly below normal recorded levels, causing serious hydrological imbalances that adversely affect land resource production systems.

d. ***"Mitigating the effects of drought":*** activities related to the prediction of drought and intended to reduce the vulnerability of societies and natural systems to drought as it relates to combating desertification.

e. ***"Land":*** terrestrial bio-productive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system.

f. ***"Land degradation":*** reduction or loss, in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rain fed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns, such as:

   i. Soil erosion caused by wind and/or water,

   ii. Deterioration of the physical, chemical and biological or economic properties of soil,

   iii. Long-term loss of natural vegetation.

g. ***"Arid semi-arid and dry sub-humid areas":*** areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65.

h. ***"Affected areas":*** arid, semi-arid and/or dry sub-humid areas affected or threatened by desertification.

i. ***"Affected countries":*** countries whose lands include, in whole or in part, affected areas.

j. ***"Regional economic integration organization":*** an organization constituted by sovereign states of a given region - which has competence in matters governed by this Convention and

has been duly authorized, in accordance with its internal procedures, to sign, ratify, accept, approve or accede to this Convention,

k. ***"Developed country Parties":*** developed country parties and regional economic integration organizations constituted by developed countries.

DEFINITIONS RELATED TO LAND USE, LAND USE CHANGE AND FORESTRY ACTIVITIES UNDER THE KP

1. For land use, land use change and forestry activities under Articles[1] 3.3 and 3.4, the following definitions apply:

   a. ***"Forest"*** an area of land of at least 0.05–1.0 ha with tree crown cover (or equivalent stocking level) of more than 10–30 percent, with trees with the potential to reach a minimum height of 2–5 metres at maturity. A forest may consist either of closed forest formations where trees of various storeys and undergrowth cover a high proportion of the ground or open forest. Young natural stands and all plantations which have yet to reach a crown density of 10–30 per cent or tree height of 2–5 metres are included under forest, as are areas normally forming part of the forest area which are temporarily unstocked as a result of human intervention such as harvesting or natural causes but which are expected to revert to forest.

   b. ***"Afforestation":*** the direct human induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human induced promotion of natural seed sources.

   c. ***"Reforestation":*** the direct human-induced conversion of non-forested land to forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to those lands that did not contain forest on 31 December 1989.

   d. ***"Deforestation":*** the direct human-induced conversion of forested land to non-forested land.

   e. ***"Revegetation":*** a direct human-induced activity meant to increase C stocks on sites by re-establishing vegetation that covers a minimum area of 0.05 ha and does not meet the aforementioned definitions of afforestation and reforestation.

   f. ***"Forest management":*** a system of practices for the stewardship and use of forest land aimed at fulfilling the relevant ecological (including biological diversity), economic and social functions of the forest in a sustainable manner.

   g. ***"Cropland management":*** the system of practices on land on which agricultural crops are grown and on land that is set aside or temporarily not being used for crop production.

   h. ***"Grazing land management"*** is the system of practices on land used for livestock production aimed at manipulating the amount and type of vegetation and livestock produced.

[1] "Article" in this annex refers to an Article of the Kyoto Protocol, unless otherwise specified.

Terms related to carbon credits

Since the early 1990s, a variety of terms have been used to refer to different project-level climate change mitigation mechanisms and their outputs. The meanings of these terms have changed gradually. Below are some of the definitions that have been used. Most bear some relation to stipulations of the UN Framework Convention on Climate Change (UNFCCC) signed in 1992, whose provisions are fleshed out by the KP, signed in December 1997.

MECHANISMS (1) EARLY PRE-KYOTO DEFINITIONS

Joint Implementation (JI)

The concept of joint implementation (JI) was introduced by Norway into pre-UNCED negotiations in 1991. This was reflected in Article 4.2 (a) of the UNFCCC which gives Annex I countries (see below) the option of contributing to the Convention objectives by implementing policies and measures jointly with other countries. The participants investing in these projects could claim emission reduction credits for the activities financed, and these credits could then be used to lower greenhouse gas (GHG) related liabilities (e.g., carbon taxes, emission caps) in their home countries.

Activities Implemented Jointly (AIJ)

In the first Conference of the Parties (CoP 1) to the UNFCCC held in 1995 in Berlin, developing country dissatisfaction with the JI model was voiced as a formal refusal of JI with crediting against objectives set by the Convention (see text for full discussion). Instead, a compromise was found in the form of a pilot phase, during which projects were called Activities Implemented Jointly (AIJ). During the AIJ Pilot Phase, projects were conducted with the objective of establishing protocols and experiences, but without allowing C credit transfer between developed and developing countries. The AIJ Pilot Phase is to be continued at least until the year 2000.

MECHANISMS (2) POST-KYOTO DEFINITIONS

The KP of the UNFCCC created three instruments, collectively known as the 'flexibility mechanisms', to facilitate accomplishment of the objectives of the Convention. A new terminology was adopted to refer to these mechanisms, as detailed below. Note that because of the KP distinction between projects carried out in the developed and developing world, some AIJ projects may be reclassified as CDM or JI projects.

Joint Implementation (JI)

Set out in Article 6 of the Protocol, JI refers to climate change mitigation projects implemented between two Annex 1 countries (see below). JI allows for the creation, acquisition and transfer of "emission reduction units" or ERUs.

The Clean Development Mechanism (CDM)

The CDM was established by Article 12 of the Protocol and refers to climate change mitigation projects undertaken between Annex 1 countries and non-Annex 1 countries (see below). This new mechanism, whilst resembling JI, has important points of difference. In particular, project investments must contribute to the sustainable development of the non-Annex 1 host country, and must also be independently certified. This latter requirement gives rise to the term "certified emissions reductions" or CER, which describe the output of CDM projects, and which under the terms of Article 12 can be banked from the year 2000, eight years before the first commitment period (2008-2012).

Emissions Trading (ET) or QUELRO trading (Quantified Emission Limitation and Reduction Obligations trading)

Article 17 of the Protocol allows for emissions-capped Annex B countries to transfer among themselves portions of their assigned amounts (AAs) of GHG emissions. Under this mechanism, countries that emit less than they are allowed under the Protocol (their AAs) can sell surplus allowances to those countries that have surpassed their AAs. Such transfers do not necessarily have to be directly linked to emission reductions from specific projects.

WHICH COUNTRIES IN WHICH MECHANISMS?

Annex 1 countries

These are the 36 industrialised countries and economies in transition listed in Annex 1 of the UNFCCC. Their responsibilities under the Convention are various, and include a non-binding commitment to reduce their GHG emissions to 1990 levels by the year 2000.

Annex B countries

These are the 39 emissions-capped industrialised countries and economies in transition listed in Annex B of the KP. Legally-binding emission reduction obligations for Annex B countries range from an 8 percent decrease (e.g., European Union) to a 10 percent increase (Iceland) on 1990 levels by the first commitment period of the Protocol, 2008 – 2012.

Annex 1 or Annex B?

In practice, Annex 1 of the Convention and Annex B of the Protocol are used almost interchangeably. However, strictly speaking, it is the Annex 1 countries which can invest in JI/CDM projects as well as host JI projects, and non-Annex 1 countries which can host CDM projects, even though it is the Annex B countries which have the emission reduction obligations under the Protocol. Note that Belarussia and Turkey are listed in Annex 1 but not Annex B, and that Croatia, Liechtenstein, Monaco and Slovenia are listed in Annex B but not Annex 1.

PROJECT OUTPUTS

Carbon offsets – used in a variety of contexts, most commonly either to mean the output of carbon sequestration projects in the forestry sector, or more generally to refer to the output of any climate change mitigation project.

Carbon credits – as for carbon offsets, though with added connotations of (1) being used as 'credits' in companies or countries emission accounts to counter 'debits' i.e. emissions, and (2) being tradable, or at least fungible with the emission permit trading system

ERUs (emission reduction units) – the technical term for the output of JI projects, as defined by the KP.

CER – the technical term for the output of CDM projects, as defined by the KP.

Moura-Costa P. (2002)

Annex VIII
Type of projects and potential impact on climate change and local and global sustainability

	Impact on Climate Change			*Impact on Local Sustainability*					*Other Global Impacts*		
Type of Project:	**Carbon Sequestration Potentiality**	**Cost Efficiency**	**Potentiality for Soil C Sequestration**	**Environment**	**Employment Generation**	**Economic Gains for Locals**	**Potential-ity for Win Win Situation**	**Type of Land Teniorship**	**Self-empowerment?**	**Impact on Biodiversity**	**Impact on reversion of Desertification**
Afforestation *Pinus radiata* & ucalyptus	**H**	**H**	**?**	**?**	**L**	**L**	**L**	**State**	**L**	**L**	**M**
Afforestation local species	**H**	**M**	**?**	**H**	**M**	**M**	**H**	**State or Private**	**L -M**	**H**	**H**
Reforestation	**H**	**H**	**?**	**H**	**L-M**	**L**	**L**	**State or Private**	**L**	**L-M**	**H**
Forest Conservation and Protection	**L**	**L-M**	**?**	**H**	**L**	**L-M**	**H**	**Communal or National Parks**	**H**	**H**	**H**
Agroforestry-Multi-Component	**L**	**M**	**?**	**H**	**H**	**H**	**H**	**Private**	**H**	**?**	**?**
Agro-Pastoral Rangeland Management	**L**	**L**	**M-**	**H**	**H**	**H**	**H**	**Private or Trans-human**	**H**	**?**	**H**

H = high; M = medium; L = low; ? = Information not available.

Annex IX
Project selection rules for the BioCarbon Fund

Criteria	Primary standards / guidelines
Climate and environment	
Will there be real gains in carbon sequestration or net GHG emission reductions (considering all GHG), what amount and at what cost?	IPCC Good Practice Guidance for LULUCF – currently being drafted for CoP9, but available to the BCF
Does the project meet the likely requirements of the CDM? A project can still be considered even if it does not fulfil this requirement as the Fund will have CDM compliant and CDM non-compliant windows.	Executive Board of the CDM and related work
Does the project clearly meet sustainability criteria and contribute to the goals of the major environmental conventions such as The Convention on Biological Diversity (CBD)[1], The Convention to Combat Desertification (CCD)[2] and the Ramsar Convention on wetlands?	Definitions, criteria and other supporting material from these Conventions
Poverty alleviation	
Will the project improve the livelihoods of a significant number of low income people?	TBD
Will the World Bank Safeguard Policies[3] be met?	World Bank Safeguard Policies
Project management and learning	
Is the project cost effective?	Draw upon experience in Prototype Carbon Fund
What learning opportunities does the project offer? Can we learn about, and address, design, finance, institutional arrangements, implementation, monitoring, leakage and permanence issues?	BCF Team in consultation with the Technical Advisory Group and eventually the Participants Advisory Committee and the Host Country Committee
Is there an adequate enabling environment[4] in place? (Factors to consider here include the general political/security situation, a national climate change policy framework, etc.)	As above. Also building upon World Bank Group experience.
Do appropriate institutions exist to serve as intermediaries between the BCF as a buyer and local communities as sellers?	As above
Portfolio balance	
How replicable (transferable) is the experience and knowledge gained from this project?	Primarily the BCF Team and the Technical Advisory Group.
Does this project add to the range (project type, economic situation, geographic distribution, social environment) and learning experience in the portfolio?	BCF Team in consultation with the Participants Advisory Committee and the Host Country Committee

[i] **UNCBD Article 10. Sustainable Use of Components of Biological Diversity**

Each Contracting Party shall, as far as possible and as appropriate:

(a) Integrate consideration of the conservation and sustainable use of biological resources into national decision-making.

(b) Adopt measures relating to the use of biological resources to avoid or minimize adverse impacts on biological diversity.

(c) Protect and encourage customary use of biological resources in accordance with traditional cultural practices that are compatible with conservation or sustainable use requirements.

(d) Support local populations to develop and implement remedial action in degraded areas where biological diversity has been reduced, and

(e) Encourage cooperation between its governmental authorities and its private sector in developing methods for sustainable use of biological resources.

UNCBD Definition: "*Sustainable us*e means the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations."

[iii] UNCCD Article 6. **Strategic planning framework for sustainable development**

1. National action programmes shall be a central and integral part of a broader process of formulating national policies for the sustainable development of affected African country Parties.
2. A consultative and participatory process involving appropriate levels of government, local populations, communities and non governmental organizations shall be undertaken to provide guidance on a strategy with flexible planning to allow maximum participation from local populations and communities. As appropriate, bilateral and multilateral assistance agencies may be involved in this process at the request of an affected African country Party.

[iii] See http://wbln0018.worldbank.org/essd/essd.nsf/Safeguard/Homepage

[iv] See http://www.ifc.org/sme/html/business_enabling.html

Source: Ian Noble (Per. Comm.)

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F - French
S - Spanish