REFERENCES

Baalman, P. & B. Schlamadinger. 2008. *Scaling Up AFOLU Mitigation Activities in Non-Annex I Countries*. Working Paper. A report by Climate Strategies & GHG Offset Services for the Eliasch Review.

Chomba, S. & P. A. Minang. 2009. *Africa's biocarbon experience: Lessons for improving performance in the African carbon markets*. World Agroforestry Centre Policy Brief 06. World Agroforestry Centre, Nairobi, Kenya.

FAO. 2009. *Food Security and Agricultural Mitigation in Developing Countries: Options for Capturing Synergies*. Rome, Italy. www.fao.org/docrep/012/i1318e/i1318e00.pdf.

FAO. 2010. Making the Step From Carbon to Cash – A Systematic Approach to Accessing Carbon Finance in the Forest Sector. Forest and Climate Change Working Paper no. x. [in press]

Greenpeace International. 2008. Cool Farming: Climate change impacts of agriculture and mitigation potential. Amsterdam. www.greenpeace.org/raw/content/international/press/reports/cool-farming-full-report.pdf.

Hamilton, K., M. Sjardin, T. Marcello, & G. Xu. 2008. Forging a Frontier: State of the Voluntary Carbon Markets 2008. New York. Ecosystem Marketplace & New Carbon Finance. http://ecosystemmarketplace.com/documents/cms_documents/2008_StateofVoluntaryCarbon Market.4.pdf.

Hamilton, K., M. Sjardin, A. Shapiro & T. Marcello. 2009. Fortifying the Foundation: State of the Voluntary Carbon Markets 2009. New York. Ecosystem Marketplace & New Carbon Finance. www.ecosystemmarketplace.com/documents/cms_documents/StateOfTheVoluntaryCarbonMarkets_2009.pdf.

IPCC. 2007. Changes in Atmospheric Constituents and in Radiative Forcing. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jindal, R., B. Swallow, & J. Kerr. 2008. Forestry-based carbon sequestration projects in Africa: Potential benefits and challenges. *Natural Resources Forum* 32 (2):116-130.

UNEP Risoe. 2009. The CDM/JI Pipeline Analysis and Database. http://cdmpipeline.org.

Viana, V. M., M. Grieg-Gran, R. Della Mea & G. Ribenboim. 2009. *The costs of REDD: lessons from Amazonas*. IIED Briefing papers. www.iied.org/pubs/pdfs/17076IIED.pdf.

ANNEX 1

AGRICULTURAL LAND MANAGEMENT PRACTICES WHICH HAVE GHG MITIGATING EFFECTS

IMPROVED CROPLAND MANAGEMENT	
Improved agronomic practices	• Use of cover crops • Improved crop/fallow rotations • Improved crop varieties • Use of legumes in crop rotation
Integrated nutrient management	• Increased efficiency of nitrogen fertilizer; organic fertilization; legumes and green manure; • compost; animal manure
Tillage/residue management	• Incorporation of residues • Reduced/zero tillage
Water management	• Irrigation • Bunds/zai • Terraces, contour farming • Water harvesting (e.g. runoff collection techniques, water storage tank construction, devices for lifting and conveying water)
Perennials and Agroforestry	• Live barriers/fences • Various agroforestry practices: undersowing of Tephrosia vogelii, pigeon • pea and Sesbania sesban in maize for soil fertility improvement; dispersed tree • interplanting (e.g. Faidherbia, Acacia • polycantha, A.galpiniii. and contour grass hedges)
IMPROVED PASTURE AND GRAZING MANAGEMENT	
Improved pasture management	• Improving forage quality and quantity • Seeding fodder grasses • Improving vegetation community structure (e.g. seeding fodder grasses or legumes; reducing fuel load by vegetation management)
Improved grazing management	• Stocking rate management • Rotational grazing
RESTORING DEGRADED LAND	
	• Re-vegetation • Applying nutrient amendments (manures, biosolids, compost)

Based on Annex 7.1 from FAO, 2009.

ANNEX 2

STANDARDS

A variety of **standards** have been developed in the AFOLU sector and the following are of interest:

- **VCS Standard**: The VCS Program provides a robust, new global standard and programme for approval of credible voluntary offsets. VCS offsets must be real (have happened), additional (the project can only be implemented because of the carbon finance component), measurable, permanent (not temporarily displace emissions), independently verified and unique (not used more than once to offset emissions) (www.v-c-s.org). A **tool** has been developed to provide guidance for dealing with the methodological issues of AFOLU projects and to determine the land eligibility. At the time of writing it can be used for four activities:
  1. Afforestation, Reforestation and Revegetation;
  2. Agricultural Land Management;
  3. Improved Forest management;
  4. REDD,

  but the activity types will probably expanded in the near future, eg to wetlands.

VOLUNTARY CARBON STANDARD

Tool for AFOLU Methodological Issues

The steps to be followed are:

Step 0: follow the general methodological guidance (determination and quantification of the baseline and the project scenario; measurement, estimation and monitoring of GHG sources and leakage for baseline and project scenario).

Step 1: determine the land eligibility (the land must be used for the eligible AFOLU activities).

Step 2: determine the project boundary (geographic boundary, crediting period, sources and sinks, GHG types, and carbon pools).

Step 3: determine the carbon pools (living biomass or dead organic matter).

Step 4: establish a project baseline (demonstrating the business-as-usual situation and the with-project scenario).

Step 5: assess and manage leakage (any increase in greenhouse gas emissions that occurs outside a project's boundary (but within the same country), but is measurable and attributable to the project activities needs to be accounted for).

Step 6: estimate and monitor net project greenhouse gas benefits (using IPCC 2006 guidelines the GHG emissions are estimated).

(www.v-c-s.org/docs/Tool%20for%20AFOLU%20Methodological%20Issues.pdf)

Other standards exist which can also be used for AFOLU projects:

- **VER + Standard** developed by TÜV SÜD, a Designated Operational Entity (DOE) for the validation and verification of CDM projects accepts AFOLU projects, including REDD www.tuev-sued.de/uploads/images/1179142340972697520616/Standard_VER_e.pdf.
- the **California Climate Action Registry**, which provides detailed protocols for forest carbon sequestration projects www.climateregistry.org.
- the **CarbonFix Standard** emphasizes sustainable forest management www.carbonfix.info.
- the **Climate, Community, and Biodiversity Standards (CCB)** are a set of project-design criteria for evaluating land-based carbon mitigation projects and their community and biodiversity co-benefits www.climate-standards.org.
- the **CCX standards** also include uniform rules for AFOLU projects www.chicagoclimatex.com.

ANNEX 3

TWO CASE STUDIES OF CARBON PROJECTS

SUSTAINABLE AGRICULTURAL LAND MANAGEMENT: KENYA SMALLHOLDER COFFEE CARBON PROJECT

In 2007 a pre-feasibility study to identify cropping systems with a high economic mitigation potential in Kenya was started by the BioCarbon Fund of the World Bank. Coaching support was provided to shortlisted project developers to prepare promising Project Idea Notes. Finally it was decided to support two pilot projects to develop a Project Design Document (see also Table 1., Agricultural Soil Project in Kenya) and it was agreed to develop a methodology under the Voluntary Carbon Standard (VCS). The project developer for the Kenya Smallholder Coffee Carbon Project is ECOM Agroindustrial Corp, an international coffee trader, which together with the World Bank and the German Technical Cooperation (GTZ) will be implementing the project.

The project aims at restoring coffee production and producing certified specialty coffee using best coffee practices, as well as reducing climate change vulnerability. It is working with the Komothai smallholder farmers cooperation which has 9,000 members. The project site is located in Kiambu District in Central Kenya and during the first phase 7,200 ha are targeted of which 50% are coffee and 50% subsistence agriculture, and during the second phase it will be enlarged to 10,000 ha.

Photo by UNIQUE forestry consultants.

By adopting sustainable agricultural land management (SALM) practices such as agroforestry, mulching and soil and water conservation techniques, approximately 3.5 tCO_2/ha/yr or more than 30,000 tCO_2/year will be mitigatedin the total project area during the first phase. Apart from the income through carbon credits, the coffee yields are also expected to rise. In addition the practices have the potential to increase climate resilience of agricultural production systems.

For more information, see:

www.rural21.com/uploads/media/R21_Harvesting_agricultural_carbon..._0109.pdf,

http://siteresources.worldbank.org/INTARD/Resources/335807-1236361651968/Timm_RWsideevent.pdf.

REDD PROJECT: THE JUMA SUSTAINABLE DEVELOPMENT RESERVE IN BRASIL

This project has been set up in 2006 in the Amazonas. The Juma Reserve has a size of 589,612 ha and is home to 370 families. The region is isolated but it is expected to have high deforestation rates in the future. The Brazilian NGO the Amazonas Sustainable Foundation (FAS) is implementing the project the project which is expected to prevent the deforestation of approximately 330,000 ha of tropical rainforest.

It is estimated to prevent the emissions of 3.6 million tons of GHGs between 2006 and 2016. Until 2050 over the entire project period it is expected to displace 190 million tonnes of CO_2 eq. The project is certified through the German firm TÜV-SÜD for the Climate, Community and Biodiversity Alliance (CCBA).

The funding for the project is supplied by the Amazonas state government and the Brazilian Bradesco Bank. Additionally the Marriot International hotel chain contributes US$2 million for the up-front costs of the project during the first four years.

The families which live in the region will receive payments, grants are made to community associations for social programmes and sustainable income-generating activities are promoted.

Source: Viana *et al.*, 2009.

FAO ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT SERIES

Groups: 1. Environment, 2. Climate Change, 3. Bioenergy, 4. Monitoring and Assessment

1. **Africover: Specifications for geometry and cartography, summary report of the workshop on Africover, 2000 (E)**
2. **Terrestrial Carbon Observation: The Ottawa assessment of requirements, status and next steps, by J.Cihlar, A.S. Denning and J. GOsz, 2002 (E)**
3. **Terrestrial Carbon Observation: The Rio de Janeiro recommendations for terrestrial and atmospheric measurements, by J. Cihlar, A. S. Denning, 2002 (E)**
4. **Organic agriculture: Environment and food security, by Nadia El-Hage Scialabba and Caroline Hattam, 2002 (E and S)**
5. **Terrestrial Carbon Observation: The Frascati report on in situ carbon data and information, by J. Cihlar, M. Heimann and R. Olson, 2002 (E)**
6. **The Clean Development Mechanism: Implications for energy and sustainable agriculture and rural development projects, 2003 (E)*: Out of print/not available**
7. **The application of a spatial regression model to the analysis and mapping of poverty, by Alessandra Petrucci, Nicola Salvati, Chiara Seghieri, 2003 (E)**
8. **Land Cover Classification System (LCCS) + CD-ROM, version 2, Geo-spatial Data and Information, by Antonio di Gregorio and Louisa J. M. Jansen, 2005 (E)**
9. **Coastal GTOS. Strategic design and phase 1 implementation plan, Global Environmental Change, by Christian, R. R. "*et al*", 2005 (E)**
10. **Frost Protection: fundamentals, practice and economics- Volume I and II + CD, Assessment and Monitoring, by Richard L. Snyder, J. Paulo de Melo-Abreu, Scott Matulich, 2005 (E), 2009 (S)**
11. **Mapping biophysical factors that influence agricultural production and rural vulnerability, Geo-spatial Data and Information, by Harri Van Velthuizen "*et al*", 2006 (E)**
12. **Rapid Agriculture Disaster Assessment Routine (RADAR) 2008 (E)**
13. **Disaster risk management systems analysis: A guide book, 2008 (E and S)**
14. **Community Based Adaptation in Action: A case study from Bangladesh, 2008 (E)**
15. **Coping with a changing climate: considerations for adaptation and mitigation in agriculture, 2009 (E)**

Ar	Arabic	F	French	Multil	Multilingual
C	Chinese	P	Portuguese	*	Out of print
E	English	S	Spanish	**	In preparation

FAO ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT WORKING PAPER

Groups: 1. Environment, 2. Climate Change, 3. Bioenergy, 4. Monitoring and Assessment

1. Inventory and monitoring of shrimp farms in Sri Lanka by ERS SAR data, by Carlo Travaglia, James McDaid Kapetsky, Giuliana Profeti, 1999 (E)
2. Solar photovoltaics for sustainable agriculture and rural development, by Bart Van Campen, Daniele Guidi, Gustavo Best, 2000 (E)
3. Energia solar fotovoltaica para la agricultura y el desarrollo rural sostenibles, by Bart Van Campen, Daniele Guidi, Gustavo Best, 2000 (S)
4. The energy and agriculture nexus, 2000 (E)
5. World wide agroclimatic database, FAOCLIM CD-ROM v. 2.01, 2001 (E)
6. Preparation of a land cover database of Bulgaria through remote sensing and GIS, by Carlo Travaglia "*et al"*, 2001 (E)
7. GIS and spatial analysis for poverty and food insecurity, by Daniel Z. Sui "*et al",* 2002 (E)
8. Environmental monitoring and natural resources management for food security and sustainable development, CD-ROM, 2002 (E)
9. Local climate estimator, LocClim 1.0 CD-ROM, 2002 (E)
10. Toward a GIS-based analysis of mountain environments and populations, by Barbara Hyddleston"*et al",* 2003 (E)
11. TERRASTAT: Global land resources GIS models and databases for poverty and food insecurity mapping, CD-ROM, 2003 (E)
12. FAO & climate change, CD-ROM, 2003 (E)
13. Groundwater search by remote sensing, a methodological approach, by Carlo Travaglia, Niccoló Dainelli, 2003 (E)
14. Geo-information for agriculture development. A selection of applications, by Robert A. Ryerson "*et al"*, 2003 (E)
15. Guidelines for establishing audits of agricultural-environmental hotspots, by Michael H. Glantz, 2003 (E)
16. Integrated natural resources management to enhance food security. The case for community-based approaches in Ethiopia, by Alemneh Dejene, 2003 (E)
17. Towards sustainable agriculture and rural development in the Ethiopian highlands. Proceedings of the technical workshop on improving the natural resources base of rural well-being, by Alemneh Dejene "*et al"*, 2004 (E)
18. The scope of organic agriculture, sustainable forest management and ecoforestry in protected area management, by Nadia El-Hage Scialabba, Douglas Williamson, 2004 (E)
19. An inventory and comparison of globally consistent geospatial databases and libraries, Geo-Spatial Data and Information, by Joseph F. Dooley Jr., 2005 (E)
20. New LocClim, Local Climate Estimator CD-ROM, 2005 (E)

21. AgroMet Shell: a toolbox for agrometeorological crop monitoring and forecasting CD-ROM (E)**
22. Agriculture atlas of the Union of Myanmar (agriculture year 2001-2002), by Aidan Gulliver and John Latham, 2005 (E)
23. Better understanding livelihood strategies and poverty through the mapping of livelihood assets: a pilot study in Kenya, Geo-Spatial Data and Information, by Patti Kristjanson "*et al",* 2005 (E)
24. Mapping global urban and rural population distributions, Geo-Spatial Data and Information, by Mirella Salvatore "*et al"*, 2005 (E)
25. A geospatial framework for the analysis of poverty and environment links, Geo-Spatial Data and Information, by Barbara Huddleston "*et al",* 2006 (E)
26. Food Insecurity, Poverty and Environment Global GIS Database (FGGD) and Digital Atlas for the Year 2000, Geo-Spatial Data and Information, by Ergin Ataman "*et al",* 2006 (E)
27. Wood-energy supply/demand scenarios in the context of the poverty mapping, Geo-Spatial Data and Information, by Rudi Drigo, 2006 (E)
28. Policies, Institutions and Markets Shaping Biofuel Expansion: the case of ethanol and biodiesel in Brazil (E)
29. Geoinformation in Socio-Economic Development Determination of Fundamental Datasets for Africa (E) and (F)
30. Assessment of energy and greenhouse gas inventories of Sweet Sorghum for first and second generation bioethanol (E)
31. Small Scale Bioenergy Initiatives, Brief description and preliminary lessons on livelihood impacts from case studies in Asia, Latin America and Africa (E)
32. Review of Evidence on Dryland Pastoral Systems and Climate Change: Implications and opportunities for mitigation and adaptation (E)
33. Algae Based Biofuels: A Review of Challenges and Opportunities for Developing Countries (E)
34. Carbon Finance Possibilities for Agriculture, Forestry and Other Land Use Projects in a Smallholder Context (E), (F), (S)

Ar	Arabic	F	French	Multil	Multilingual
C	Chinese	P	Portuguese	*	Out of print
E	English	S	Spanish	**	In preparation

This booklet is intended to guide extension service advisors and institutions who work with small-scale farmers and foresters with an interest in Carbon Finance and Carbon Projects. Its aim is to support setting-up carbon projects which involve small-scale farmers. Their participation allows them to be involved in the development and implementation of the project, influence the design of the project to generate positive impacts for the farmers and increase their knowledge about carbon finance. The definition of a small-scale farmer differs between and within countries. In most cases it is a farmer who cultivates less than one hectare of land and has diverse sources of livelihood.

The guide is structured into five sections: first, the background of climate change is explained (1); second, an introduction is given to how the carbon market works (2); this is followed by an explanation of carbon project development and the timeline and project size to take into account for planning (3); four, costs to be expected during the development of carbon projects are summarised, as well as benefits (4); finally, different funds and grants are presented (5). This booklet will need constant updating, as the political framework is changing very fast, causing changes in legislation, as well as actors, funds and regulations. In addition, the available data, research and knowledge for the development of carbon projects is constantly improving which will facilitate their future upgrowth.

Climate, Energy and Tenure Division (NRC) publications
www.fao.org/nr
www.fao.org/climatechange/61879/en
www.fao.org/climatechange/61878/en

NRC contact: Climate-change@fao.org

Food and Agriculture Organization of the United Nations (FAO)