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Africa and the Carbon Cycle

Proceedings of the Open Science Conference on "Africa and Carbon Cycle: the CarboAfrica project"

Accra (Ghana) 25-27 November 2008





CarboAfrica

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by

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&

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FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2011

The conclusions given in this report are considered appropriate at the time of its preparation. They may be modified in the light of further knowledge gained at subsequent stages of the project.

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Preface

This publication is based mainly on the works presented at the Open Science Conference "Africa and Carbon Cycle", held in Accra, Ghana, from 25 to 27 November 2008. The Conference was organized by the Food and Agriculture Organization of the United Nations (FAO) and the University of Tuscia, the Coordinator of the International project CarboAfrica.

CarboAfrica (www.carboafrica.net) is an international project funded by the European Commission under the 6th Framework Programme. The CarboAfrica partnership includes 15 Institutions from Europe and Africa, and FAO. Directly involved African countries are: Benin, Botswana, Burkina Faso, Ghana, Ivory Coast, Mali, Niger, Congo, South Africa, Sudan and Zambia. Other countries are indirectly affected by project outcomes.

Main project objectives are:

1. to support and expand a network of continued and enhanced observations of carbon stocks, fluxes, atmospheric concentrations and ecological processes in sub-Saharan Africa (SSA);
2. to improve biogeochemical models representing the main African ecosystem types;
3. to better understand the role of fire emissions from SSA in the global carbon cycle;
4. to enhance African capabilities to undertake mitigation and adaptation actions.

The work is organized in a multi-disciplinary integrated research approach through the division of main tasks in seven complementary work-packages.

WP1: Observation system & data integration & consolidation
WP2: Ecosystems processes understanding of carbon fluxes
WP3: Modelling for up-scaling to region and continent
WP4: Fire-Climate-Carbon cycle interactions
WP5: Communications and Capacity Development
WP6: Evaluation of a sustainable carbon sequestration
WP7: Project Management

Main expected results are:

1. increased network of carbon observations in SSA
2. better quantification of the terrestrial carbon budget of SSA
3. improved understanding of the SSA role in the global carbon cycle
4. estimation of the potential of SSA for emission reduction and carbon sequestration, particularly in soil and forests

Summary

A peer reviewed selection of articles derived from the presentations and posters showed at the Open Science Conference "Africa and Carbon Cycle", Accra, Ghana (25-27 November 2008) is presented.

The Conference brought together about 100 participants from 28 nations, mainly from Africa and Europe, presenting issues related to the following sessions:

i. Keynote speeches on Africa and Global Carbon Cycle;

ii. Terrestrial Carbon Observations in Africa and Ecosystem fluxes;

iii. Soil and Vegetation: Carbon and GHGs emissions in Africa;

iv. Biogeochemical Modelling;

v. Carbon sequestration and reduced emissions potentialities in Africa;

vi. Demonstration projects and developing capacities in Africa

A poster session was also organized especially to give visibility to African students and young researchers. Contributors belong both to the CarboAfrica consortium and other African or international initiatives.

The conference focused on Africa's contribution to the global carbon cycle and climate system through an overview of the carbon related studies in sub-Saharan Africa carried out both by the project CarboAfrica and other African and international initiatives.

The Conference showed the high number of initiatives currently ongoing in Africa, related to the study of all the component of the carbon cycle, from science to socio-economic issues, and considering all natural components, from soil to the atmosphere, through terrestrial ecosystems.

In spite of the high number of efforts and of the important results already achieved, it was evident that there is still a strong need for continued and enhanced observations of Africa's carbon stocks and fluxes. The CarboAfrica network has been building a large partnership of relevant African and international institutions especially to meet this need. CarboAfrica will provide a future unique data set to enable a more precise assessment of Africa's carbon balance and its sensitivity to natural and anthropogenic pressures and future climate.

Acknowledgements

The successful organization of the Conference on Africa and Carbon Cycle and the publication of this book were made possible because of the outstanding efforts of many institutions and individuals working in close partnership.

CarboAfrica wishes to express its sincere appreciation to FAO for its contribution to the organization of the conference and the financial support that made possible the participation of many African people. In particular the FAO Regional Office for Africa (RAF) provided valuable logistical support and played a key role in making the conference a success. We are especially grateful to the FAO Deputy Regional Representative for Africa, Ms Maria Helena Semedo, for her participation and precious contribution. Special thanks also to Land and Water Division for the opportunity to publish this book in the FAO World Soil Resources Reports.

The whole CarboAfrica consortium gratefully acknowledges the European Commission, which has been funding the project under the 6th Framework Programme (FP6) and supported the participation of keynote speakers. Special appreciation to Mr Anastasios Kentarchos, Project Officer, Climate Change & Environmental Risks Unit, Directorate Environment, DG-Research of the European Commission, for his participation and stimulating discussion.

The organizers are also grateful to the local hosts, for providing excellent facilities and a warm welcome in Ghana, and to Campbell Scientific Africa, for sponsoring functions in support of the conference.

The CarboAfrica Secretariat wishes also to thank all the participants in the conference, for coming to Accra, the speakers, for their valuable presentations, the authors, who prepared the papers for this publication, and particularly African students and young researchers, who will be the scientific experts and the decision makers of tomorrow: we hope they can make the most of this event.

Thank you very much to Ms. Gerboin Sandrine and Ms. Cárdenas Paola for their support to the preparation of this publication.

Finally thanks to all the CarboAfrica partners and collaborators, and the University of Tuscia in particular, who made this project possible.

List of acronyms and abbreviations

AATSR sensor	Advanced Along-Track Scanning Radiometer
ACT	African Conservation Tillage network
AfDB	African Development Bank
AGB	aboveground biomass
AGRA	Alliance for a Green Revolution in Africa
ANN	artificial neural network
ANOVA	One-Way Analysis of Variance
CARE	CarboAfrica Regional Experiment
CIFOR	Center for International Forestry Research
CSIF	Country Strategic Investment Frameworks
EnKF	Ensemble Kalman Filter
EPA	Environmental Protection Agency
fAPAR	fraction absorbed photosynthetically active radiation
FCPF	Forestry Carbon Partnership Facility
FLEGT	Forest Law Enforcement Governance and Trade
FMC	fuel moisture content
FRLF	Free light fraction
FRP	fire radiative power
FTIR-spectroscopy	Fourier Transform Infra-red (FTIR) Spectroscopy
GCMs	General Circulation Models
GEF	Global Environment Facility
GEMS	General Ensemble biogeochemical Modelling System
GHG	Greenhouse gas
GHGI	greenhouse gas inventories
GPD	Generalised Poisson Distribution
GPG	Good Practices Guidance
GPP	gross primary production
GWP	global warming potential
IALF	Intra-aggregate light fraction
IER	Institut d'Economie Rurale
IGBP	International Geosphere-Biosphere Programme
ILCA	International Livestock Centre for Africa
IPCC	Intergovernmental Panel on Climate Change
ITTO	International Tropical Timber Organization
LandSAF	Land-surface analysis Satellite Applications Facility
LSCE	Laboratoire des Sciences du Climat et l'Environnement

LST	Land-surface temperature
LUCF	land use change and forestry
LULC	land use and land cover
MAE 0.42 gC/m2/day	mass absorption efficiency
MEF	Moist Evergreen Forest
MODIS	Moderate resolution imaging spectroradiometer
NEE	net ecosystem exchange
NEPAD	New Partnership for Africa's Development
NTFPs	non-timber forest products
R_{eco}	ecosystem respiration
REDD	reduced emissions from deforestation and degradation
RLCM	Rapid Land Cover Mapper
SADC	South African Development Community
SCURS	Soil Carbon Uptake for Restoration and Sustainability
SEVIRI	Spinning Enhanced Visible and Infrared Imager
SHARE project	Soil Moisture for Hydrometeorologic Applications in the SADC region
SOC	soil organic carbon
SPITFIRE	fire module
TER	terrestrial ecosystem respiration
TroFCCA	Tropical Forests and Climate Change Adaptation
UNCCD	United Nations Convention to Combat Desertification (citato 1 volta)
UNCED	United Nations Conference on Environment and Development
UNDP	United Nation Development Programme
UNEP	United Nations Environment Programme (citato 1 volta)
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
UR2PI	Unité de Recherche sur la Productivité des Plantations Industrielles (ex CTFT)