



# CARBOAFRICA

Quantification, understanding and prediction of carbon cycle and other GHG gases in Sub Saharan Africa

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## EDITORIAL

Dear reader,

*This second issue of CarboAfrica Newsletter is bringing updated information on ongoing project activities and forecoming events. The project has now taken off and rolling with various activities both in the field and in the lab, with modelling approaches. Once again, please send us your feedbacks, suggestions and any news related to carbon sequestration and green house gas studies (particularly in Africa) that you are aware of.*

The CarboAfrica Secretariat

with Ghana Forestry Commission and is now proceeding on field with the "Contemporary Engineering" implementing agency.

The tower is 65 metres high, with three platforms and its construction is almost completed. It will use solar panels and an optional generator for energy supply. The foundation and road access are ready.

The tower will be soon erected in situ, and around September 2007 will start the scientific phase, just after the installation of the required instrumentation (sonic anemometer, infra-red gas analyser, meteorological station). Then the station will measure in continuous the fluxes of CO<sub>2</sub>, water and energy and local meteorological data.

We believe that the information provided by this flux station will give an important contribute to the understanding of the Africa's role in the global carbon cycle.

## CarboAfrica activities and developments

### Installation of the first tower for monitoring CO<sub>2</sub> fluxes in an African tropical forest

CarboAfrica, through the Department of Forest Science & Resources of University of Tuscia (Italy) is the first project that has undertook the winning challenge to set up an eddy covariance flux tower in a tropical forest in Africa. The tower is under construction in the moist evergreen forest of the Ankasa National Park, in the Western Region of Ghana and we believe it will trigger the scientific and tourist interests in the park. The construction of the tower is successful started in collaboration



Figure 1: Basement for the new tower for monitoring CO<sub>2</sub> fluxes in Ghana.

## Improvements at the eddy covariance system in Demokeya, Sudan.

In the first week in March 2007 a new computer for data collection was installed at the Demokeya site in Sudan.

The system (called Eddy PPC) generates approximately 23 Mbyte raw data per day allowing some 40 days of data on the SD card. 30 min averages are stored in a text file and sent by SMS, at regular intervals, via a GSM modem for easy control of system performance. System sensors include a GILL R3 anemometer and a LI-7500 open path infrared gas analyst.

The iPAQ system was compiled by A. Matese and colleagues at the Institute of Biometeorology, Florence, Italy. At the time of writing, SMS are received at regular intervals indicating that the system is up and running.

The iPAQ is more heat resistant (55 C) according to the manual compared to a standard PC (approx. 45 C). The system is equipped with a Peltier cooler to keep temperatures down and an overheat protection that cut power at 45 degrees. This heat protection will now be exchanged to allow higher temperatures in the system box (Figure 2).

The winter is the dry season when most of the filed layer is wilted but some of the trees still keep green leaves and assimilate some CO<sub>2</sub>.

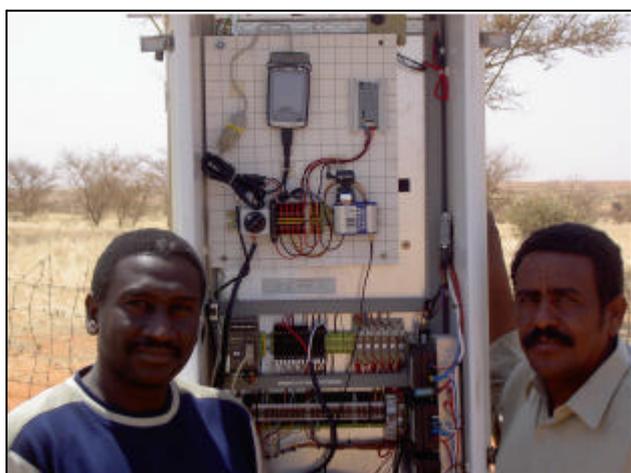


Figure 2: The system box for data collection installed at the Demokeya site in Sudan.

## Modelling workshop held in Jena (12-13 April).

The CarboAfrica modelling workshop took place in at the Max Planck Institute for Biogeochemistry in Jena, April 12-13 2007. The participants agreed in organizing the first CARBOAFRICA model intercomparison at continental scale, which aim is to provide a baseline data set of modelled seasonal and interannual variability and associated climate sensitivity of

ecosystem-atmosphere CO<sub>2</sub> and water exchange. This data set will represent the knowledge 'prior-to-CARBOAFRICA-data ingestion' about carbon and water cycles as implemented in the participating models. It will help to identify areas and conditions with large uncertainties and will serve as a reference for various follow on modelling work (e.g. effects of including dynamic vegetation and land-use change, fire emissions, and using different climate data, improvements via data assimilation of ecosystem level data).

During the workshop the links and collaboration with the Africa Carbon Exchange Project (ACE) were discussed and a tight collaboration between ACE and CARBOAFRICA modelling was agreed on. The model intercomparison was viewed as a valuable extension of previous ACE modelling and compatibility with the past and current ACE modelling will be pursued. ACE SIB2 will participate in the model intercomparison, either with runs already performed or with new ones.

A further decision not to consider the fire variable in the intercomparison was taken, as this will be considered in WP4 with the single LPJ-guess-SPITFIRE and evaluated with remote sensing based approaches.



Figure 3: The CarboAfrica Modelling Team in Jena (April 2007).

## CarboAfrica Model Intercomparison Protocol.

The protocol for Intercomparison was developed as agreed in the workshop held in Jena. The first simulation results will be available by the end of July 2007. For further details please contact Markus Reichstein (markus.reichstein@bgc-jena.mpg.de).

### Field work: root biomass measuring methods (Congo).

CarboAfrica partner CIRAD made a fieldwork trip to Congo from 11<sup>th</sup> to 21<sup>st</sup> of April 2007 in order to measure root biomass, a poorly understood component of the forest carbon stock. The field activities focused on the comparison of four techniques for measuring medium and fine root biomass. As no standard method is set in the literature, the team aimed at comparing the different methods in terms of efficacy and cost/labour effectiveness. The methods were all based on excavation and weighing of samples around one single eucalyptus tree. The results of the comparison will be available in the next few months. The scheme of the sampling design around one tree is represented below.

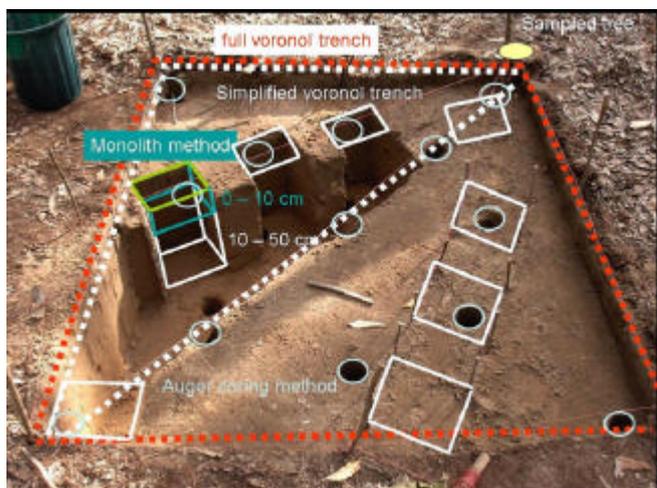


Figure 4: Sampling scheme for root biomass around a tree in Congo.

### Field work: Assessment of soil erosion (Congo)

A team from CarboAfrica partners CIRAD and UR2PI went on a mission to Congo for collecting data on carbon sequestration and on erosion risks associated to Eucalyptus plantations.

The latter have been showed to play a major role in improving the capacity of the ground to produce cellulose and firewood, but no studies have previously focused on the potentials for carbon sequestration and on the assessment of risks of soil erosion, which causes losses of carbon.



Figure 5 - The manual rainfall simulator built in Congo.

Local field personnel was trained on methods for quantification of erosion and a manual rainfall simulator was built (Figure 5). The team found that the soil of medium- to old-aged plantations seemed to be well protected from erosion because of (i) a quasi continuous mulch of litter, (ii) a modest understory of herbaceous species (if fires) and sometimes, establishment of tree species from nearby natural forests.

Moreover a very dense root mat, located at the interface litter – mineral soil, protect the soil against the aggressions of the energy of rainfalls and surface runoff. The erosive potential is very large on these sandy soils and was mainly found on the bare soils. Using the rainfall simulator designed by E. Roose, Cirad and UR2PI will assess the risks of erosion in a large range of situations (slopes, vegetation cover) so as to provide a map of C losses by erosion over the whole forest area around Pointe-Noire.

## Students and PhDs within CarboAfrica

**Fanny Bikindou** has started her Phd at University of Brazzaville, in collaboration with UR2PI. The research will focus on site Index as a function of site descriptors for one natural hybrid Eucalyptus on sandy soils in Congo.

The aim of her work is first to determine which site descriptors explain the observed variability of production and second to provide to the forest manager tools and indicators to estimate the wood production (and therefore carbon stocks). Her work is funded by CarboAfrica, the International Foundation for Science (IFS), UR2PI and Cirad.

**Armel Thongo M'bou** started this year his Phd at University of Brazzaville, in collaboration with the University of Nancy (France) and UR2PI. His work will investigate the root development and root architecture of natural hybrid Eucalyptus on sandy soils in Congo. This study, bringing supplementary knowledge on Eucalyptus root system, will contribute to the assessment of carbon balance of the eucalyptus plantation in Congo. His work is funded by UR2PI, the International Foundation for Science (IFS), CIRAD and the French project FORINFO (Sustainable forestry in Central Africa).

**Marion Chesnes** (Forest Engineer Student from France) will go to Ghana at the Plantation Production Division (FORIG) for 4 months. She will work with Stephen Adu-Bredu (Researcher at FORIG) and Matieu Henri (Phd Student at University of Tuscia) on potentials of avoided deforestation in Ghana.

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# Forthcoming activities

## Field campaigns (Congo, Zambia, South Africa)

This summer 2007 the SUN-DSA will start the field campaigns for the measurement of soil fluxes of greenhouse gases  $N_2O$ ,  $CH_4$  and  $CO_2$  in some of the CARBOAFRICA sites. The campaigns will be held in collaboration with the local partners. In late June 2007 a dry season campaign will be carried on in Brazzaville (Congo) at the station of Tchizalamou, near Pointe Noire, in burnt and unburnt herbaceous savannas, in collaboration with the group of UR2PI and CIRAD.

At the end of August 2007 a dry season campaign will be held in South Africa, at Skukuza, in open tree savannas, in collaboration with CSIR. In the late autumn a campaign will be held in Zambia at the station of Mongu, a woodland savanna, together with the Max Planck Institute of Jena, in charge of the site. Daily fluxes of  $N_2O$  and  $CH_4$  will be measured by GC and photoacoustic techniques using closed chambers.  $CO_2$  fluxes will be measured by IR. At each site, where eddy covariance net  $CO_2$  exchange is anyway available, several abiotic and biotic soil parameters, plant biomass density, standing litter and litter fall will be measured, as described in the general part of the project. Attention will be given to significant changes in the micro-environment, such as areas under tree canopy and open grassland spaces which are often co-occurring as a mosaic environment in savannas ecosystems. Also the role of termite nest in the overall field site  $CH_4$  budget will be followed by the UR2PI and DSA-SUN in Congo grassland over one entire season after burning. Dedicated experiment will be held at sites to investigate gas pulses after rain events. In the next year, other campaigns will be held in the same site in the complementary season and possibly other sites will be included in the investigation.

## Training Activities

One of the aims of CarboAfrica is to train local people in doing carbon and climate related research. Training will be provided at theoretical (seminars, workshops) and practical (field campaigns) level. People interested can participate in the foreseen field campaigns (see previous paragraph) and learn the use of field instrumentation for ecological processes measurements.

A workshop on ecosystem functioning and biomass measurements will be held in Autumn 2007 at the Marien N'gouabi University of Brazzaville, Congo. Courses will be given in English and French.

A methodological course on eddy covariance, leaf photosynthesis and soil respiration, including practical training (with instruments), data evaluation and first principles of modelling activities, should be held next year in southern Africa (South Africa or Zambia).

More details will come soon.

## Events

### CarboAfrica First Annual Meeting

*25-26 August, Kruger National Park, South Africa*

During the CarboAfrica annual meeting the activities of the first year will be presented and next steps of the project will be planned. Each partner will be requested to present a communication showing the progress in the practical effectiveness of the activities under his/her responsibility. The project achievements and the timing according to the workplan for the first year will be evaluated, and any problem will be discussed. At the end of the meeting a report on the internal evaluation of the project will be drawn. Moreover, the preparation of the reports officially requested by the European Commission by the end of the first year (Activity Report, Management Report, etc.) will be started.

The meeting is open to the project participants and the advisory board. External people representing any initiative relevant to CarboAfrica will be invited and a specific session to present relevant projects and discuss cooperation is foreseen.

More information will be soon available in the project website.

### Carbon Cycle Symposium in South Africa

*Carbon-Climate-Human Interactions in Africa:*

*Current Understanding and Future Research*

*23-25 August 2007*

*Kruger National Park, South Africa*

The meeting will bring together regional and international experts working on carbon cycle sciences in the African continent which address the interactions with climate change

and human activity. The goal of the *Symposium* is to present the latest research results on:

- \* Regional carbon exchanges and budgets
- \* Drivers of anthropogenic carbon emissions (fossil fuel, land use change, fire)
- \* Urban and regional carbon management
- \* Carbon-climate mitigation and adaptation
- \* Bioenergy production and associated land use change issues
- \* Carbon-biodiversity interactions
- \* Ocean carbon exchanges and freshwater carbon transport

The *Symposium* will also discuss the regional needs to further develop a research capacity to understand and manage the carbon cycle in Africa. The *Symposium* is open to all interested research and environmental policy communities.

For further information please visit the Symposium website:

<http://www.globalcarbonproject.org/meetings/africa.htm>

## Advisory board: new members appointed

The CarboAfrica Advisory Board (AB) is an independent group of 3 people who shall follow the project work and provide inputs, guidance and external evaluation. The AB will meet annually during the annual meeting of the project, and by telephone conferences at any time required by the project leaders. The 3 members should represent and balance relevant stakeholders to CarboAfrica, both at scientific (experimental and modelling) and political level.

It is with pleasure that we welcome the first 2 members of the advisory board:  
Dr. Jason Beringer, Monash University (Australia),



and Dr. Niall P Hanan, Colorado State University (USA).

The third member, possibly a representative of African environmental policy, will be identified during the next annual meeting.

## Collaboration between CarboAfrica and other Initiatives



It is with pleasure that we announce that an agreement has been reached between CarboAfrica and the project AMMA-EU, for collaboration and data sharing.

AMMA (African Monsoon Multidisciplinary Analysis) is an international project aiming at the improvement of knowledge and understanding of the West African Monsoon (WAM). The project particularly focuses on its variability and its impacts on West African countries, with an emphasis on daily-to-interannual timescales. AMMA involves more than 25 countries, representing more than 140 national and pan-national agencies and institutions. Among the objectives of AMMA there is the development of close partnerships between those involved in research relevant to WAM and climate change in Africa. In this context the collaboration between AMMA and CarboAfrica will represent an important synergy, fruitful for both the project.

One AMMA partner, the Centre for Ecology and Hydrology (CEH) of the UK Natural Environment Research Council (NERC), is already a full CarboAfrica participant, and another one, the Centre d'Etude Spatial de la Biosphère (CESBIO) of the University Paul Sabatier (France) will become soon a full participant, and will be responsible for the relationship between the two projects.

As a result of the agreement, all CO<sub>2</sub> flux data from the Benin, Niger and Mali sites will share their flux and meteorological data with CarboAfrica. Each AMMA principal investigator participating in, or collaborating with CarboAfrica will assume the responsibility to oversee the maintenance and download of its respective equipment and data from September 2007. In return, common data processing, additional modelling and measurements efforts in CarboAfrica, in addition to a limited funding from CarboAfrica, will improve AMMA studies.

The process to make this agreement official with the European Commission will start soon.

## RELATED LINKS

**ACE** – African Carbon Exchange (ACE) Project

<http://www.nrel.colostate.edu/projects/ace>

**AMMA** - African Monsoon Multidisciplinary Analysis

<http://amma.mediasfrance.org/>

**CARBOEUROPE** (Integrated Project CarboEurope-IP, Assessment of the European Terrestrial Carbon Balance)

<http://www.carboeurope.org>

**EO-LANDEG** (Earth Observation initiative in a former homeland of South Africa in support of EU activities in land degradation and integrated catchment management)

<http://www.eolandeg.com>

**ESASTAP** - European South Africa Science and Technology Advancement Programme

<http://www.esastap.org.za/esastap/home/index.php>

**GCP** - Global Carbon Project

<http://www.globalcarbonproject.org>

**FLUXNET** (Integrating Worldwide CO<sub>2</sub> Flux Measurements)

<http://www.fluxnet.ornl.gov/fluxnet/index.cfm>

**ILEAPS** - Integrated Land Ecosystem-Atmosphere Processes Study

<http://www.atm.helsinki.fi/ILEAPS/>

**NEPAD** - New Partnership for Africa's Development

<http://www.nepad.org/>

**TCO** - Terrestrial Carbon Observation

<http://www.fao.org/gtos/TCO.html>

**TroFCCA** - Tropical Forest and Climate Change Adaptation

<http://www.cifor.cgiar.org/trofcca>

**Carbon Cycle Symposium** - 23-25 August 2007 Kruger National Park, South Africa

<http://www.globalcarbonproject.org/meetings/africa.htm>

**Marien Ngouabi University** - University of Brazzaville, Congo

<http://www.univ-mngb.net/>

## EXPRESSION OF INTEREST

Any collaboration with other new or ongoing initiatives is welcome: if you are interested in collaborating with CARBOAFRICA you are encouraged to send us a letter of interest downloading the template available on CarboAfrica web site (section Documents/Miscellaneous). We will get back to you as soon as possible.

## CONTACT CARBOAFRICA

*CARBOAFRICA is coordinated by Università della Tuscia (ITALY).*

*For any further information contact:*

**Antonio Bombelli** (Project Manager):

*bombelli@unitus.it*

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## NEW CARBOAFRICA WEB ADDRESS

CARBOAFRICA Web site address will soon be

<http://www.carboafrika.net>