



Projet financé par l'Union Européenne

Modeling of potential of carbon sequestration in West Africa

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Résumé

Global Climate Change Alliance (GCCA) is an initiative of the European Union to support the CILSS and ECOWAS countries to address climate change with a view to achieve the Millennium Development Goals (MDGs). The GCCA project is organized along three components. The COMPONENT 3 of GCCA aims to "strengthen the capacity of West African Countries in climate negotiations and access to carbon finance". The development of tools for estimating carbon stocks allows communities to establish carbon sequestration projects that have a real impact on reducing people's vulnerability to climate change. This paper shows different steps of carbon modeling, different types of models and an integrated framework to model carbon dynamics in West Africa.

Justification

- By its structural properties, of storage and exchange of information, of energy and nutrients, carbon plays in the ecosystem multiple roles of static type (formation of plant skeleton and matrix clay-humus soil) and dynamic type (transfer of energy and matter within and between individuals).
- Carbon dynamics must be understood as a complex system. This dynamic involves various forms of carbon manipulated by various actors (plant, microorganism, animal, man), that produce, consume, or transform them in a non-independent way along trophic paths.
- The complexity of the carbon dynamics makes computer modeling an essential experimental tool for the analysis of the carbon cycle

Carbon dynamics modeling, to answer to the following questions:

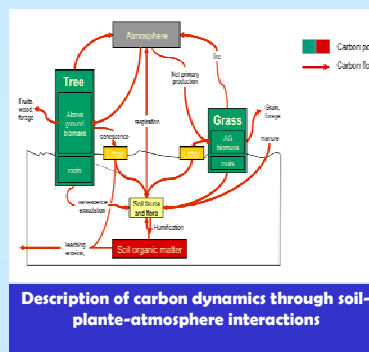
- What is the biophysical and / or economic potential of carbon sequestration?
- How these potentials evolve at different scales of time and space?
- How different management practices can influence the carbon stock in short and long terms?
- What synergies can we find between different objectives: carbon sequestration, food security, environment, etc.?

Global objective

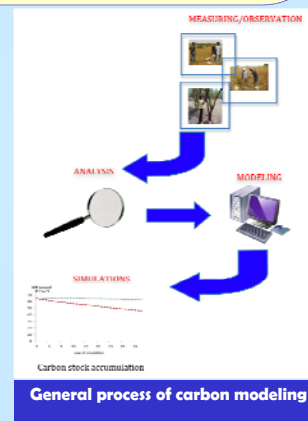
- Develop a reference model for carbon sequestration projects and analysis of the dynamics of carbon stock for West Africa

Specific objectives

- Build a state of art on carbon dynamics modeling
- Propose an integrated model for carbon dynamics modeling in West Africa
- Use the model to assess the synergies between different objectives: carbon sequestration, reduction of soil degradation, social and economy development



Description of carbon dynamics through soil-plant-atmosphere interactions



General process of carbon modeling

Three modeling approaches currently used

Regional and global models

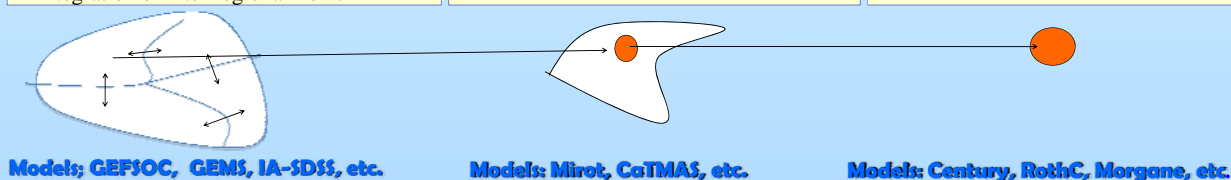
- Several types of vegetation, soil and climate
- Integration of inter-regional flows

Local models

- Several types of vegetation, soil and a local climate

Soil carbon models

- A type of vegetation, soil and a local climate



Models: GEFIOC, GEMIS, IA-SDSS, etc.

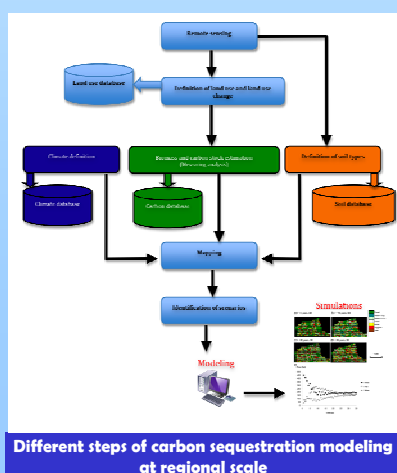
Models: Miroc, CatMAS, etc.

Models: Century, RothC, Morgane, etc.

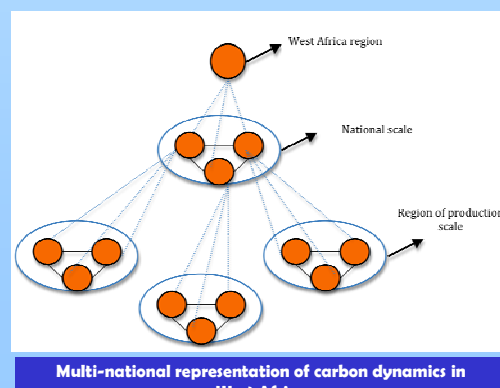
More than 20 models divided in three categories are studied

Toward an integrated framework for carbon dynamics modeling in West-Africa

- In the purpose of carbon dynamics modeling in West Africa, a methodological and a conceptual framework was proposed
- The integration of vegetation, soil and climate spatial variability in West Africa requires a regional approach for carbon dynamics modeling in West Africa
- The proposed framework integrates social, economic, environmental and policy dimensions of carbon resources management
- It accounts the articulations between local and global options of carbon resources management
- The tool to develop will be for the CILSS / ECOWAS member countries a support for:
 - Carbon measuring, modeling and monitoring
 - Joint analysis of different environmental, social, economic and policy objectives



Different steps of carbon sequestration modeling at regional scale



Multi-national representation of carbon dynamics in West Africa