



Context : The sustainability of agroecosystems, along with the ecological services they provide, is a major stake for present and future agronomy. In the context of global change, it is urgent to revisit the paradigms of agronomy, to come up with a new sustainable agriculture with high productivity and low energy and fertilizer consumption.

In west African agro-sylvo-pastoral agroecosystems where there are low inputs of nutrients, fallow and livestock managements are key agricultural practices that influence both nutrient retention within the agroecosystem, and nutrient fluxes between spatial components of the agroecosystems. Therefore, these practices might be key levers to optimize crop/meat productivity.

Leaders:

Tanguy DAUFRESNE
UMR Eco&Sols, INRA
tanguy.daufresne@inra.fr

Céline CASENAVE
UMR MISTEA, INRA
celine.casenave@inra.fr

Realized actions:

The project was organized in 3 steps, the objective being the optimization of the crop production or of the crop and meat productions of a typical West-African agroecosystem:

➤Step 1. Optimization of the crop production through numerical simulations of the biogeochemical fluxes and stocks model developed by Anne Bisson

➤Step 2. Application of tools from control theory to optimize the crop-production through the adaptation of the herbivory pressure over the year

➤Step 3. Multi-criteria optimization of both crop and meat production

For the optimization, two types of agricultural practices were considered as possible leverages to be used by the farmers to optimize the agroecosystem:

➤the "organizational practices", that is the spatial and temporal organization of the agroecosystem

➤the "interconnection practices", that is the nutrient fluxes due to livestock and the fluxes of fertilizers, of harvest and of crop exportation.



Objectives :

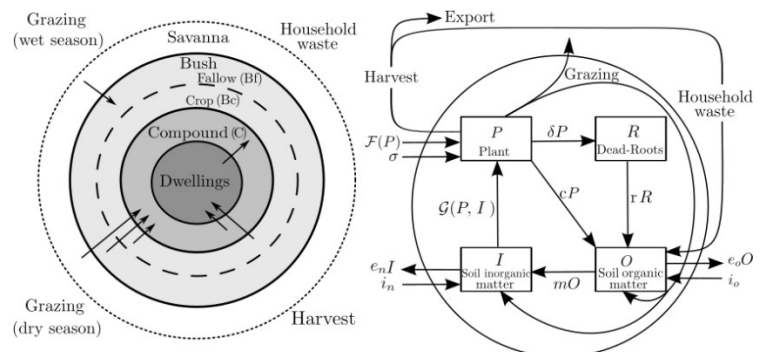
At the crossroad between Agronomy, Ecology, Mathematical modelling and Control theory, the ECOW project aims at identifying the optimal configurations and control strategies of agroecosystems for the optimization of crop/meat production in a sustainable way. We propose an innovative approach based on the use of concepts from ecology such as meta-ecosystem and compartments model, and on mathematical methods of the control theory.

Partners(s) :

- UMR Eco&Sols (INRA/SupAgro/CIRAD/IRD)
- UMR MISTEA (INRA/SupAgro)
- Selmet (INRA/SupAgro/CIRAD)
- LMI IESOL Dakar (IRD, CIRAD)
- UMR IESS (IRD Bondy)

Duration : december 2018 – december 2019

Funding : 20 000 €



Publications:

Maximization of fertility transfers from rangeland to cropland: the contribution of control theory. A. Bisson, C. Casenave; T. Daufresne; S. Boudsocq, Journal of Theoretical Biology, 2019, vol. 469, p. 187-200. <https://doi.org/10.1016/j.jtbi.2019.01.039>

