CLEMATIS

CoLEarning with Models to Assess diversificaTIon Services Assessing the contribution of crop diversification to ecoABSYSs services : co-learning with models to integrate farmers' and researchers' knowledge

ABSTRACT

In West Africa, a major challenge for farming systems it to evolve towards increased but stable production despite climatic variability and climate change, and maintain or even improve soil fertility. A promising avenue in this respect is to diversify agro-ecosystems to improve resource use efficiency, yields and their stability. Diversification of farming systems through the inclusion of legumes and better integration with livestock keeping represent key agriculture-based solutions towards enhancing resilience and sustainable food production. Agricultural models associated with multi- criteria analysis are key tools to assess the performance of farming systems and explore multi-dimensional effects of interventions. However, for model results to be useful for local decision making, modelling exercises have to be conducted in collaboration with stakeholders so that locally-relevant criteria are included in the evaluation. Furthermore, stakeholder feedback helps to refine and contextualize simulated solutions. As such, models can enable a bottom-up process of co-learning in which both researchers and farmers learn from interacting around system re-design.

CLEMATIS will use existing crop models (e.g. DSSAT, APSIM, Samara, STICS) to assess the contribution of system diversification to ecosystems services: resilience to climate change, adaptation-mitigation co-benefits, soil fertility improvement, and resources use efficiencies. The main research question of a first objective will be: by which mechanisms does diversification enhance systems' resilience and contribute to ecosystems services? An understanding of these mechanisms will help to guide the choice of locally adapted solutions.

Second, we hypothesize that using a model will be an efficient way to share knowledge, and to bridge different scales (plant, field, livestock herd, farm), scientific disciplines (breeders, system agronomists, economists) and stakeholders (farmers, researchers). A substantial task of the post-doc will be to favor inter- and transdisciplinary research through the adoption of a systems approach, tackling system components at different scales and enabling two-way communication of research findings for co-learning. Working with complementary initiatives in the region, CLEMATIS will strive to answer the main research question by using participatory modelling tools. Serving as boundary objects for integrating and sharing knowledge, the modelling tools will promote a better interaction among multi-disciplinary researchers and farmers to explore and co-design options for farming system diversificaTIon that are adapted to the local contexts.

GOAL

The overall objective is to co-design innovative farming systems, including legumes and crop-livestock integration, to enhance resilience and adaptation to climate change for smallholder farmers of the semi-arid zone of West Africa (Burkina Faso, Mali, Senegal).
We hypothesize that diversified farming systems can secure crop production and enhance provisioning and regulating ecosystem services (nutrient cycling, climate regulation). Agriculture-based solutions (including legumes and tighter crop-livestock integration) can promote agrobiodiversity and enhance system component interactions. To explore the effect of management decisions on crop allocation, species/varieties choices, fertilization, livestock husbandry and manure management, we will do a co-learning process, by participatory, bottom-up approaches with local farmers.

More precisely, it will consist of coupling a crop modeling method with a participatory method Crop models to share knowledge and to bridge the gap between different scales, disciplines, and actors to better co-designing farming systems.