les dossiers d'AGROPOLIS INTERNATIONAL

Expertise of the scientific community

Special Partnership Issue



Insight on France-CGIAR research

Number 26 September 2021 In the framework of water management research carried out under climate change and water scarcity conditions on a small watershed scale in India*, several models developed at different scales reflect the hydrological functioning on farms and in territories. These models are used to test different adaptation scenarios (choice of crops and irrigation methods) with the aim of safeguarding water resources while maintaining farmers' income. These models were designed by coupling existing models developed by several communities (agronomists, hydrologists, economists) in order to represent the different

system components and their interactions (see p. 74). Decision-making processes involved in agroecosystem management have been mainstreamed into these models. The integrated ATCHA model* simulates the behavior of farmers who have to make daily decisions regarding the operational management of cultivated plot irrigation. It also simulates strategic farm management scenarios, in terms of the choice of crops to be planted in plots according to the state of water resources and the choice of irrigation level. ATCHA* modelling and scenario development were carried out using

a co-design approach with stakeholders. Finally, the multi-simulation tools enable extension of the models on different spatiotemporal scales. A model initially developed at the cultivated field scale was simulated at multiple points (experimental design) for potential application throughout France**.

* ATCHA ANR project, Accompanying the adaptation of irrigated agriculture to climate change: www6.inrae.fr/atcha

See the EFESE-EA study, Évaluation française des écosystèmes et des services écosystémiques visant à faire l'évaluation des services écosystémiques rendus par l'agriculture française: www6.paris.inrae.fr/depe/Page-d-accueil/Actualites/EFESE

Biofunctool[®]: a low tech field tool for soil health assessment

ssessing the impact of changes in agricultural practices on soil health is key challenge of the agroecological transition. Soil health implies the capacity of the soil to function and provide ecosystem services. Yet current assessment methods are mainly based on stock indicators (C, N, microbial biomass, etc.) and generally do not incorporate dynamic functional indicators related to the role of the soil biota. When these functional measurements are carried out, this is mostly done under standardized laboratory conditions which do not necessarily reflect the

current level of the functions in the field. To overcome these methodological shortcomings, a new integrative soil health assessment method has been proposed that takes into account the relationships between the physicochemical properties and biological activity of soils. This so-called Biofunctool® $method^{(1,2)} \ includes \ nine \ rapid \ low-cost \ field$ indicators (Fig. A) for assessing three main soil functions: carbon dynamics, nutrient cycling and soil structure maintenance. The ability of all of the indicators to assess the impact of land management on soil health has been validated





0.13al

0.246

Rubber

13-17yr

0.10al

.22b

Rubber

>24yr

0.32a

Forest

Carbon

transformation

0.24

0.05

0 14

Rubber

10yr

0.30

0.20

0.10

0.00

0.10al

0.17cc

Cassava

Contacts

Alain Brauman (Eco&Sols, IRD, France), alain.brauman@ird.fr Alexis Thoumazeau (ABSYS, CIRAD, France), alexis.thoumazeau@cirad.fr

For further information

(1) Brauman A., Thoumazeau A., 2020. Biofunctool[®] : un outil de terrain pour évaluer la santé des sols, basé sur la mesure de fonctions issues de l'activité des organismes du sol. Étude et gestion des sols, 27(1): 289-303.

(2) Thoumazeau A., Bessou C., Renevier M., Trap J., Marichal R., Mareschal L., Decaëns T., Bottinelli N., Jaillard B., Chevallier T., Suvannang N., Sajjaphan K., Thaler P., Gay F., Brauman A., 2019. Biofunctool®: a new framework to assess the impact of land management on soil quality. Part A: concept and validation of the set of indicators. Ecol. Indic., 97: 100-110.

(3) Thoumazeau A., Chevallier T., Baron V., Rakotondrazafy N., Panklang P., Marichal R., Kibblewhite M., Sebag D., Tivet F., Bessou C., Gay F., Brauman A., 2020. A new in-field indicator to assess the impact of land management on soil carbon dynamics. Geoderma, 375: art. 114496 [10 p.].

▲ Figure A. Biofunctool®: list of indicators used for each function.

◄ Figure B. Illustration of a soil health index produced by Biofunctool®. (2019) Impact of land use change (cassava to rubber plantation) on soil functioning along a 24-year rubber plantation chronosequence. From Thoumazeau et al.