



HAL
open science

An agent-based model to analyze the ecological functioning of agro-silvo-pastoral landscapes in West Africa

Myriam Grillot, Jonathan Vayssières, Benoit Gaudou, Alassane Bah,
Dominique Masse

► To cite this version:

Myriam Grillot, Jonathan Vayssières, Benoit Gaudou, Alassane Bah, Dominique Masse. An agent-based model to analyze the ecological functioning of agro-silvo-pastoral landscapes in West Africa. 8th International Congress on Environmental Modelling and Software Society (iEMSs 2016), Jul 2016, Toulouse, France. pp. 1305. hal-01493784

HAL Id: hal-01493784

<https://hal.science/hal-01493784>

Submitted on 22 Mar 2017

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Open Archive TOULOUSE Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in : <http://oatao.univ-toulouse.fr/>
Eprints ID : 17125

The contribution was presented at iEMSs 2016:
<http://www.iemss.org/sites/iemss2016/>

To cite this version : Grillot, Myriam and Vayssières, Jonathan and Gaudou, Benoit and Bah, Alassane and Masse, Dominique *An agent-based model to analyze the ecological functioning of agro-silvo-pastoral landscapes in West Africa*. (2016) In: International Environmental Modelling and Software Society (iEMSs 2016), 10 July 2016 - 14 July 2016 (Toulouse, France).

Any correspondence concerning this service should be sent to the repository administrator: staff-oatao@listes-diff.inp-toulouse.fr

An agent-based model to analyze the ecological functioning of agro-silvo-pastoral landscapes in West Africa

Myriam Grillot^{a,b}, Jonathan Vayssières^{a,b}, Benoit Gaudou^c, Alassane Bah^{b,d}, Dominique Masse^{e,f}

^a CIRAD Umr SELMET “Mediterranean and Tropical Livestock Systems”, Montpellier, France

^b Dp PPZS “Pastoral Systems and Dry Lands”, Dakar, Sénégal

^c IRIT CNRS, Université de Toulouse, Toulouse, France

^d UCAD - Ummisco, “Dakar Cheikh Anta Diop University - Unit for Mathematical and Computer Modeling of Complex Systems”, Dakar Fann, Senegal

^e IRD, UMR Eco&Sols “Functional Ecology and Biochemistry of Soils and Agroecosystems”, Montpellier, France

^f LMI IESOL “Ecological Intensification of cultivated Soils in west Africa”, Centre ISRA IRD Bel Air, Dakar, Sénégal

Abstract

Biomass recycling plays a major role in the functioning and sustainability of agro-silvo-pastoral ecosystems in West Africa. However, farming systems must adjust rapidly to changing landscapes. This abstract describes an Agent-Based Model (ABM) that analyzes nutrient (N) cycles within the village “terroir” agro-ecosystem to assess how changes in land use and farming practices affect crop-livestock integration and spatial heterogeneity.

The ABM is implemented on the GAMA platform (Generic Agent-based Modelling Architecture). Each simulated household is classified according to a farm type with a pre-defined biomass management strategy (use of crop products, manure, etc.). The model is spatially explicit, with biomass being moved across landscape units and through different ecosystem components: soil, plants, animals, humans, etc. Biomass flows are converted into N flows which are then used to calculate indicators such as N balance, N use efficiency, and the diversity and recycling indexes that characterize N cycles.

The model was parameterized through on-farm measurements of crop and livestock productions (for the biophysical sub-system) and participatory workshops with farmers (for the decision sub-system). The model was validated on the basis of biomass flows observed in two villages in the Senegalese groundnut basin.

The model is original in its multi-scale analysis of N cycles occurring at different organizational levels: plot, herd, household and landscape. For instance this highlights the consequences of households’ choices at the plot scale for spatial heterogeneity at the landscape scale. This ABM is potentially generalizable for designing ecological intensification pathways in West African village “terroirs”.

Keywords: Agent-based-model, agro-silvo-pastoral ecosystem, biomass flows, multi-scale analysis