

From Local Actors to Leaf Protectors: A Collaborative Modeling Approach for Rethinking Tree Management and Protection Measures in Senegal's Groundnut Basin

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Abstract

How can a participatory simulation model contribute to understanding the socio-ecological dynamics and fostering innovative strategies for sustainable management of trees, crops, and pastoralism in the peanut basin?

In the agro-pastoral zones, the Sahelian ecosystems have undergone significant degradation, characterized by a reduction in tree cover, as a consequence of the droughts in the 1960s and 1990s. The peanut basin stands out for its positive interrelationships between trees, crops, and pastoralism. However, the regeneration of the *Faidherbia* park has declined since the major droughts. Through collaborative efforts with agro-pastoral farmers, we have developed a simulation model that aims to unravel the complex social and ecological dynamics at play and explore potential strategies in partnership with local communities.

By exploring the results of the model co-designed with local stakeholders, we have identified more effective management strategies, as per the request of the local actors. However, more importantly, we have collectively questioned the conditions for improving tree cover and the viability of the socio-ecosystem, particularly in relation to the demand for firewood and local cereal for sustenance. This has prompted the stakeholders to engage in community-wide discussions and transform agro-pastoralists into leaf protectors.

30 **1 Introduction**

31 Your manuscript should contain all of the numbered sections specified in this template: Introduction,
32 Results, Discussion, Materials and Methods.

33 The manuscript should start with a brief introduction that lays out the problem addressed by
34 the research and describes the paper's importance. The scientific question being investigated should
35 be described in detail. The introduction should provide sufficient background information to make
36 the article understandable to readers in other disciplines and provide enough context to ensure that
37 the implications of the experimental findings are clear.

38 **2 Materials and Methods**

39 **2.1 ODD**

40 **2.2 Statistical Analysis and Companion Modeling**

41 On va parler de ComMod, de viabilité et de la manière dont on questionne les deux

42 **3 Results**

43 **3.1 Sensibilité - Saltelli**

44 Le fait de passer a une surveillance communautaire réduire l'influence de la discussion et déplace le
45 focus sur le temps au champs

46 Il faudrait refaire un saltelli en ajoutant le nombre de jeune pousse protégé, ce qui fera se déplacé
47 le narratif sur le nombre de jeune pousse détruite par les agriculteurs aux même.

48 **3.2 Patern Space exploration**

49 Viabilité du système

50 **4 Discussion**

51 Include a Discussion that summarizes (but does not merely repeat) your conclusions and elaborates
52 on their implications. There should be a paragraph outlining the limitations of your results and
53 interpretation, as well as a discussion of the steps that need to be taken for the findings to be
54 applied. Please avoid claims of priority.

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56 General

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60 Thiamal.

61 Author Contributions

62 Describe contributions of each author to the paper, using the first initial and full last name.

63 “L. Broutin conceived the model and realize interviews.”

64 “E. Delay and L. Broutin animate multi-actor focus groups.”

65 “E. Delay conducte the HPC exploration.”

66 “E. Delay and L. Broutin realize the first draft of this manuscript.”

67 “All authors contributed equally to 2nd version of the manuscript.”

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74 Conflicts of Interest

75 The author(s) declare(s) that there is no conflict of interest regarding the publication of this article.

76 Data Availability

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79 what the nature of the data is, 2) where the data can be accessed, and 3) any restrictions on data
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