Coding Project: Crop Wars

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1 Introduction

Agricultural structures are shaped by a variety of factors, including economic, environmental, cultural, technological and geographical conditions [1].
Consequently, both farmers and policymakers can benefit from farm-level models which optimise water usage and crop nature, based on a set of different externalities including water ressources availability and market dynamics.
The model featured in this coding project aims to illustrate the process behind the development of agent-based farm-level models, by starting with a simple, deterministic model that is progressively complexified with elements from physics-based models and game theory.

2 State-of-the-Art

To guide the development of our illustrative model, a literature review was conducted to assess the state-of-the-art on agent-based modelling for water ressources allocation and farming simulations.
Our starting point was the thesis *"Agricultural policies and farm structures: Agent-based modelling and application to EU-policy reform"* by Happe (2004) [1], which outlines in details the development of an agent-based model (AgriPoliS) to assess the influence of agricultural policies at the farm level, which is applied to a case study in the region of Holenhole in Germany.
To have an overview of more recent approaches. a seed review paper was selected, *"A review of Agent Based Modeling for agricultural policy evaluation"* by Kremmydas et al.(2018) [2] from which a literature graph was generated using the online tools Connected Papers, and is shown on figure 1.
For completeness, the graphs generated through other seed papers were also analysed, including an older paper applying game theory to decision making in farmer cooperatives by Staatz (1983) [3] and a case application if agent-based models to the transboundary Nile river by Ding (2016) [4].

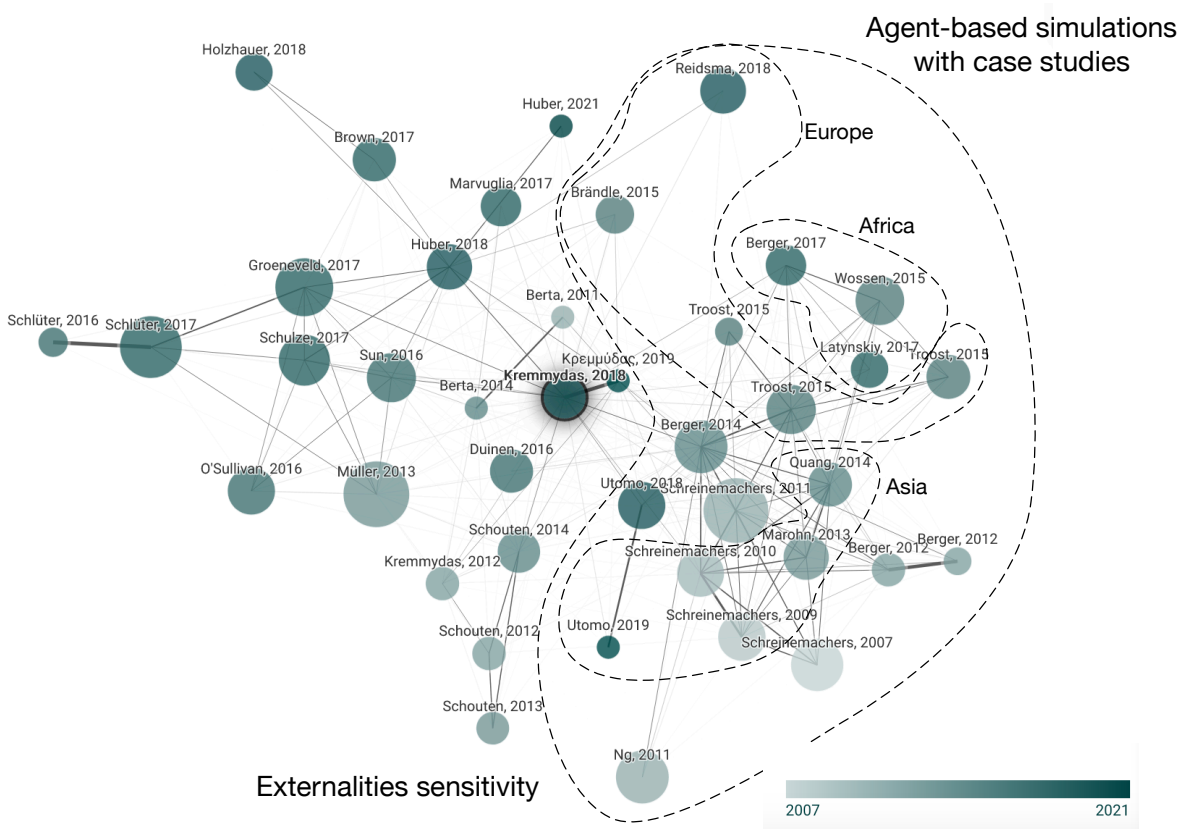

Figure 1: Graph showing papers related to ref.X generated on ConnectedPapers.com. Circle radius is proportionnal to number of citation, color to publication date, dashed line refers to paper categories.

References

[1] K. Happe, ed., *Agricultural policies and farm structures - Agent-based modelling and application to EU-policy reform.* Studies on the Agricultural and Food Sector in Central and Eastern Europe, Volume 30, 2004.

[2] D. Kremmydas, I. N. Athanasiadis, and S. Rozakis, "A review of Agent Based Modeling for agricultural policy evaluation," *Agricultural Systems*, vol. 164, pp. 95–106, July 2018.

[3] J. M. Staatz, "A game-theoretic analysis of decision making in farmer cooperatives," *American Journal of Agricultural Economics*, 1983.

[4] N. Ding, R. Erfani, H. Mokhtar, and T. Erfani, "Agent Based Modelling for Water Resource Allocation in the Transboundary Nile River," *Water*, vol. 8, p. 139, Apr. 2016.