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Modelling the evolution of territorial agriculture: an economics and geography perspective based on the example of the French Riviera

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Summary

The French Riviera (and more precisely the Alpes-Maritimes department) has seen the virtual disappearance of its local traditional agriculture, owing to the rapid urban development and touristic influx beginning in the second part of the 20th century. As part of an effort to understand the modalities of agricultural reterritorialization, we have developed an agent-based model based on a purely economic approach. In this presentation, we explore how such a model can be expanded in order to include a few spatial elements: difference between coast and hinterland, irreversibility of urbanisation, core-periphery dynamics and type of agriculture according to zones.

Introduction

In the context of a globalised food system that has created a “food from nowhere” regime (Shermer 2015), the development of a sustainable and nourishing agriculture at the territorial level can be thought of as a *wicked problem* (Rittel & Webber, 1973). A myriad of interlinked social, cultural, geographical, economic, environmental and technical factors has locked territories into trajectories that render the possibility of a relocalization of the production of food a difficult one.

Our work is carried out in the context of a territory in Southeast France with a strong farming tradition that has seen its agriculture virtually disappear over the last 60 years. The trajectory has seen a strong division between a highly populated coastline (including the cities of Cannes and Antibes) where land has been urbanized, and a hinterland where it has been mostly left unused or kept for extensive animal husbandry. In response, the past 10 years have seen an increase in citizen's interest (and in some territories, political will) to regain a certain level of local agriculture, which has led to a number of efforts to understand the levers and blockages, as well as to implement solutions.

An important issue is the level of income that farmers obtain from their activity, which is substantially lower than that which can be earned from a different activity. In that sense, increasing farmers' income is one of the levers of reterritorialization (Gneiting & Sonenshine, 2018). Recent work has produced a model of reterritorialization that studies this variable (Lopez-Merino, Zeppini & Lazaric, 2024), offering a first insight as to how a more resilience trajectory for the food system can be achieved.

The present work is an effort to complement this, through the inclusion of spatial variables that can interact with income ones and therefore with the decision of farmers to produce. We seek to recreate not only the decline in the level of agricultural activity, but also its geographical evolution and the type of products that remain, to study where and what type of agriculture can be revitalized. The model is a co-design effort by economists and geographers.

Methodology and Results

The model we depart from uses the evolution in farmers' income in the region as compared to other activities as an input. It includes also network effects which are considered central in farming (Rasel et al., 2022), although it is silent with regards of the spatial dimensions of the evolution of agriculture, and includes full reversibility in land uses. **Our intention here is first and foremost to determine how such a model can be fit to a spatial**

treatment, and as such is a contribution to the field of economic geography. Secondly, we seek to recreate a stylized version of the dynamics observed in the territory under study over the past 50 years: agricultural land lost to urbanization in the southern coastal area, reduction in the overall number of farms, specialization in animal husbandry in the northern hinterland.

We introduce the following modifications to the initial model: i) Land can be urbanised, therefore becoming permanently lost to agriculture (non-reversibility). ii) Urbanisation follows a process of spatial diffusion, tending to be concentrated in coastal zones. iii) Non-urban land can have three states: vegetable agriculture, animal agriculture or unused. iii) The likelihood of each state is partially dependent on proximity to urban centers.

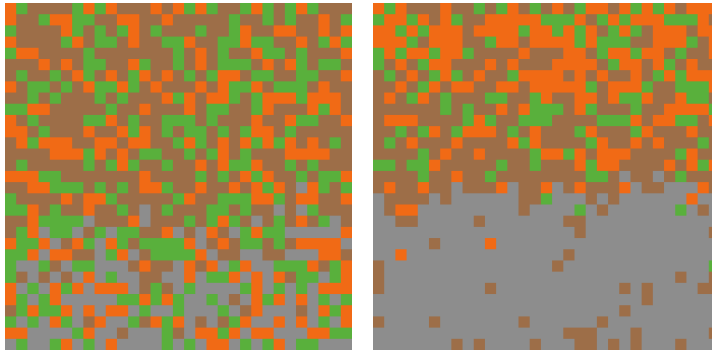


Figure 1 (left): Simulation grid at $t=0$. **Figure 2 (right):** Simulation grid at $t=\max$. Gray=urban, green=vegetable agriculture, orange=animal husbandry, brown=unused land. We observe an expansion of the urban land concentrated in the lower part of the grid (akin to the coastal area), and the emergence of an agriculture specialised in animal husbandry in the upper part of the grid (akin to the hinterland).

Conclusions

The complexity of the problem of reterritorialization implies that complex approaches to its study, drawing from different disciplines and local knowledges are key to understanding how it can take place. At the same time, modelling complex systems needs to be done in a step-by-step fashion in order to avoid black-box results (Le Page, 2017). We have made an effort to include spatial considerations into an economic model, and adapt it to the observed reality of a particular territory. It is currently being used to explore potential pathways for a reterritorialisation of agriculture.

We will discuss our ongoing co-design work, lessons learnt for good modelling practice, and how our work offers a contribution to the field of territorial agricultural transitions, using an economic geography approach.

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