Foresight on land use evolution using a coherent set of possible future land use change scenarios

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Abstract: *Changes in agricultural land use play a role in erosion and runoff, evident in Upper Normandy, France Foresight methodology is a means to shape this role.We applied the SYSPAHMM (SYStem, Processes, clusters of Hypotheses, Micro-scenarios, Macro-scenarios) foresight methodology, at the local scale (Seine-Maritime, France) and involving diverse actors in agriculture. It is a three- step methodology with a 2015 time horizon.First, the system is graphically represented to describe its current functioning. Secondly, a set of hypotheses of future evolution is elaborated involving all factors potentially influencing land use. Thirdly, relationships between the hypotheses are analysed to provide a coherent set of possible futures. A group of hypotheses leads to scenarios, a tool to evaluate the potential environmental consequences of agricultural land use changes.*

Keywords: *scenarios, prospective, runoff, SYSPHAMM, Upper Normandy*

Regional land use is undergoing many modifications and conversions not only as a consequence of CAP reforms and changes in agricultural policies but also as a consequence of large-scale ecological networks such as Natura 2000, an ever expanding EU, and changes in World Trade. Meanwhile, some regions in France, for example Upper Normandy, have been experiencing frequent and extensive damage from flooding in which erosion plays a part. The many changes that are taking place such as changes in European Union policy concerning sugar production, might lead in turn to land use changes or switches between crop types that would eventually impact runoff production and erosion.

In order to evaluate possible future developments in land use in terms of erosion, it is first necessary to foresee the possible changes in local land use scenarios. SYSPAHMM (SYStem, Processes, clusters of Hypotheses, Micro-scenarios, Macro-scenarios), developed at INRA by Sebillotte (Sebillotte M., Sebillotte C., 2002), has been used to provide foresight of Oilseed competitiveness (Sebillotte C., Messéan A., 2003), Wines and Vineyards (Sebillotte M., Aigrain P., Hannin H., Sebillotte C., 2003) at the national scale and Agriculture and food chains in Bretagne (Sebillotte C. (dir), Ledos F., Sebillotte M., 2007) at the regional scale. In this study, we use SYSPAHMM to investigate the factors that are driving land use changes at the local scale in the Seine-Maritime County in order to reveal how land use changes eventually impact the environment and cause erosion. Using this method involves the constitution of a group of local experts; we must bring together different local stakeholders with differing backgrounds and skills such as those from the local milk industry as well as those from the local agricultural outreach programs. This group will be part of the microscenarios building process.

The objective of this study on foresight of the evolution of land use is to shed light on the possible futures of local agricultural land use in the Seine-Maritime County by analysing microscenarios of possible futures, taking the year 2015 as the time horizon. In this paper we present the way in wich the SYSPAHMM methodology was applied to the Seine-Maritime County in order to construct microscenarios. They are called microscenarios because they allow us to focus on certain hypotheses for future evolution, without losing relationships with other hypotheses.

In the first part we detail the 14 key factors involved in the functioning of the land use system. They are presented in both a static way through a graphic representation and a dynamic way through processes which explain the functioning of the land use system. In the second part, we present a set of hypotheses for future evolution and provide examples out of the 60 hypotheses that have been elaborated. Lastly, we discuss how we will build a matrix of relationships between hypotheses. This

kind of environmental assessment of microscenarios should generate pertinent discussion among both local policy makers and local actors about the future of land use in the Seine-Maritime.

Key factors

Figure 1 provides a static graphic representation of the factors involved in land use in Seine-Maritime. To do so, 14 key factors have been identified through interviews with local stakeholders and literature review.
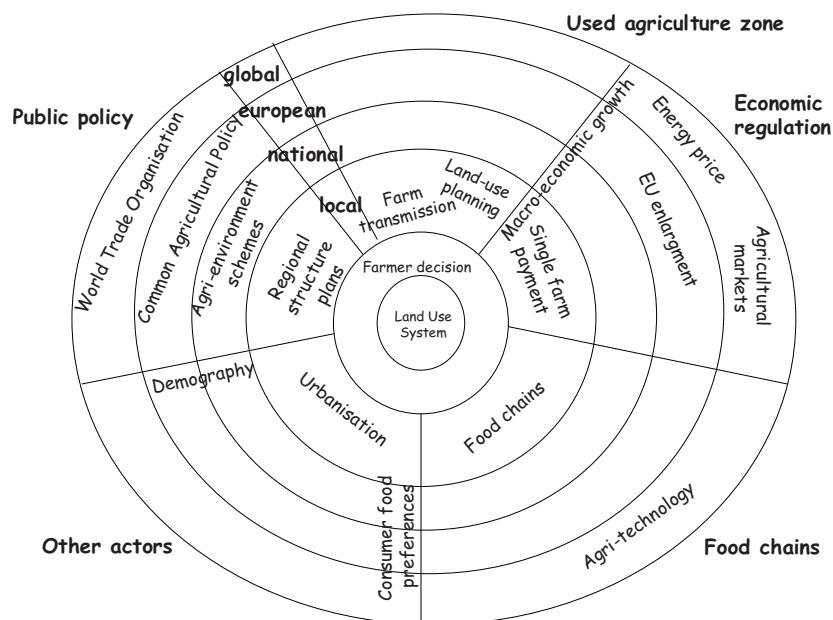

Figure 1. Graphic representation of the land use functioning

At the global and European scales, the main key factors that have been identified are: 1) the market price of different crops (agricultural markets); 2) World Trade Organization (WTO) agreements; 3) energy price; 4) the Common Agricultural Policy (CAP) policy reforms; 5) EU enlargement; 6) demographic development and 7) consumer food preferences. At the national scale, key factors are: 1) agri-environmental schemes implemented at the national scale; 2) new agricultural techniques; and 3) economic growth. At the regional and local scale, the key factors are: 1) regional structure plans and local plans; 3) urbanisation; 4) single farm payment, and 5) the agricultural chain from the field to the store. The static graphic representation (Fig.1) is the starting point to express dynamically the current situation through a list of processes such as "urbanisation is spreading into rural areas around the metropolitan centres", "cereal world prices increase"… These processes are essential to draw up a list of hypotheses.

Set of hypotheses

According to Sebillotte M. and Sebillotte C. (Sebillotte M., Sebillotte C., 2002), the second step is to elaborate —starting from the processes— a set of hypotheses for future evolution that involve all the factors having a potential influence on the land use system. Processes designated as the most important by the group of stakeholders for the land use future and having a potential impact on runoff are used for building hypotheses. Formulation of the hypotheses is based on the continuation, the acceleration or the regression of the different important processes previously selected.

As an example, one of the hypotheses could be that in the coming years "farmers will decrease their crop variability", another hypothesis could be that "farmers will opt to intensify their practices".

A matrix of relationships

The third step aims to analyze the influence any one hypothesis has on another one. This is done by building a matrix of relationships between hypotheses. Depending on the influence they exert on each other, these hypotheses are then grouped together to form clusters, each cluster corresponding to a microscenario family. Finally, individual microscenarios arise from a microscenario family. These scenarios will eventually be used as inputs in biotechnical models that evaluate environmental impacts (e.g. soil erosion and runoff) of the scenarios. This kind of environmental assessment of microscenarios should generate pertinent discussion among both local policy makers and local actors about the future of land use in the Seine-Maritime.

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