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► **To cite this version:**

Noémie N. Schaller, Christine C. Aubry, Philippe P. Martin. Modelling farmers' decisions of splitting agricultural plots at different time scales: A contribution for modelling landscape spatial configuration. 11. ESA Congress: Agro2010, European Society for Agronomy (ESA). INT., Aug 2010, Montpellier, France. pp.879-880. hal-00956159

**HAL Id: hal-00956159**

**<https://hal.science/hal-00956159>**

Submitted on 3 Jun 2020

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AGENCE NATIONALE DE LA RECHERCHE  
**ANR**



ESA congress, Montpellier, 29th Aug. – 3rd Sept.

# **Modelling farmers' decisions of splitting agricultural plots at different time scales: a contribution for modelling landscape spatial configuration**

**Noémie Schaller, Christine Aubry, Philippe Martin**

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# Introduction: landscape spatial organization results mainly from farmers' decisions in their farming territory

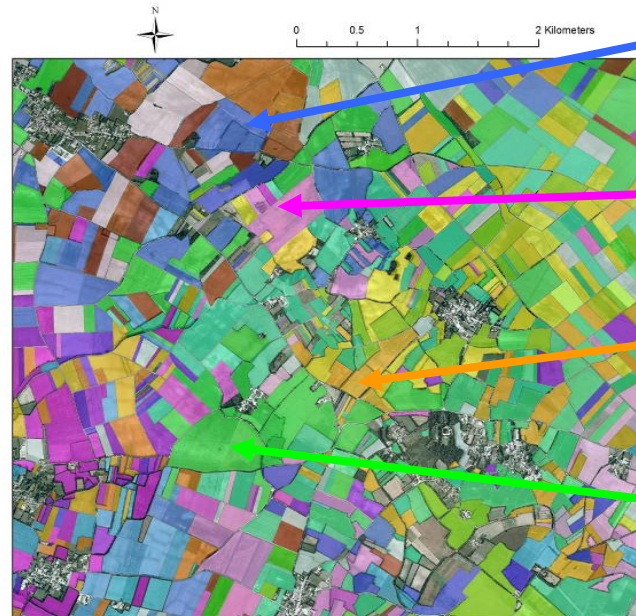
(Benoît, 1990; Joannon *et al.*, 2008; Thenail *et al.*, 2009)

Farmer decisions dealing with:

- Crop choices
- Crop allocation to land

## • Plot splitting

= Decisions a farmer has to make to divide his farming territory into several plots at any given time (≠ regrouping of lands)



Aerial picture of the Niort plain region (Poitou-Charentes). Source : ANR ADD Praterre program. RPG Data 2007 (ASP)



Etc...

Few approaches for modelling the changes in the spatial arrangements of plots in agricultural landscapes... (Gauchere and Houet, 2009)

# Outline

**“Modelling farmers’ decision-making processes dealing with plot splitting and their contribution to landscape spatial configuration and dynamics over different time scales”**

- Overview of the method for identifying and modelling farmers’ decisions
- The different time scales involved in plot splitting decisions
- Perspectives for landscape modelling

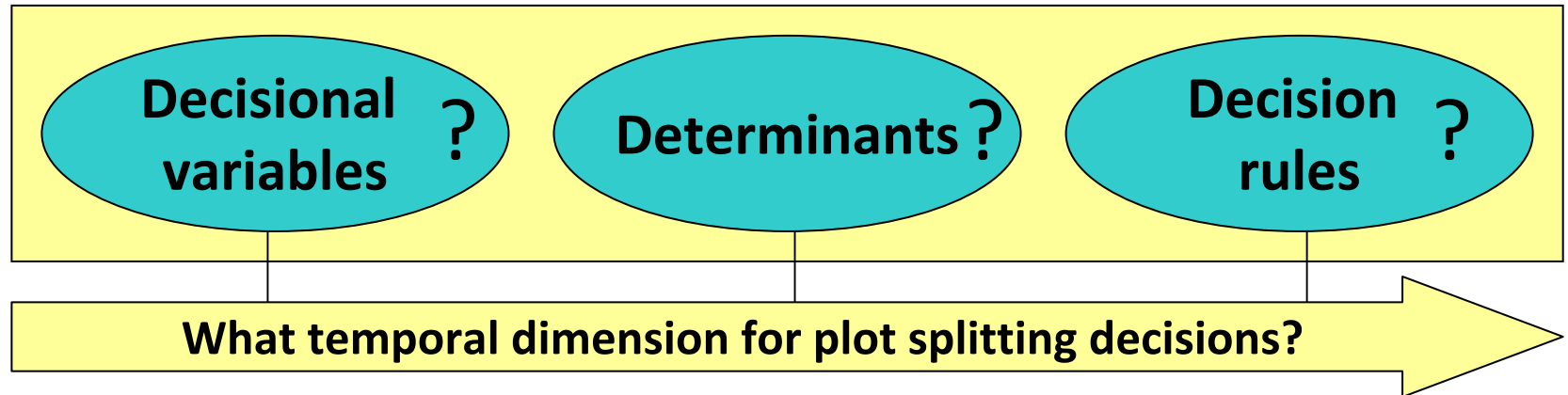
# General modelling framework

Aubry et al., 1998; Navarrete and Le Bail, 2007; Mawois, 2009



Decisions dealing with plot splitting:

Decisions a farmer has to make to divide his farming territory into several plots at any given time (≠ regrouping of lands)



**What is the decision about?**

Ex: suitable crop area (SCA) for deciding the crop allocation to land

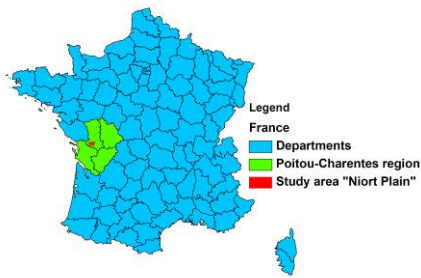
**All elements influencing the decisional variables**

Ex: SCA for corn depending on the type of soil, irrigation capacity...

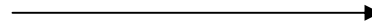
**Rule used to make the choice**

Ex: corn only grown in plots with sufficient water supply

# Specific on-farm surveys to fill in the rule-based model

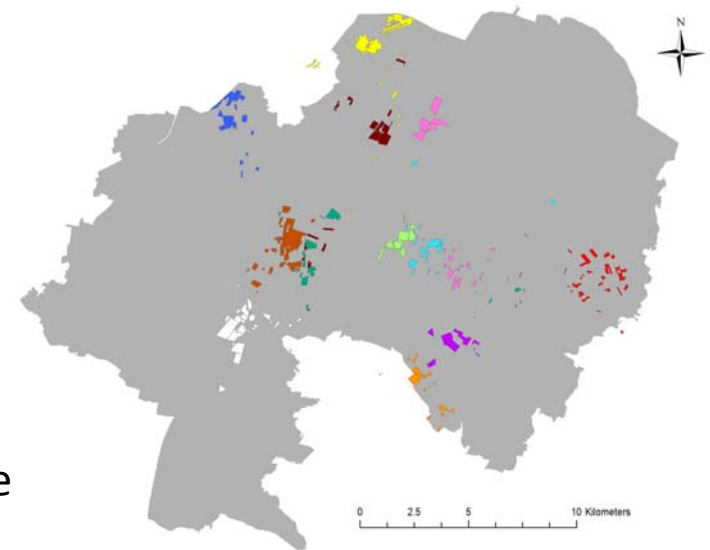


12 surveys



Accounting for the regional diversity of:

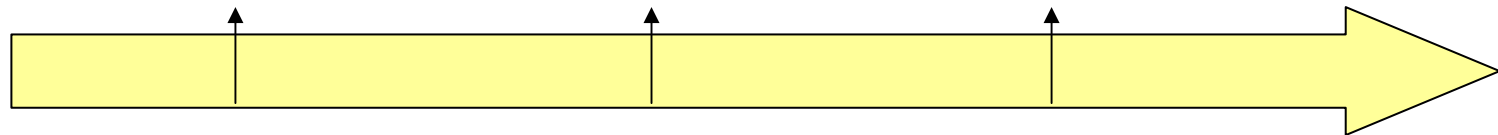
- Farming systems
- Spatial structure and scattered nature of the farming territory



May 2009

Nov. 2009

May 2010



**3 successive surveys on each farm: dynamic point of view**

In order to go into detail on the determining factors and the different time scales of farmers' decisions

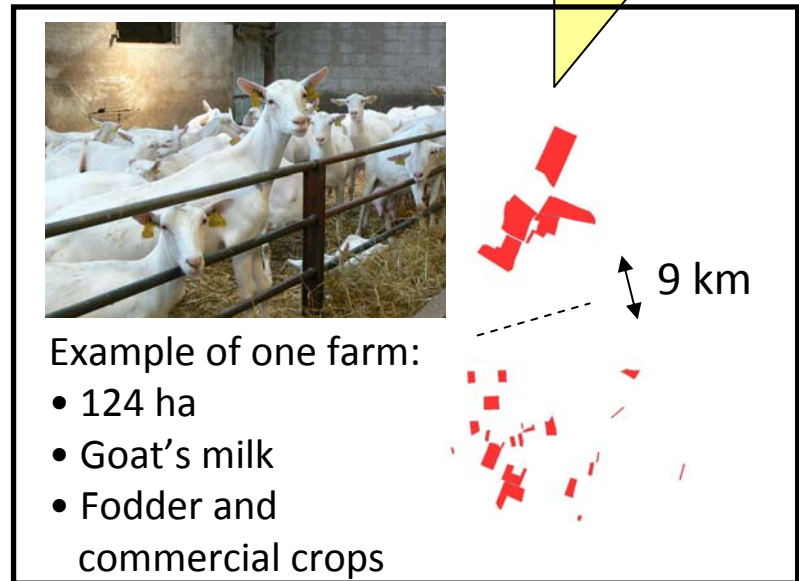


## Results: 3 different time scales

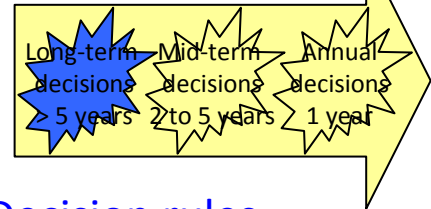


For each time scale:

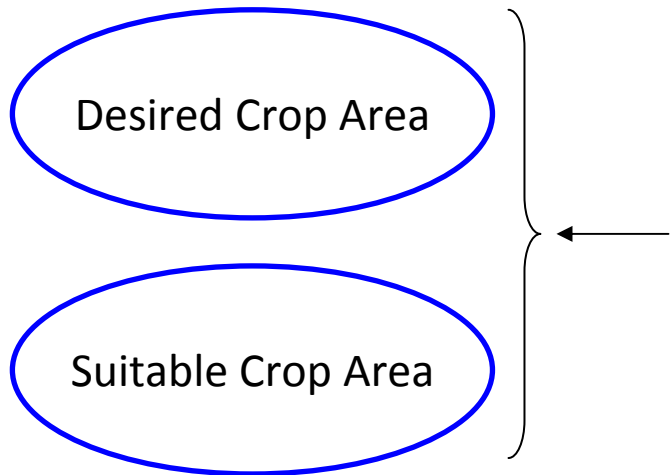
- Different combinations of decisional variables
- All variables mainly determined by the farming system and the scattering of the farming territory



# Long-term decisions (> 5 years)



## Decisional variables





## Determinants

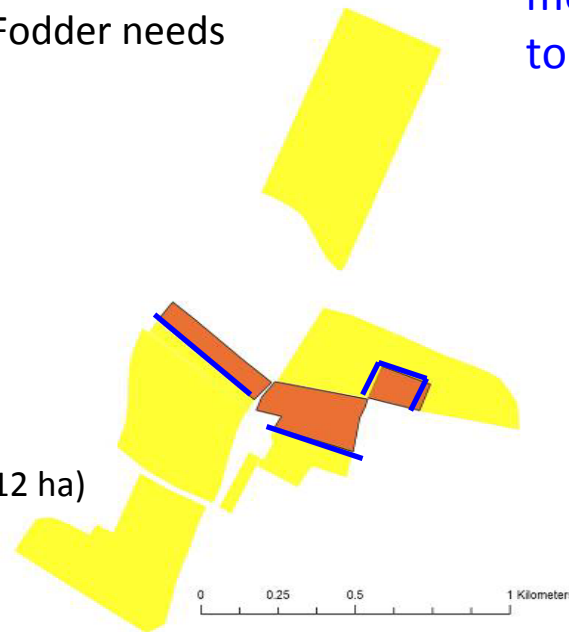
- Type of soil
- Area of pieces of land
- Farming systems
- Fodder needs

## Decision rules

10 to 15 ha in order to guarantee fodder needs

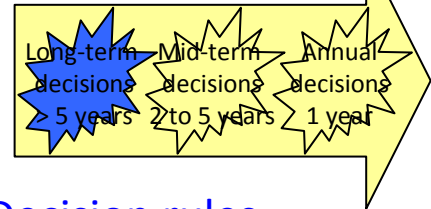
Corn located in the most humid soils to secure yields

- Stable plots with:
-  Corn monoculture (12 ha)
  -  Crops in rotation

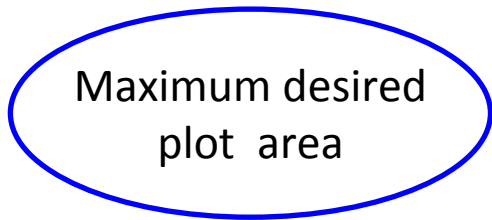




# Long-term decisions (> 5 years)



## Decisional variables



## Determinants



- Total farm area
- Crop rotation length
- Area of pieces of land

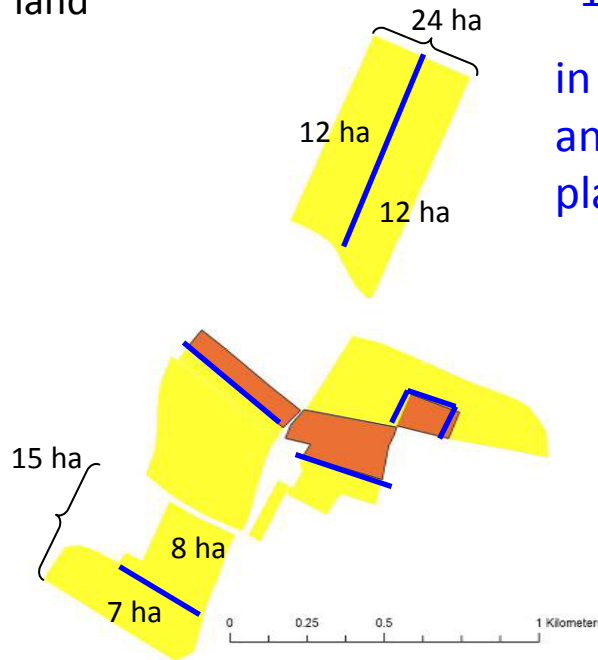
## Decision rules

Maximum plot area  
= area with crop rotation / crop rotation length

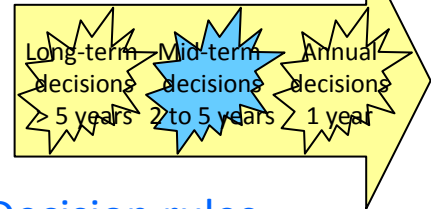
$$= 104 / 9 = 12 \text{ ha}$$

in order to balance annual cropping plans

- Stable plots with:
-  Corn monoculture
  -  Crops in rotation



# Mid-term decisions (from 2 to 5 years)



## Decisional variables

Suitable Crop Area for pluriannual crops

Crop function

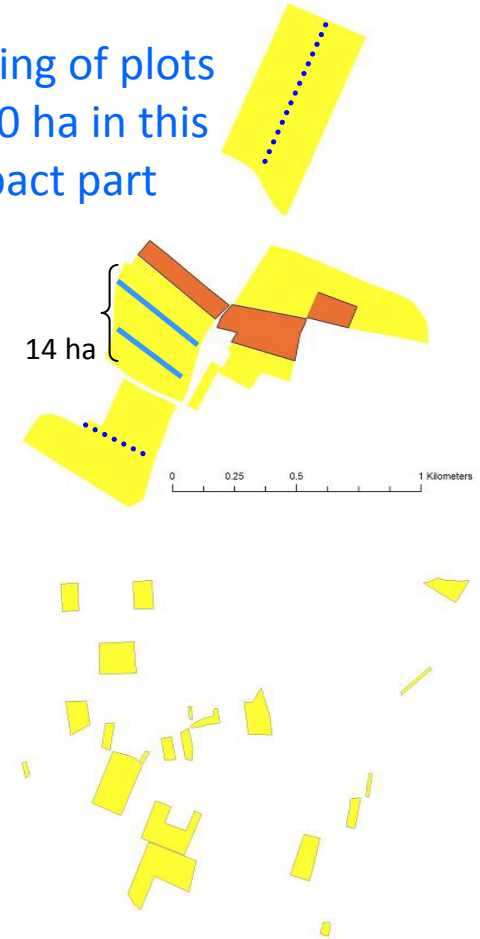
## Determinants

- Type of soil
- Plot area
- Scattering of the farming territory
- Type of grassland valorisation

- Farming system
- Farm resources
- Farmers' objectives
- Role of grasslands in the herd alimentation strategy

## Decision rules

Splitting of plots of >10 ha in this compact part

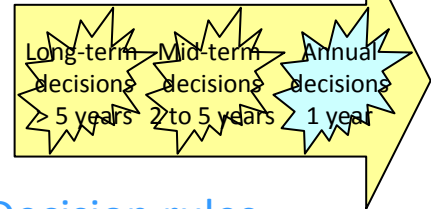


**Different strategies of mid-term plot splitting**

→ **Diversity of plot spatial arrangements**

No plot splitting in this scattered part

# Annual decisions (only one year)



## Decisional variables

Crop function

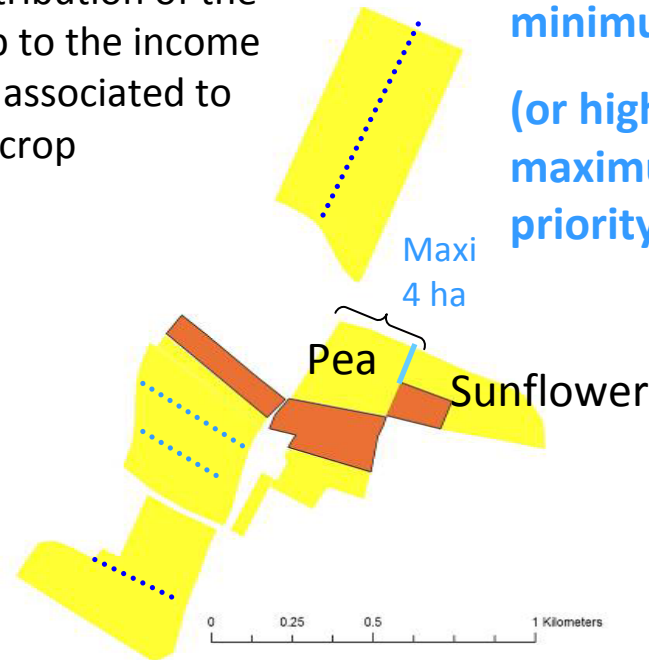
Mini/maxi desired area for priority crops

## Determinants

- Farming system
- Farm resources
- Farmers' objectives
- Contribution of the crop to the income
- Risk associated to the crop

## Decision rules

**Annual plot splitting when the area of a priority crop becomes lower than the minimum desired (or higher than the maximum for a non-priority crop)**



# Conclusion and perspectives of using farmers' decisions for landscape modelling

- The spatial arrangement of agricultural plots changes over time due to farmers' decisions of splitting their farming territory into plots lasting for different time scales.

- Conceptual modelling framework with

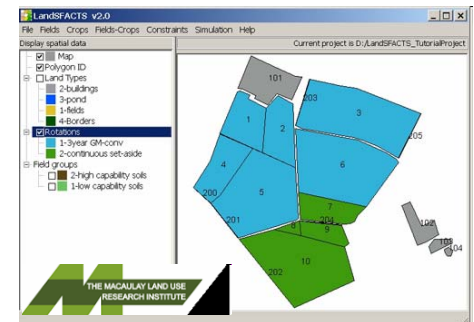
*Decisional variables*

*Determinants*

*Decision rules*

→ Useful in accounting for spatial configuration changes in landscape simulation models

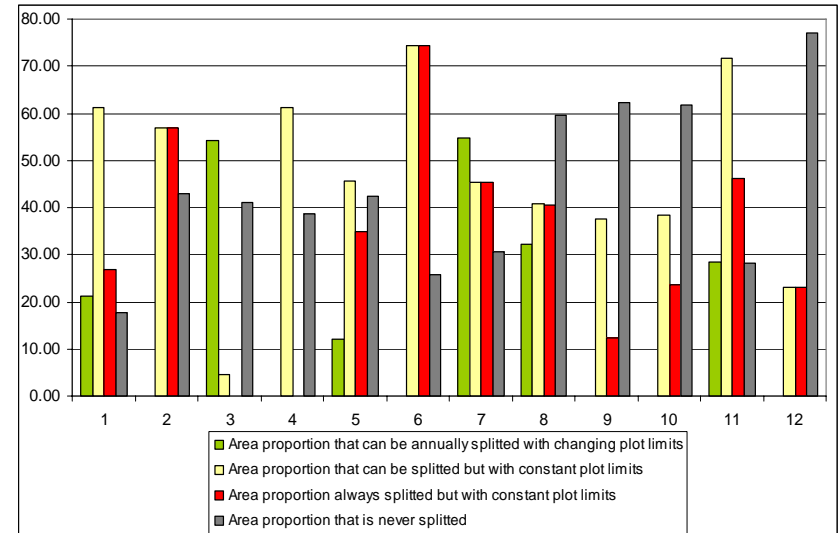
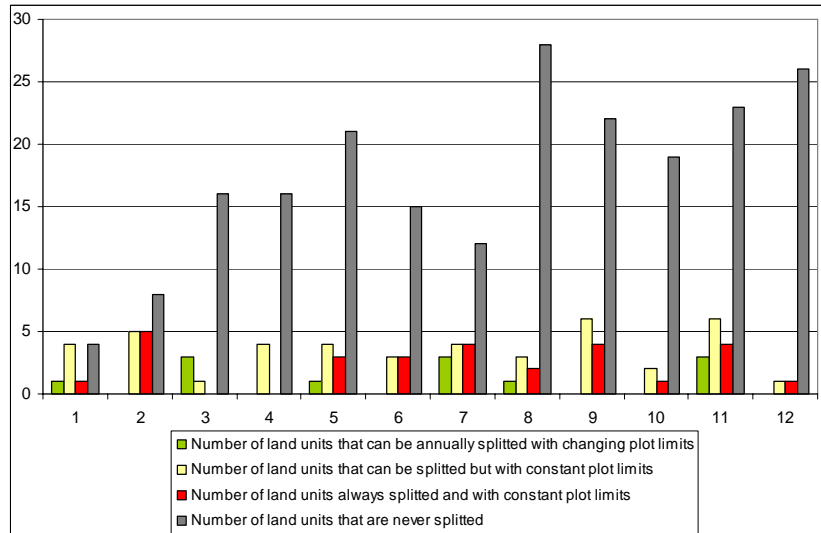
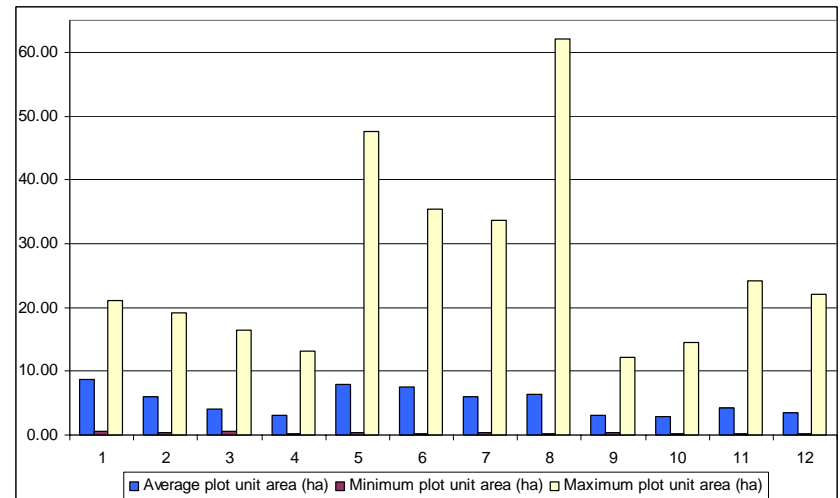
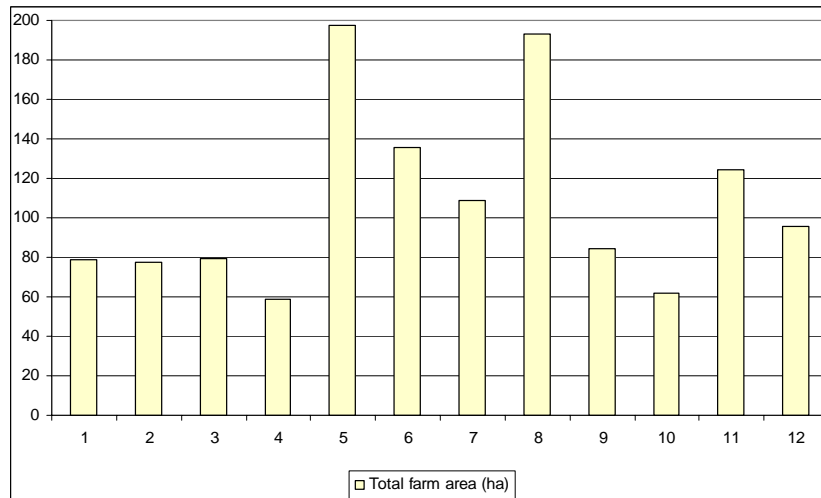
- Perspectives: implementing the decisional variables and decision rules in the LandSFACTS software (Castellazzi et al., 2008) to simulate the effects of farmers' plot splitting decisions on landscape configuration





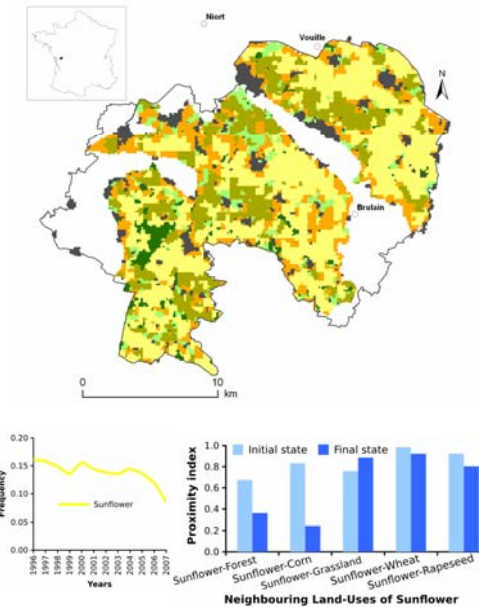
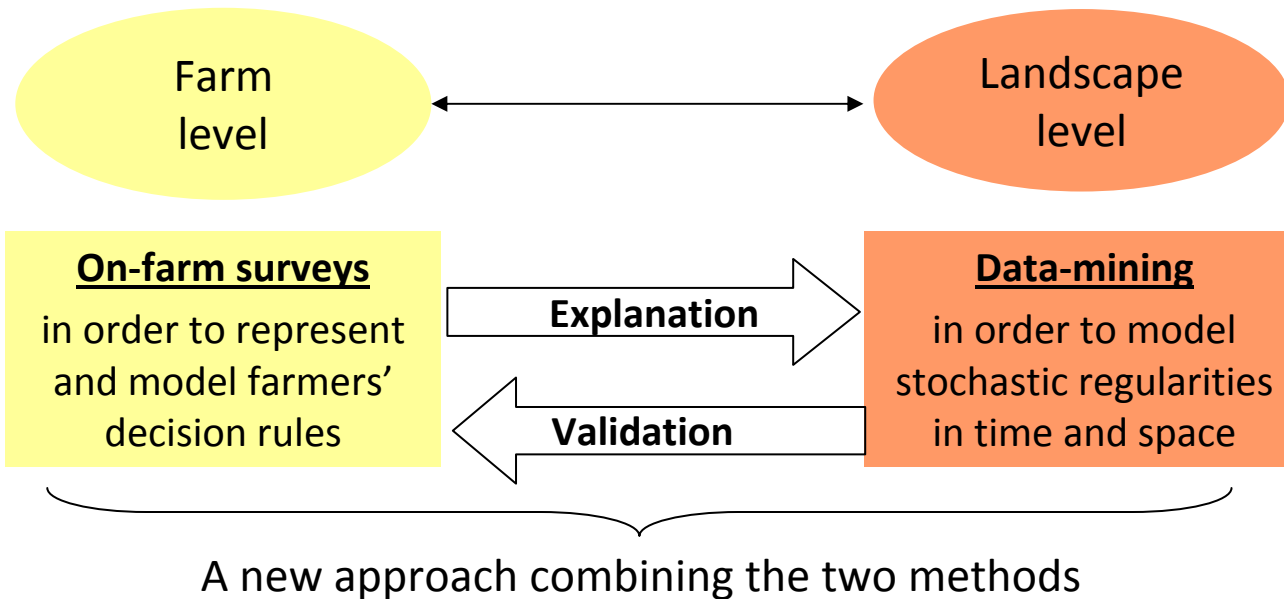


# A few more information: comparison of the presented example with the other surveyed farms





# A few more information: discussing the genericity of the approach



- See the poster in session S 3.3.3 « modelling regional land use... »
- Presentation during the symposium « environmental change and sustainable agricultural systems » on Friday



# A few more information: the temporal dimension of annual crop choices

