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## Evaluation of alley cropping agroforestry potential in northeastern France

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## In France



Agroforestry appears as a way of diversifying farms in the European context. These practices are, however, only emerging in northeastern France. There are a multitude of reasons why farmers venture or do not venture into agroforestry practices. The general tendency is that farmers consider investing into agroforestry if they have **concrete production, environmental and/or socioeconomic performance indicators** for their specific regional conditions.

The overall objective of our project PotA-GE is to evaluate **the potential of alley cropping agroforestry plantations** at the scale of the French Grand-Est region, based on indicators and to simulate agroforestry deployment scenarios at the territory scale.

The impact of introducing trees into agricultural plots is assessed at three scales: **1)** detailed analysis of biophysical processes **at a well-experimented site**, **2)** analysis of a subset of processes at the plot scale **at six selected plantations** in the region and **3)** agro-environmental and socioeconomic assessment of deployment scenarios **at the scale of the territory**.



## At regional scale

### Biophysical indicators

Six alley cropping plantations selected in the region according to the following criteria:

- Trees for timber production
- Conventional and organic farming
- Including crops and cattle farming
- Close comparable agricultural monoculture
- Comparable tree planting densities
- Trees at least two years old

Plantations monitored in terms of tree dimensions, soil functioning, interactions between trees and crop / grassland for light and for water



| Sites                  | Surface (ha) | Density (ha <sup>-1</sup> ) | Objective            | Target species | Type of farming       | Installation year |
|------------------------|--------------|-----------------------------|----------------------|----------------|-----------------------|-------------------|
| Banogne-Reouvrance (8) | 14.8         | 37                          | Timber, honey        | Walnut         | Crops - conventional  | 2015 / 2016       |
| Hennecourt (88)        | 5            | 33                          | Timber               | Walnut         | Cattle - organic      | 2014              |
| Montenois (54)         | 20           | 33                          | Timber, biodiversity | Cherry wood    | Crops - organic       | 2013              |
| Orbigny-au-Mont (52)   | 9.4          | 30                          | Timber               | Cherry wood    | Cattle - organic      | 2013 / 2014       |
| Pixerécourt (54)       | 13           | 14                          | Timber               | Ash            | Cattle - conventional | 2013 / 2014       |
| Quincey (10)           | 7.5          | 32                          | Timber               | Maple          | Crops - conventional  | 2012              |

### Socioeconomic indicators

Surveys in order to inventory reasons why farmers venture or not into agroforestry practices (motivations, brakes, needed itinerary adaptations, missing skills, etc.) and to document economic performances of these cultural systems when farmers already practice it

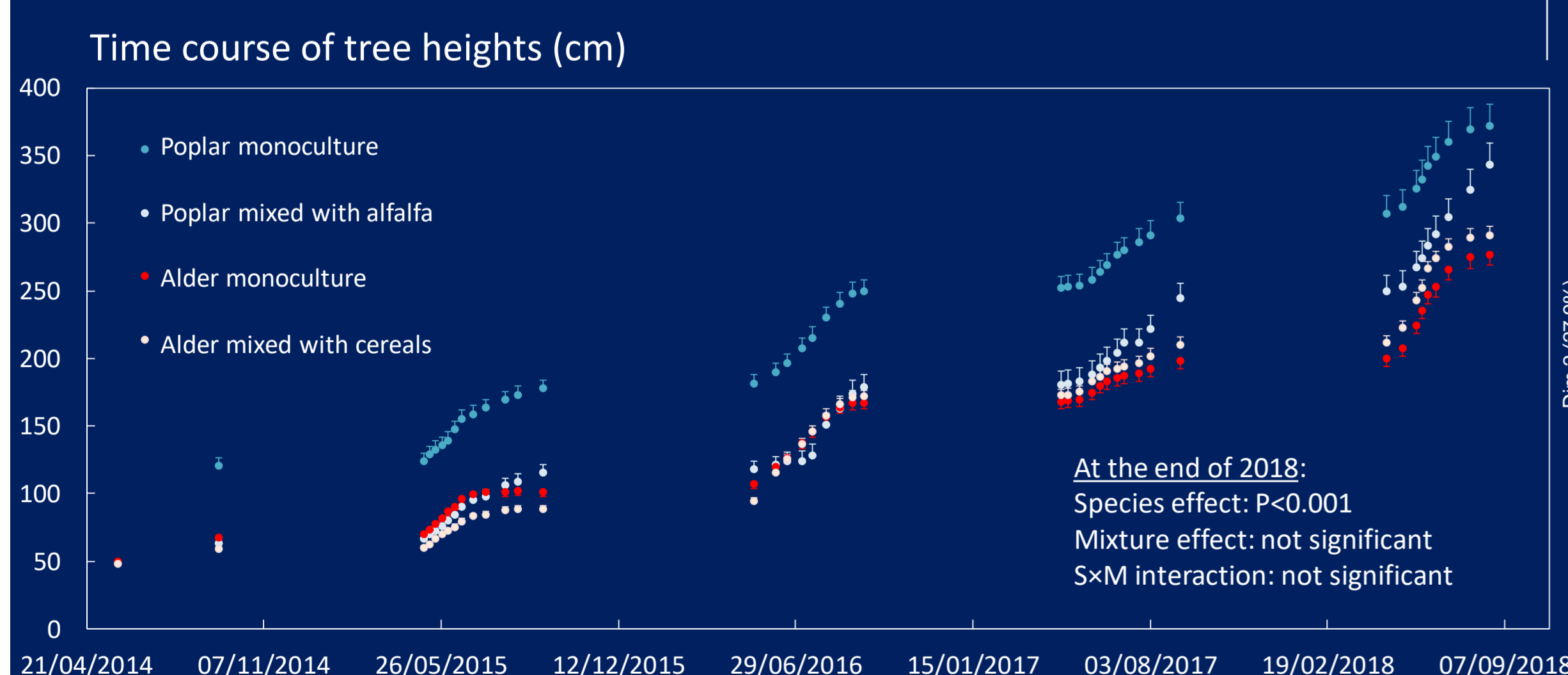


## At local scale

- Experimental plantation composed of poplar/alfalfa and alder/gramineous associations and the corresponding forest and crop monocultures in La Bouzule, near Nancy
- Plantation installed in 2014, instrumented and monitored in terms of climatic conditions, growth and production, soil functioning, plant water and carbon fluxes, environmental appraisal, etc.

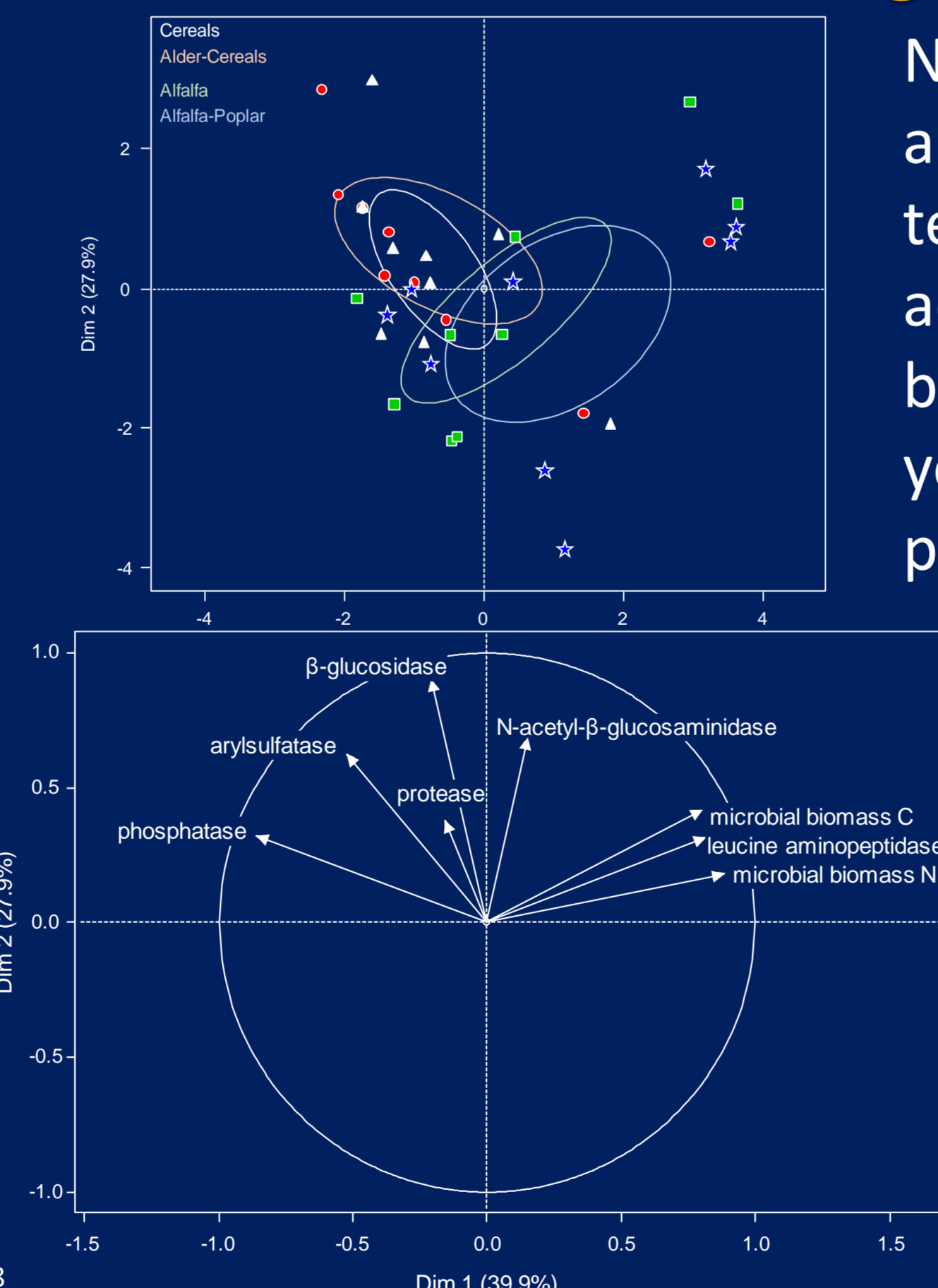
### Production indicators

- Intense competition between trees and crops during the first three growing seasons resulting in poor performances of both types of agroforest associations
- Then, trees caught up and were not significantly different in height (and diameter) in the agroforestry and monoculture plots after five growing seasons



### Soil functioning indicators

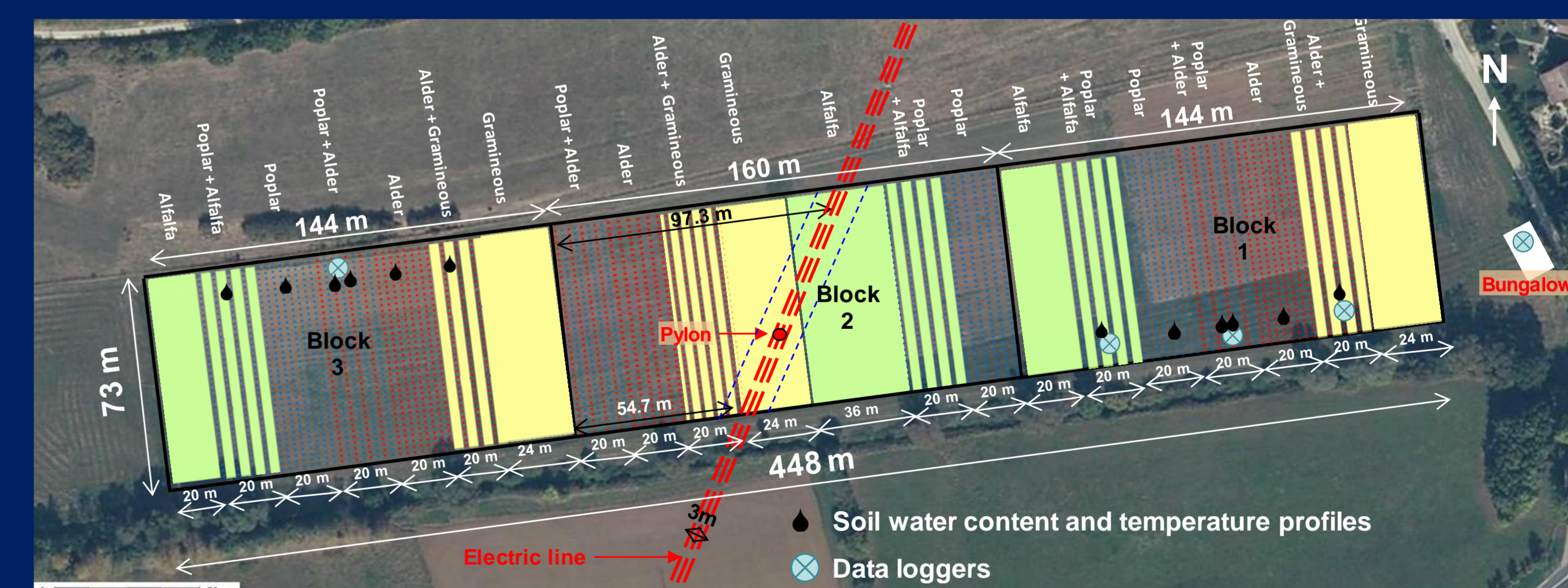
No marked distinction among treatments in terms of soil enzyme activities and microbial biomass five years after tree planting (2018)



See poster by Clivot *et al.* for more details!

### Environmental indicators

- Plantation being equipped for the monitoring of:
  - Nitrate leaching,
  - Soil greenhouse gas (CH<sub>4</sub>, N<sub>2</sub>O) emissions,
  - Carbon sequestration in biomass and soil



Layout of the pilot plantation with three kinds of associations: poplar – alfalfa, alder – gramineous, poplar – alder, and the four corresponding monocultures. These seven treatments are repeated three times. The plantation is instrumented: pedoclimatic conditions are continuously recorded

## In fine

Adaptation of the multi-agent **MAELIA platform** (<http://maelia.platform.inra.fr/>) for integrated assessment and modelling at landscape level, of scenarios of agroforestry system development  
See poster by Clivot *et al.* for more details!

Evaluation of the **development potential** of agroforestry practices at the regional scale

**Dissemination** of the project results:

- Toward students, through training modules
- Toward farmers, through the organization of information and awareness days

Work in progress...



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