

The background of the slide is a close-up, top-down view of a large stack of cut logs. The logs are arranged in a somewhat regular pattern, with their circular cross-sections facing the viewer. The wood is a warm, light brown color, and the grain patterns are clearly visible. The lighting is slightly darker towards the edges, creating a sense of depth and texture.

# Biodiversity effects of broadleaved tree shelterbelts around pine plantations

Madelein Victor

Supervisor: Bart Muys

# Background

- Pijnven Forest was created early at the end of the 19th – beginning of the 20th century for mining purposes.
- It is the result of heathland afforestation with Scots and Black pine. Different from other new forests in the Campine area, the stands in Pijnven were established with a broadleaved shelterbelt composed of Red oak, pedunculate oak, birch, etc.
- It is assumed that these managed monocultures consist of low biodiversity numbers that are a defining characteristic of pine woods.
  - Biodiversity in forests is the mixture of species associated with gene pools, structural and functional diversity.
  - Due to the low tree diversity, the stands are more susceptible to disturbances, like invasive species such as Black Cherry, and insect pests.



- Most of the plots consisted of Black pine which is considered invasive.
  - Commonly found in disturbed areas.
  - Light demanding.
  - Shade-intolerant.
- Loss of natural forests is due to the increasement of wildfires, fragmentation, and diseases.
- Shelterbelts. What are they?
  - They go under various names, firebreaks, hedgerows, windbreaks.
  - They can preserve the diversity and stability of outlaying plots.
- Most species are engaged in a predator-prey relationship.
  - Predator–prey relationships are a central component of community dynamics.
  - Essential to ecology.

# Problem statement

- Monoculture forests worldwide support little associated biodiversity.
- As a consequence, their conservation value is limited.
- Another consequence is that they are more susceptible to pests than mixed forests.
- But plantation management has also efficiency, cost and productivity advantages, which explain why plantation managers do not easily adopt species mixture.
- The question is if the establishment of broadleaved shelterbelts could be an alternative to mixing the complete forest stands, without losing the advantages of monoculture practice.
- This is not the long-term vision for Pijnven, but Pijnven forest offers the opportunity to study this effect thanks to its old well-developed shelterbelts, in support of other monocultures elsewhere.

# Objectives

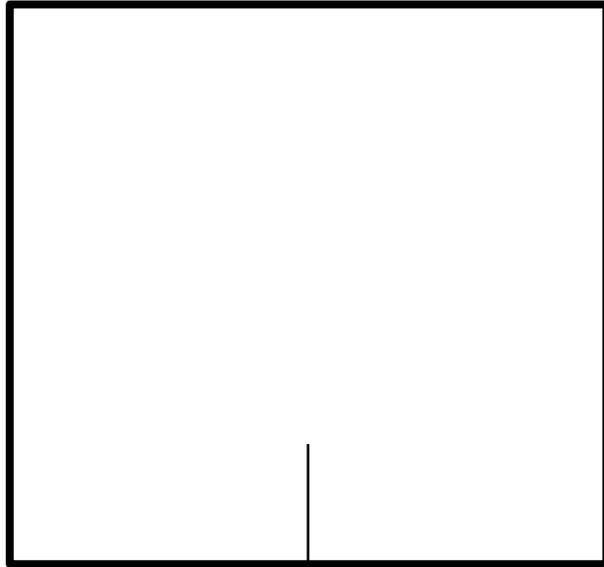
- Comparing natural pest control in Black pine monocultures and monocultures with broadleaved shelterbelts.
- Evaluating the density and diversity of insect communities by using passive traps.
- Assessing the bird and/or arthropod species that prey on herbivore insect species using fake plasticine caterpillars added on pine branches.

# Research Questions

- Would pine stands without broadleaved tree belts have higher incidence of damaging pest species?
- Furthermore, would pine stands with shelterbelt have a lower incidence of damaging pest species, but overall higher diversity of tree-related insects?
- Would pine forests with broadleaved shelterbelt trees show a higher predation percentage by pest predating bird species than pine forests without shelterbelt?

# Experimental design

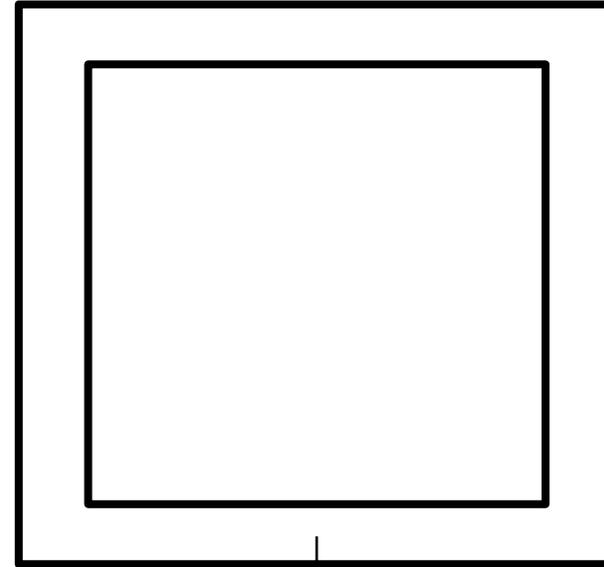
Plot without shelterbelt



*Pinus sylvestris*



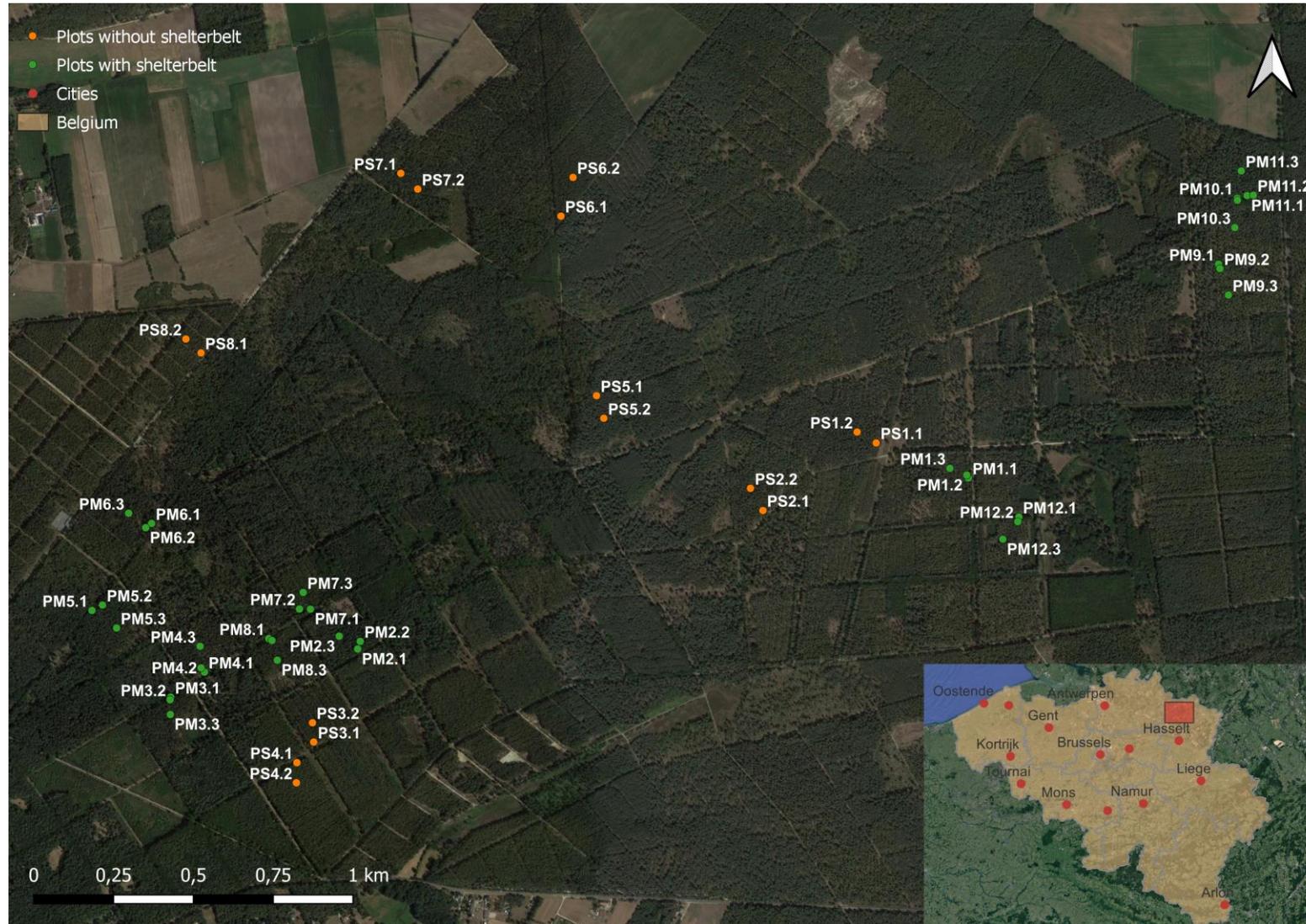
Plot with shelterbelt



*Quercus rubra*



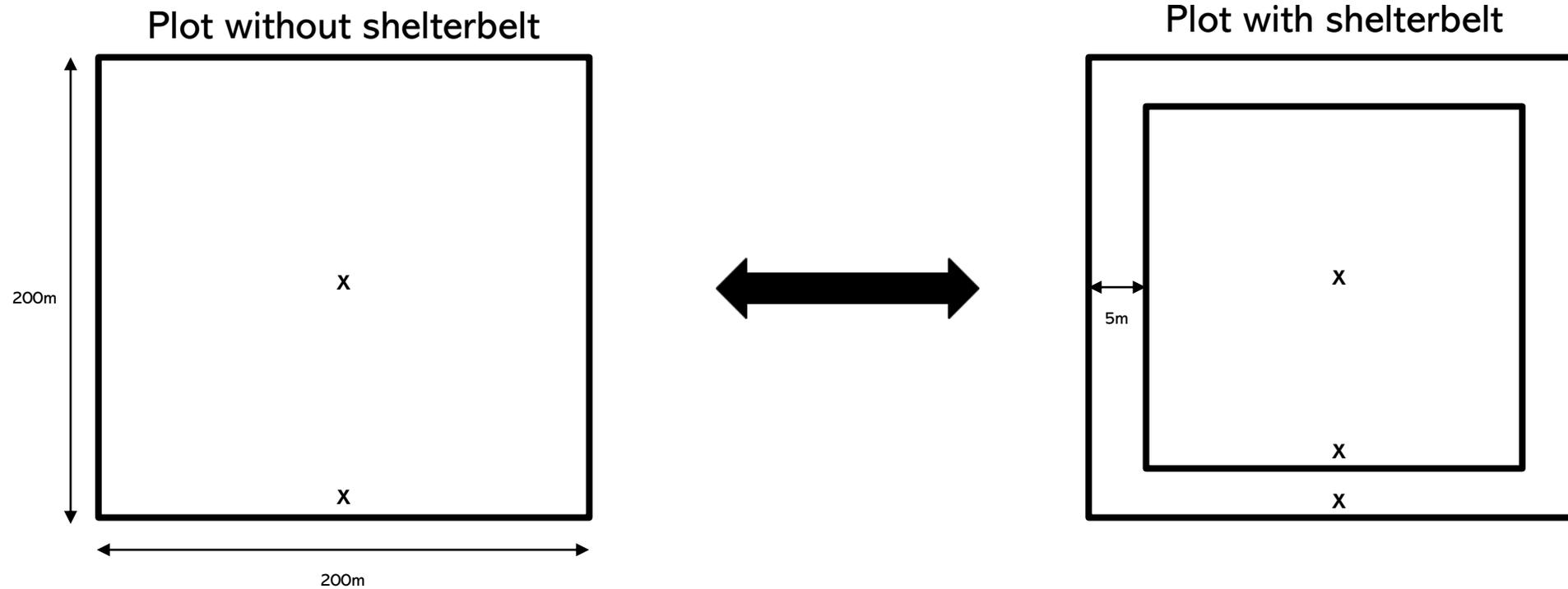
# Study area

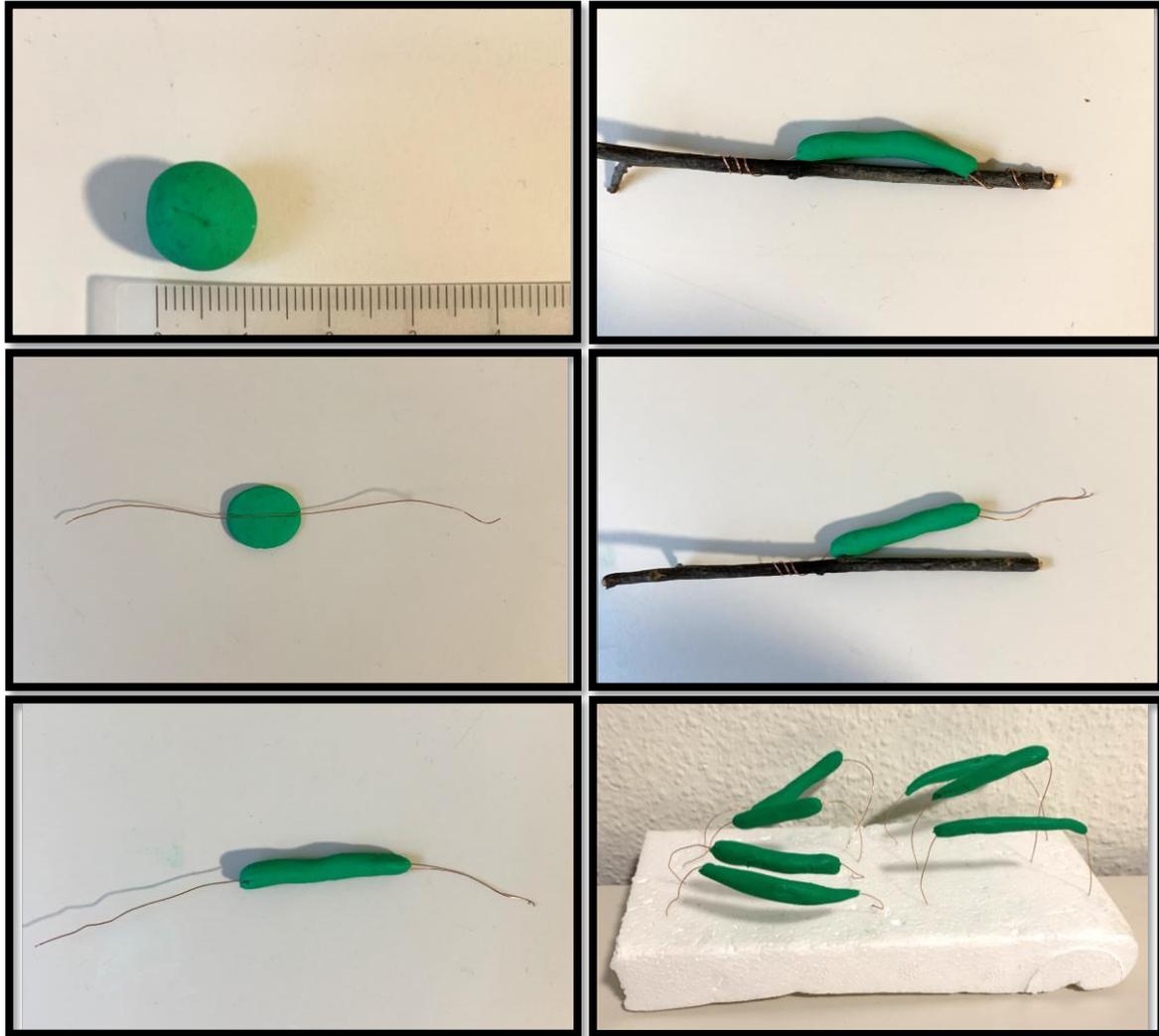


# Methodology

- Fieldwork was done in the Belgian Pijnven Bosland region managed by the Agentschap van Natuur en Bos.
- Important to synchronize the installation of fake caterpillars with the feeding season of the predator species' young (mainly *Parus major*).
- The installation period occurred in late May and collection was in late June.
  - For the sake of the breeding and feeding season.
- 52 plots were chosen to vary from North to South.
  - 12 stands with broad-leaved shelterbelts.
  - 8 stands without broad-leaved shelterbelts.
- Setting up the data found as well as conducting statistical analysis in program R.
- Using QGIS Standalone Installer Version 3.22 Long-term release to identify the plots and used them as a reference to installing caterpillars.

- 12 stands with shelterbelt, 3 trees were sampled, the broadleaved shelterbelt itself containing oak either *Quercus rubra* or *Quercus robur*, with the edge and center.





**How to make and install fake caterpillars.**



- Per host tree, placement of 3 caterpillars was done in four cardinal directions.
- In the end, each selected host tree contained 12 caterpillars making it 432 caterpillars within shelterbelt plots, and 192 caterpillars for the plot without shelterbelts.
  - The grand total for placing caterpillars into the field was 624.
- This happened over a 4-week period whereas 2 weeks were considered as an 'incubation period'.
- Inspection of the markings happened over the summer period, analyzing predator markings from false positives.
  - This was done by using a handheld magnifying glass and a torchlight.
- The most common marks are left by bird beaks and insect mandibles. Less often, you may see teeth marks left by, mice, or lizards.

# Some examples



Predation by a bird



Predation by a rodent



Predation by snails/ants



Airholes made by a parasite

Plots with shelterbelt	Amount of caterpillars	Bird marking counted	Parasite	Rodent	Plots without shelterbelt	Amount of caterpillars	Bird marking counted	Parasite	Rodent
PM1	8	4	5	1	PS1	9	21		4
PM2	11	21	4	1	PS2	2	5	2	
PM3	3	12	3		PS3	2	3		1
PM4	6	23	1	2	PS4	10	23	6	3
PM5	5	20	4	1	PS5	1	1	6	
PM6	5	4		2	PS6	4	38		5
PM7	9	14	8	1	PS7	5	5	3	3
PM8	11	55	4	4	PS8	4	12		3
PM9	8	17	3						
PM10	8	10	5						
PM11	13	16		2					
PM12	14	26	12	4					

# Challenges to consider

- Modelling clay is easily pliable, which makes it easy to work with, but sensitive to handle.
- Upon choosing a suitable tree for caterpillar installation, a mature tree is recommended, however, we opted for smaller juvenile trees, which are more accessible.
- The GPS tracker used to identify the stands wasn't as accurate, making the process of finding back the caterpillars more difficult and time-consuming.
- Seasonality is an important factor to consider when setting up the experiment in the field, especially the synchronization with predators (tits) feeding their young. We were one or two weeks late with the installation



# Conclusion

- Data analysis using R is still ongoing.
- We still want to evaluate the density and diversity of insect communities by using passive traps.
  - This will happen in March.
- Further desktop research will be needed to complete this master thesis.

