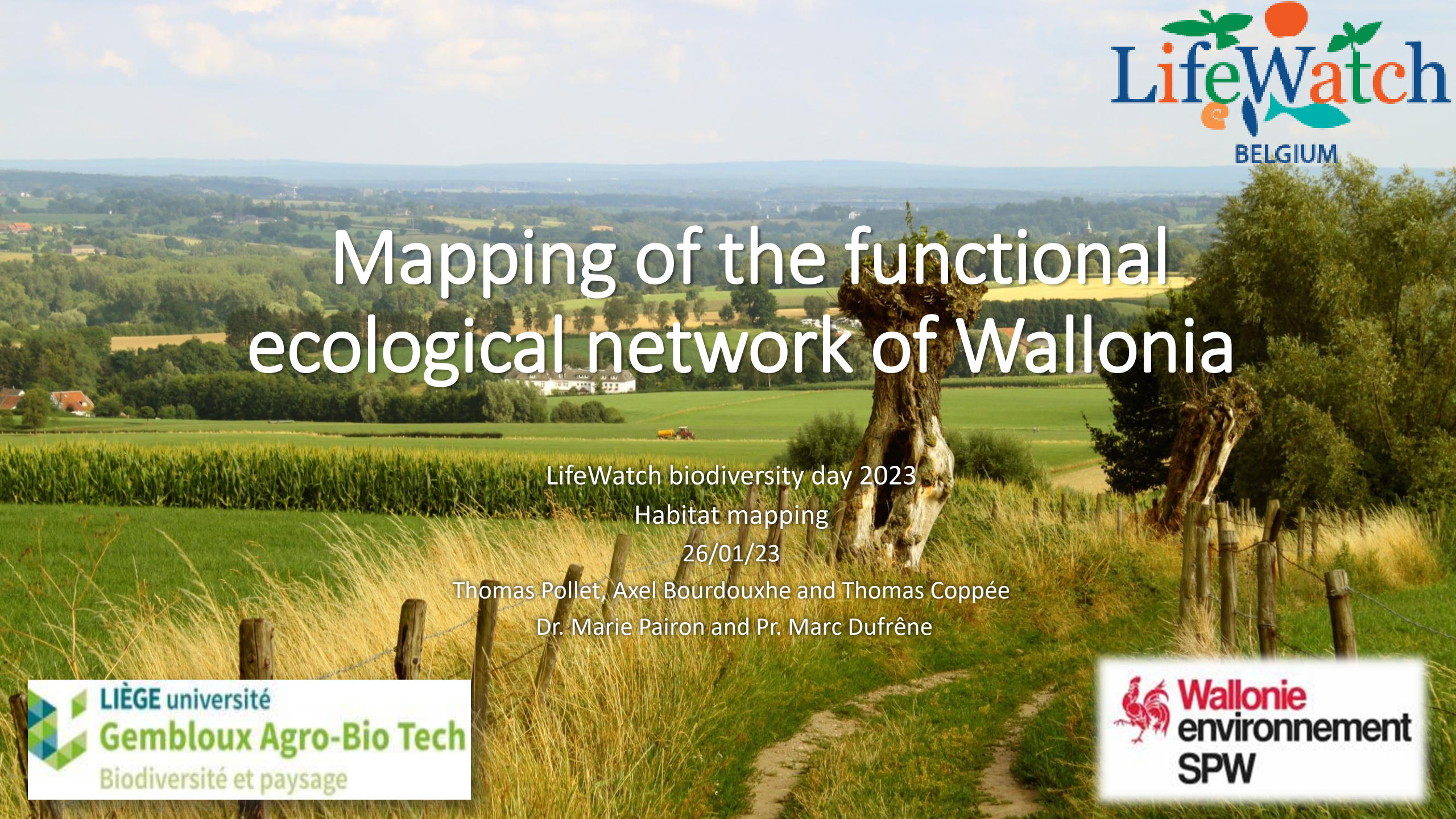


Mapping of the functional ecological network of Wallonia

LifeWatch biodiversity day 2023

Habitat mapping

26/01/23

Thomas Pollet, Axel Bourdouxhe and Thomas Coppée

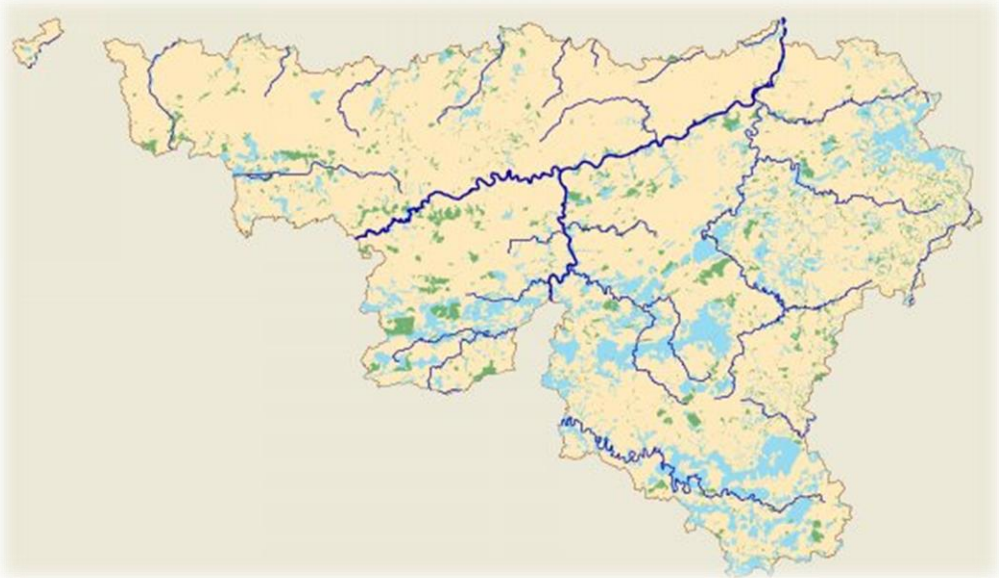
Dr. Marie Pairon and Pr. Marc Dufrêne

Context

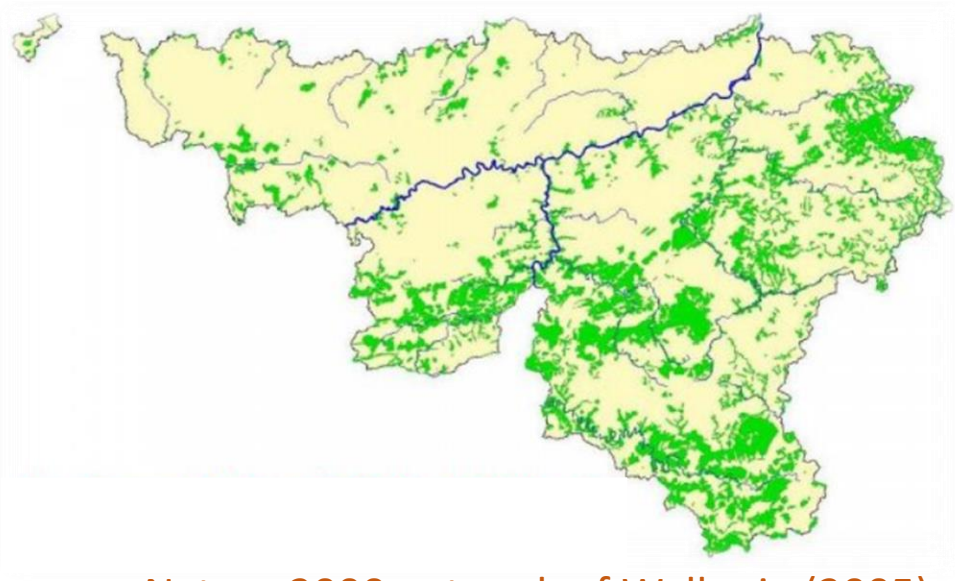
Context

Ecological network: set of ecosystems connected by the movement of organisms in a spatially cohesive manner and interacting with the surrounding environment

In Wallonia, there is no functional ecological network in place to ensure the connectivity between sites of high biodiversity importance.



Main ecological structure of Wallonia



Natura 2000 network of Wallonia (2005)

Objective

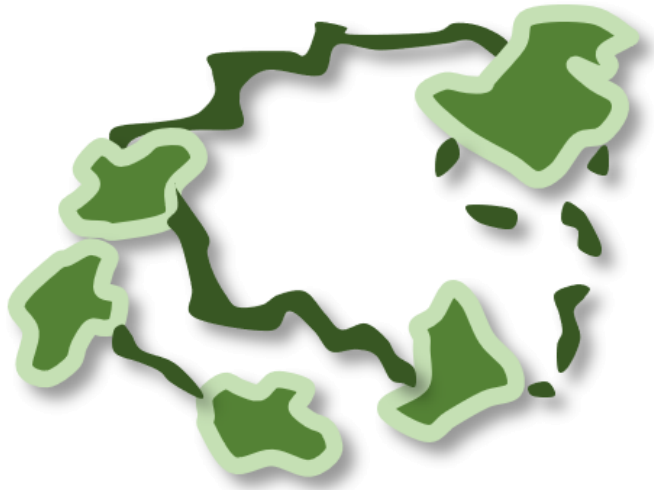
To identify important sites for the conservation of ordinary and extraordinary biodiversity in Wallonia and the connections between these sites

Cartographic data set:
Precise mapping of habitats over the entire region

Biologic data set: census data of fauna and flora

Connectivity analysis:
Connectivity levels between core areas

Functional ecological network at **Walloon region** scale



Sub-networks

Sub-networks

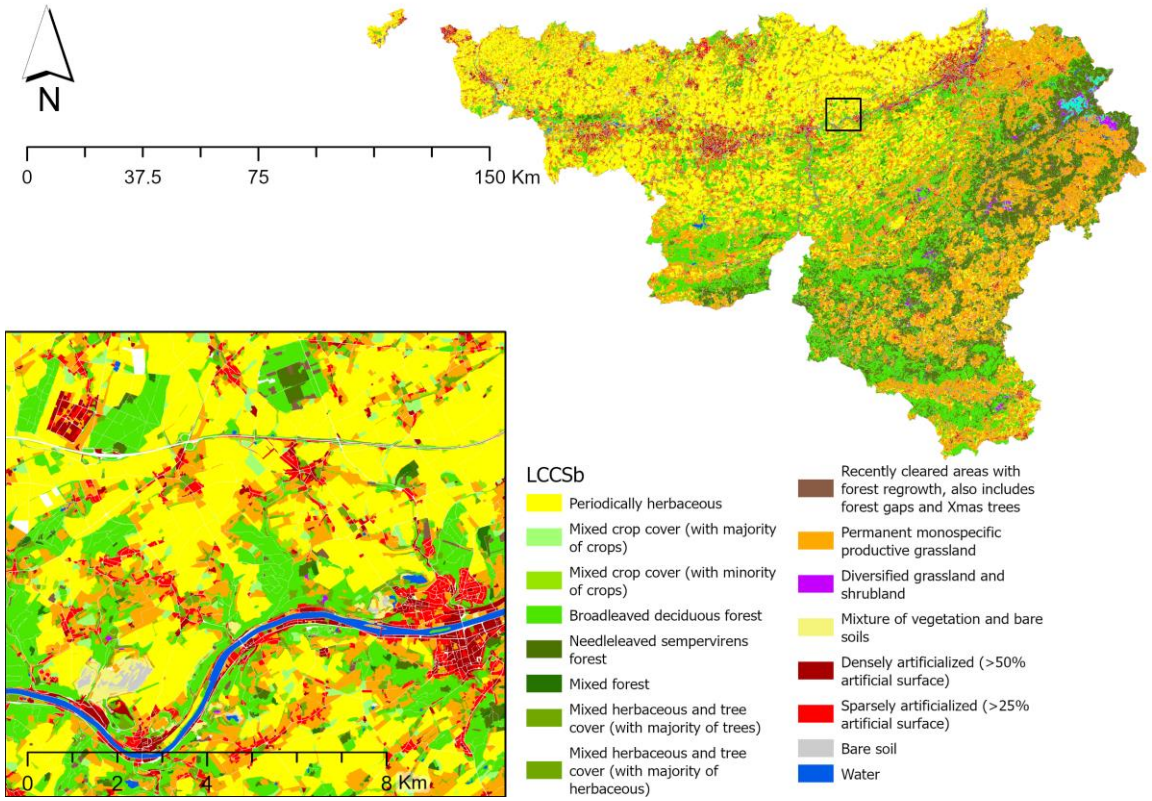
- Sub-network = Subset of similar habitats that meet the ecological requirements of a specific species group and the connection between these habitats
- Hierarchical structure : Open wetlands > Meso-eutrophic wet grasslands > Alluvial wetlands

Bistorta officinalis

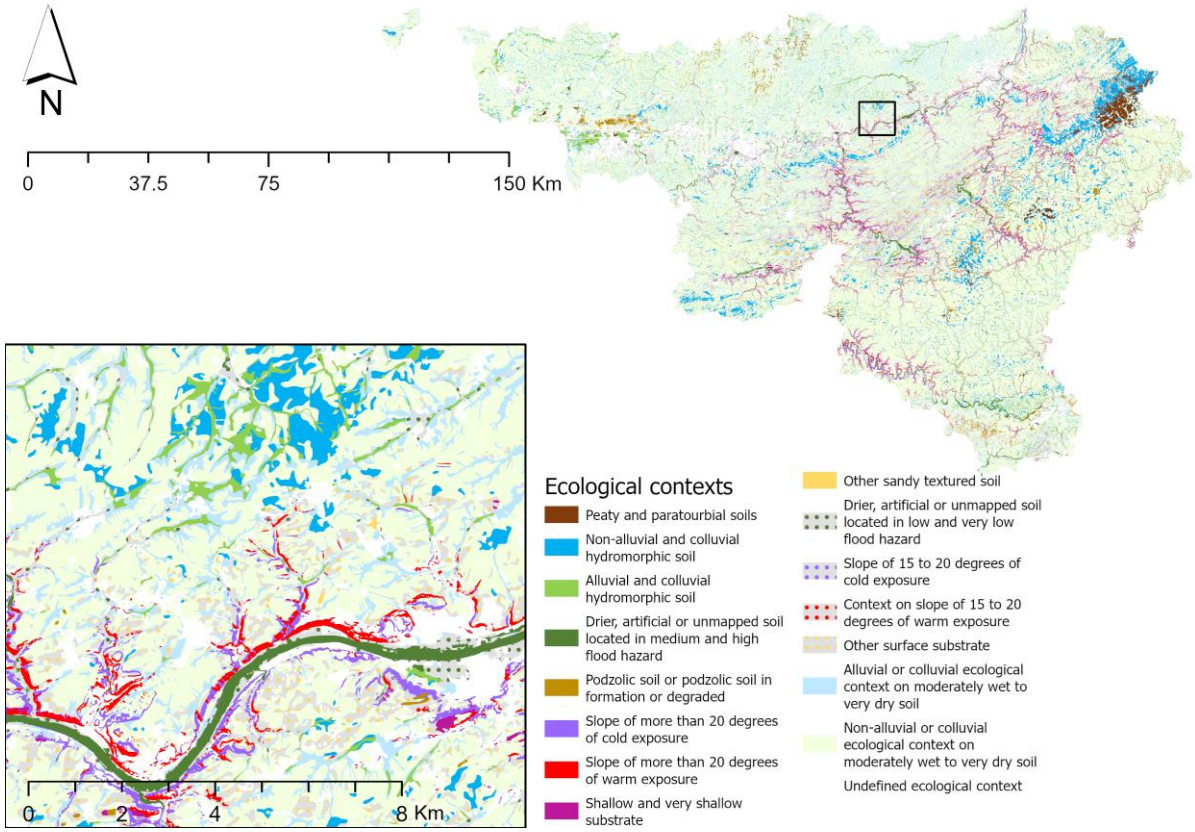
Potential mapping of sub-networks

I. Construction of the cartographic referential

LifeWatch Ecotope



Sensitive and marginal lands

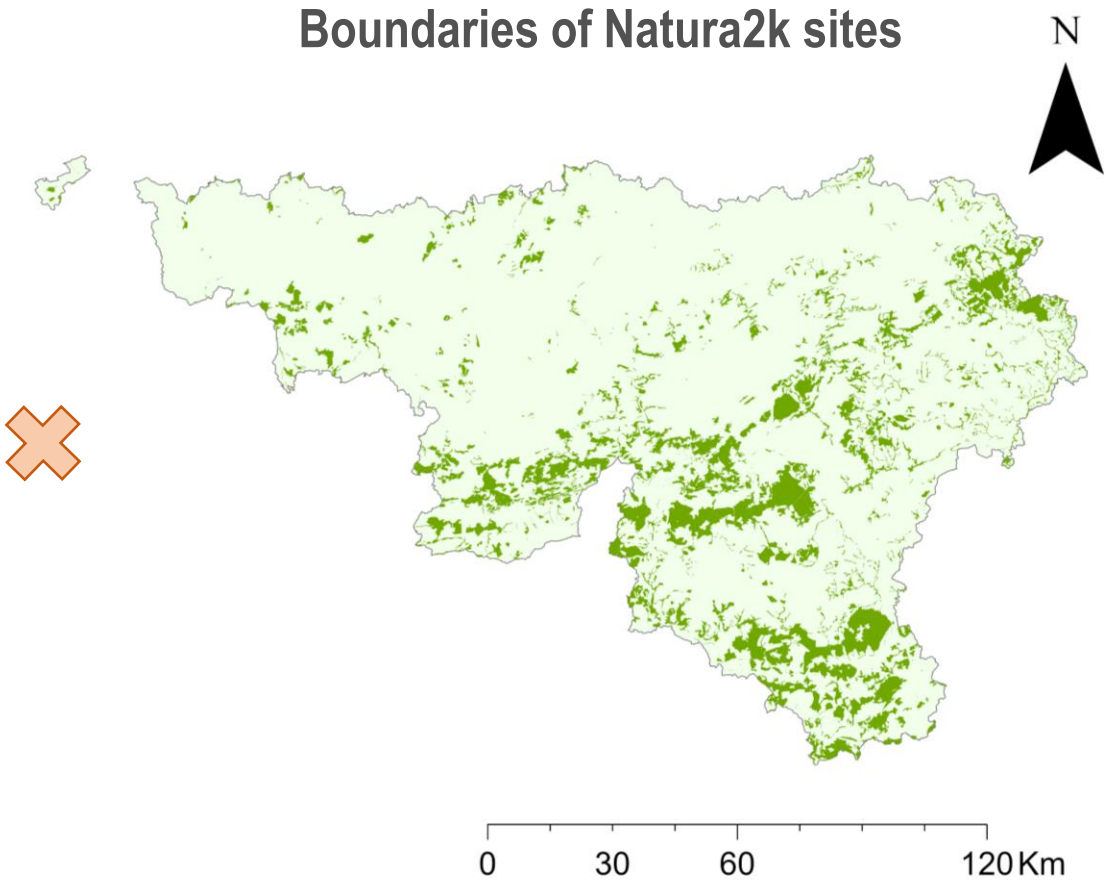


I. Construction of the cartographic referential

Ecological contexts

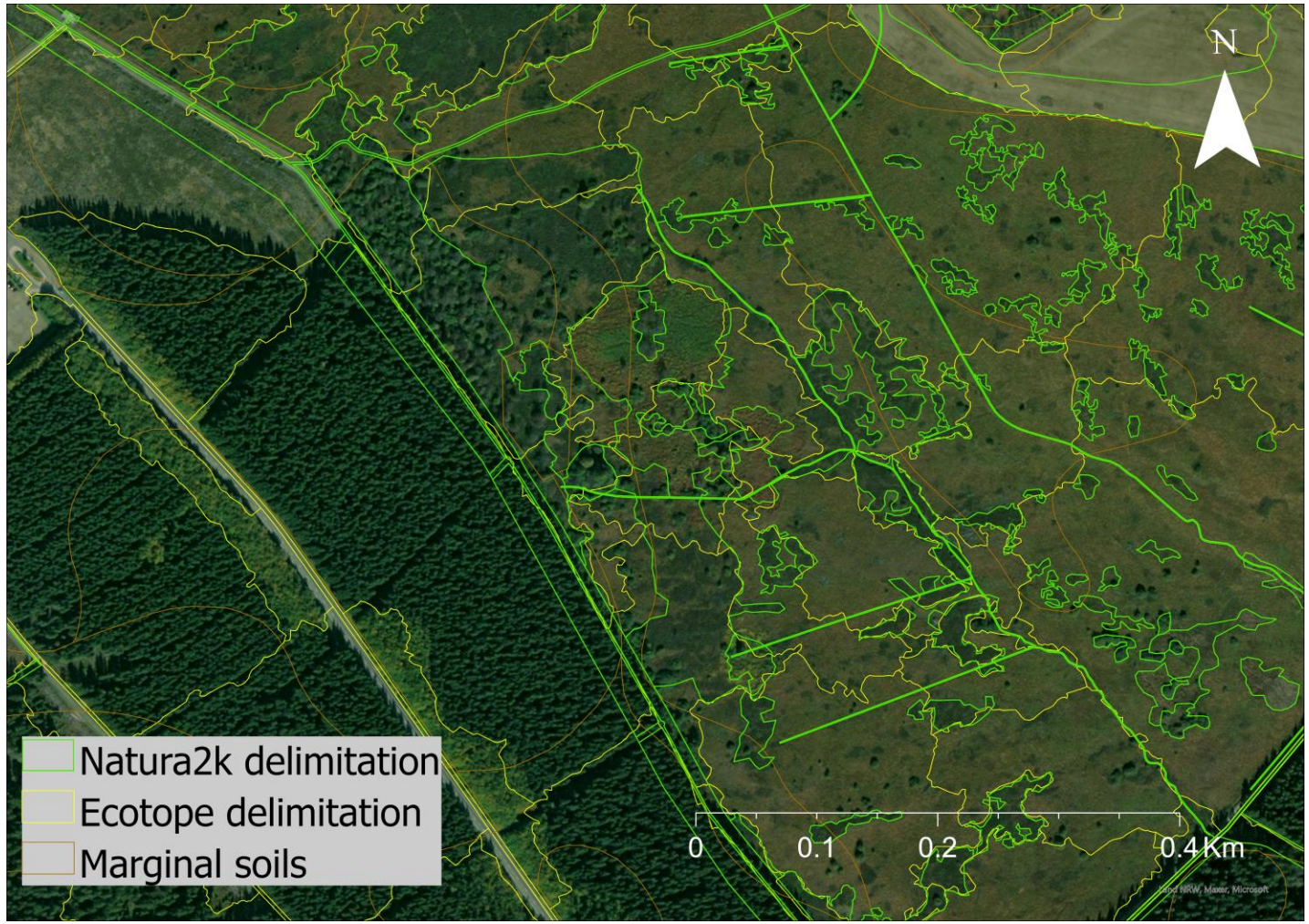
X

Ecotope boundaries



I. Construction of the cartographic referential

Final cartographic referential



II. Habitats modelisation

Method:

1. PNV construction

EUNIS code 01 } PNV 01
EUNIS code 02 }
EUNIS code 03 } PNV 02
EUNIS code 04 }
EUNIS code 05 }
EUNIS code 06 } PNV 03
EUNIS code 07 } PNV 04
EUNIS code 08 }

✖

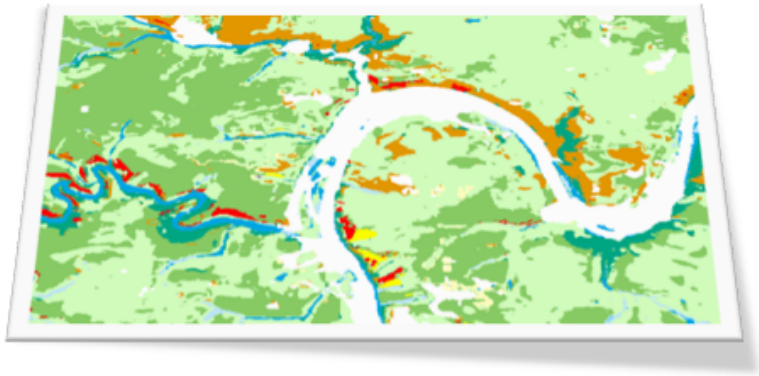
Environmental predictors

Random Forest

2. Individual PNV Modeling

Random forest

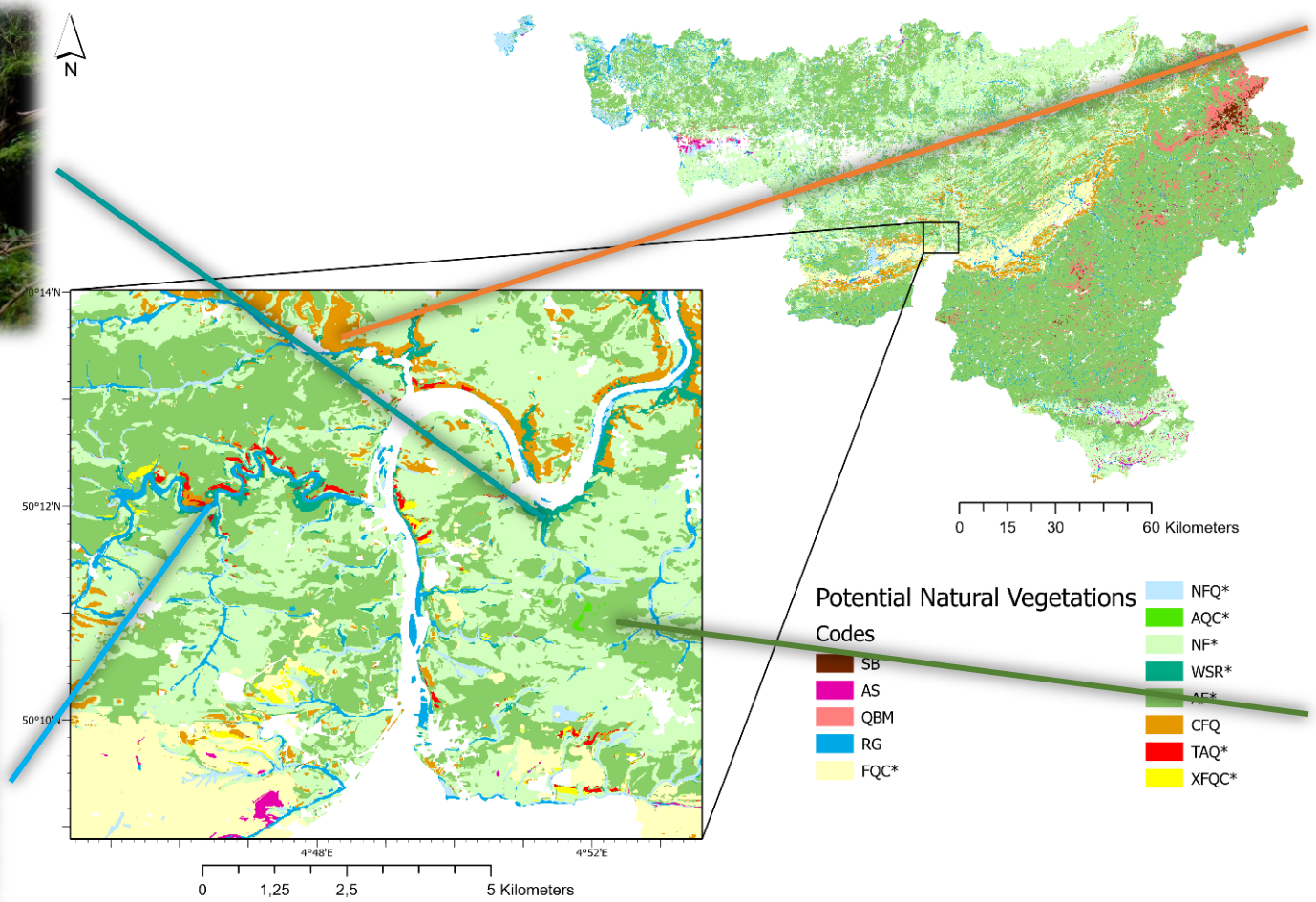
3. Dominant PNV Classification



II. Habitats modelisation

Wetland ravine forests

Beech and oak calcicole forests

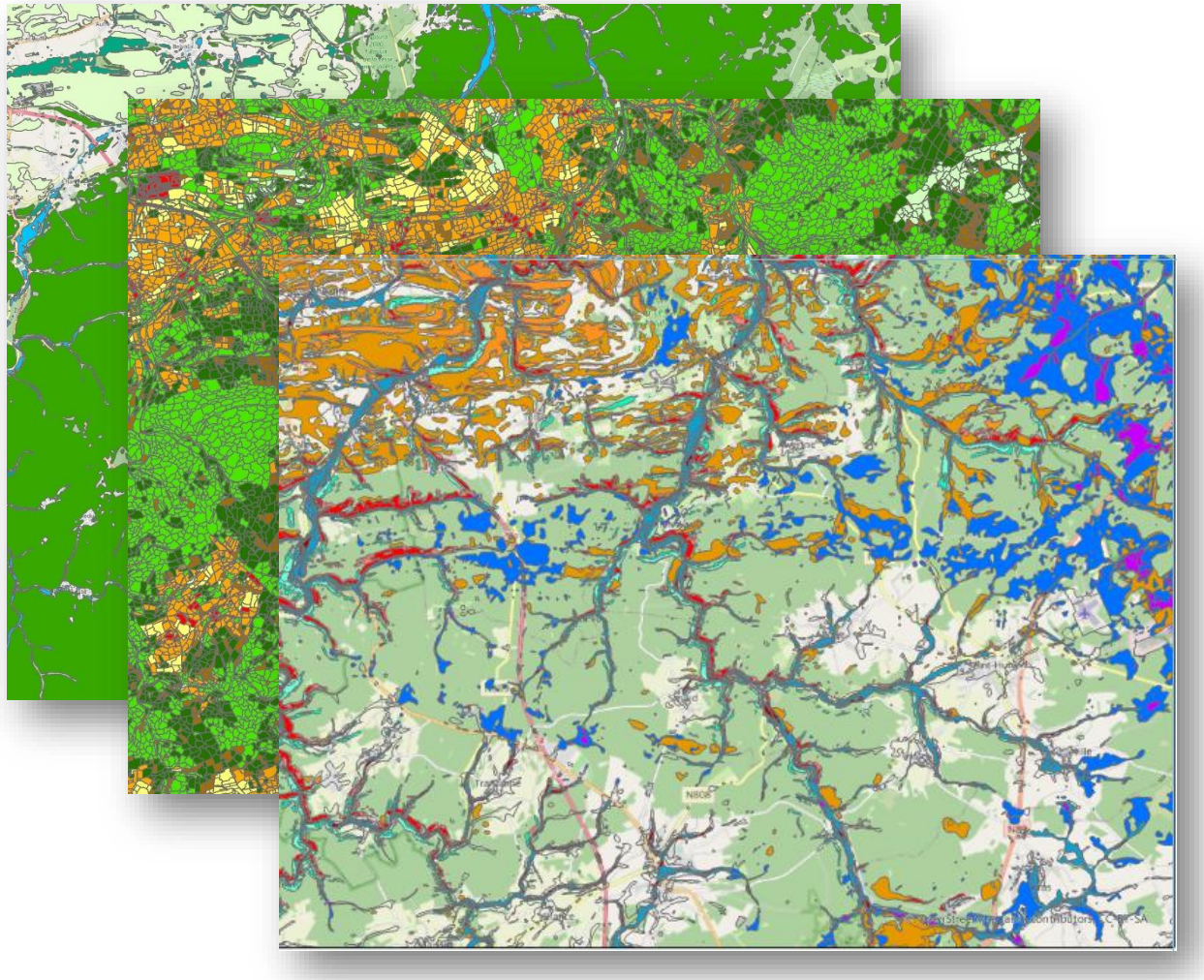


Alluvial forests

Acidophilous beech forests

III. Final mapping of the ecological sub-networks

- PNV included in the cartographic referential in proportion of surface in each polygon
- Other environmental variables
  - **Ecotope variables**
  - Draining
  - Sentive and marginal lands
  - SIGEC
  - Natura2k
  - Open areas of interest for biodiversity
  - And so on…



III. Final mapping of the ecological sub-networks

- Potential natural vegetation are linked to sub-networks but are not equal
- Goal = refine the habitats models with other ecological variables

Exemple: Sub-network of bogs and poor fens

- PNV = Peat bogs
- Open areas
- Natural areas
- Marginal soils = peaty soil or paratourbous soil
- and so on…

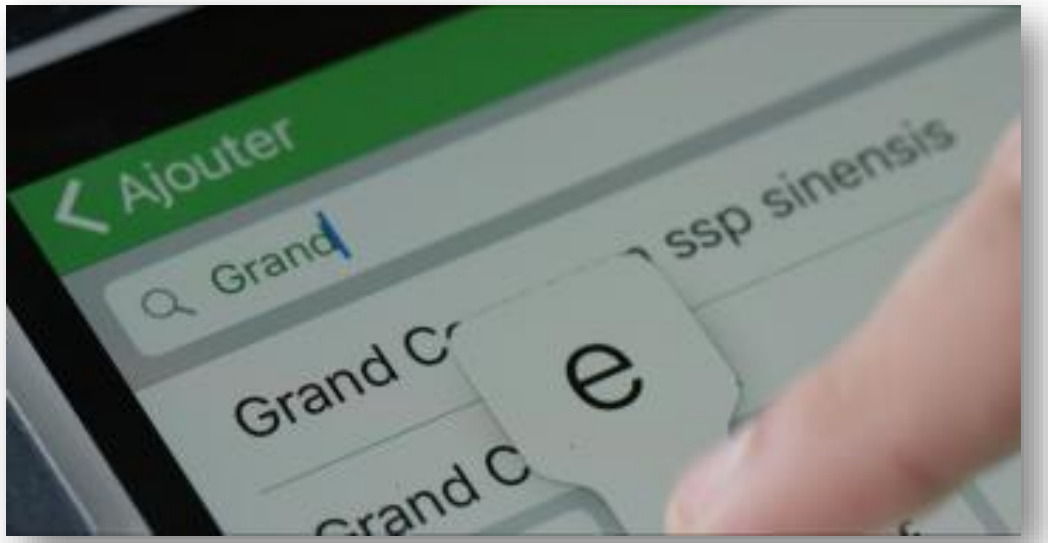
III. Final mapping of the potential ecological sub-networks

Final mapping of the potential ecological sub-networks

Biological data

Biological data: Data sorting

- 1990 to 2021: Points of presence (fauna and flora)
- Fauna: 2 300 000 observations
- Flora: 1 300 000 observations



Observations.be

Biologic data: Indicative species

- Each sub-networks is linked to a series of indicator species of flora and fauna

Marsh warbler

Ino fritillary

Field cricket

Nickerl's fritillary

Open wetlands

White-faced darter

Dry open areas

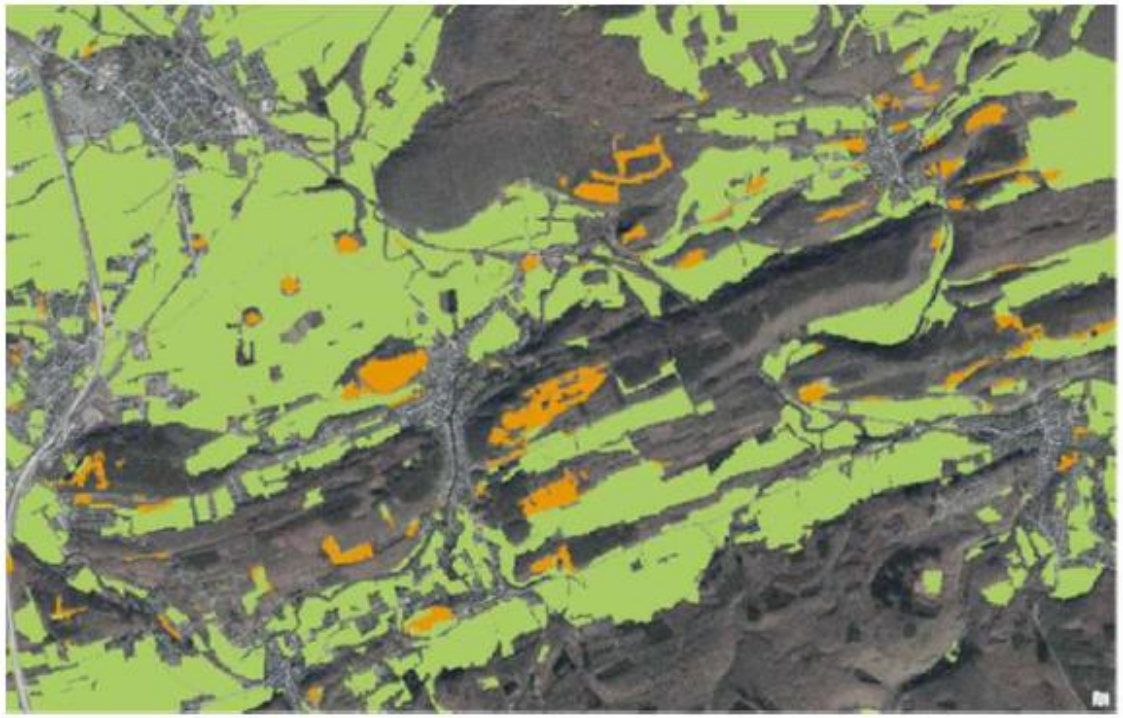
Acteon Skipper

Biologic data: SDM

Only for species of interest to be modelled and whose models are consistent

Species distribution modelling

- Limits the problems of uneven sampling efforts
- Highlights areas potentially favourable to biodiversity
- The whole region is covered



Iphiclides podalirius distribution modeling
Orange = Presence
Green = Absence

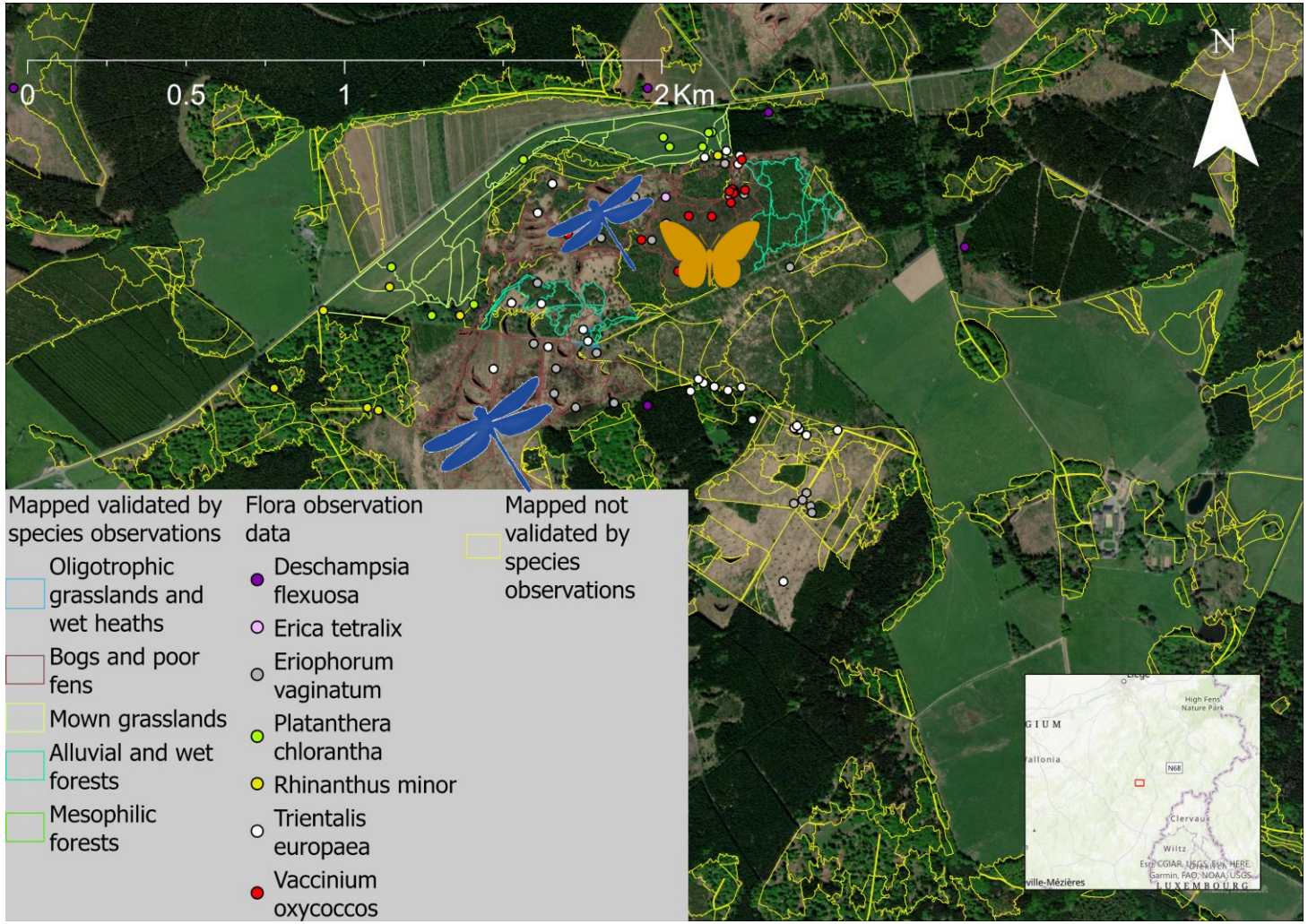
Data crossing

The objective is to carry out a mapping validation of the ecological sub-network via biological data

Data crossing

The objective is to carry out a mapping validation of the ecological sub-network via **biological data**

Sympetrum danae

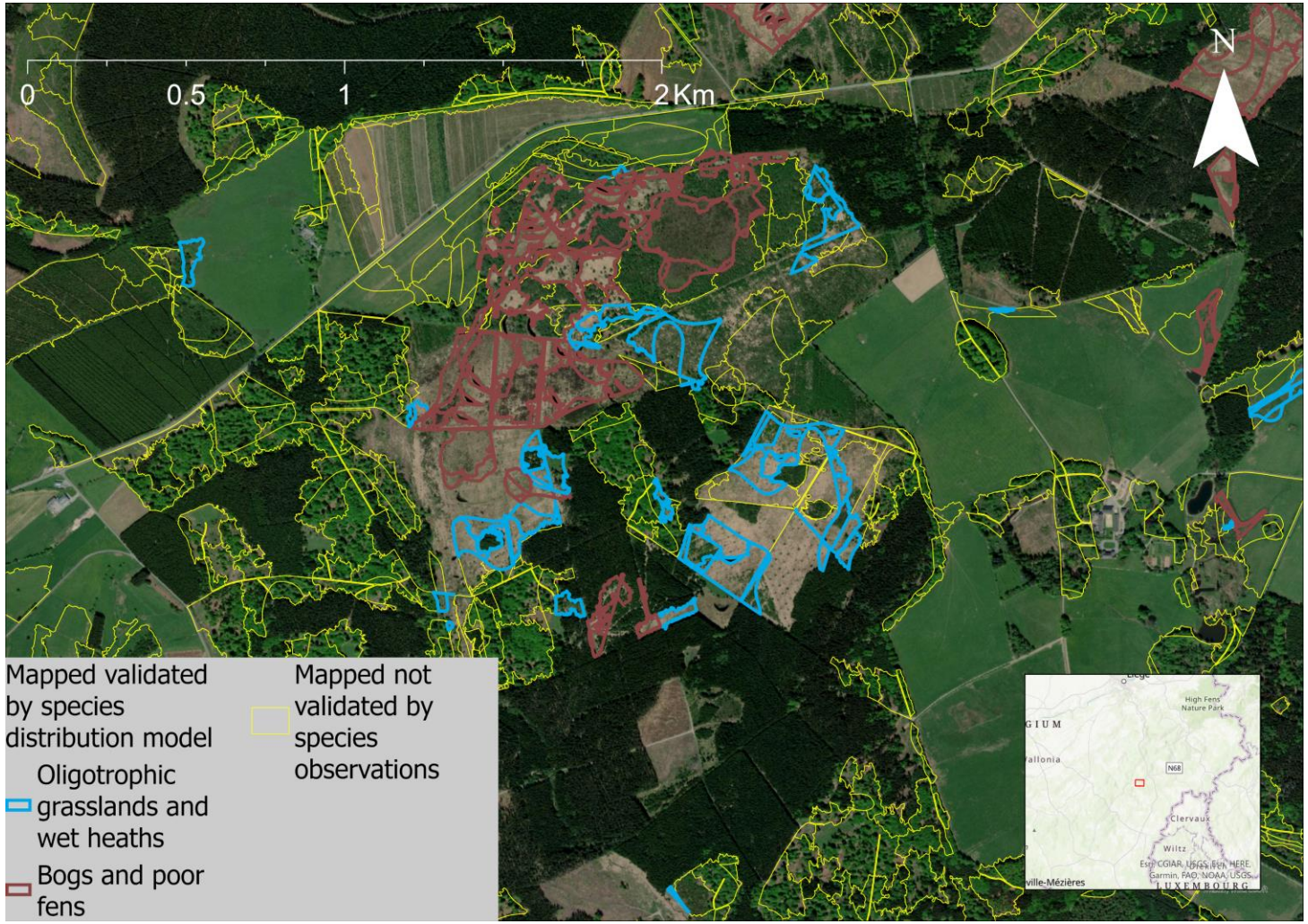


Boloria aquilonaris

Data crossing

The objective is to carry out a mapping validation of the ecological sub-network via biological data and **species distribution modeling**

Somatochlora arctica

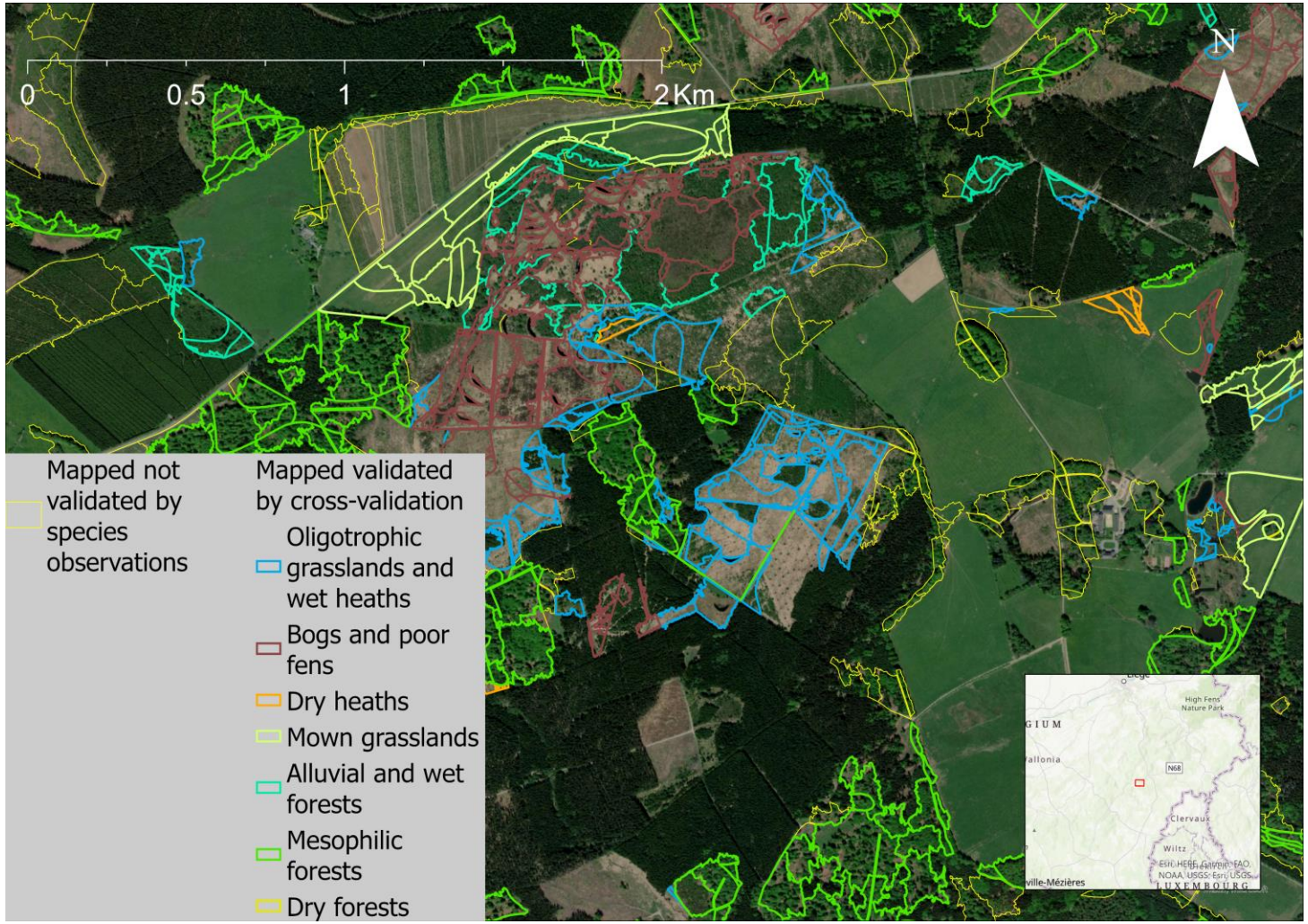


Boloria eunomia

Data crossing

The objective is to carry out a validation of the mapping of the ecological sub-network via biological data and species distribution modeling

Hypericum pulchrum

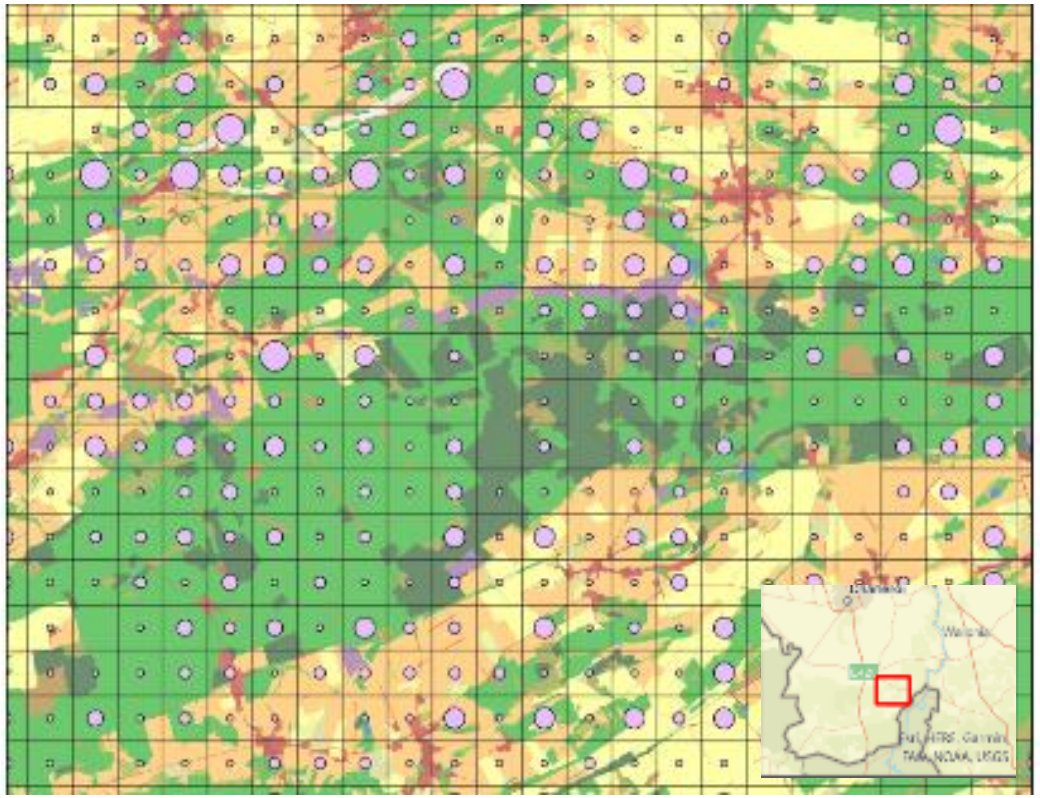


Chorthippus montanus

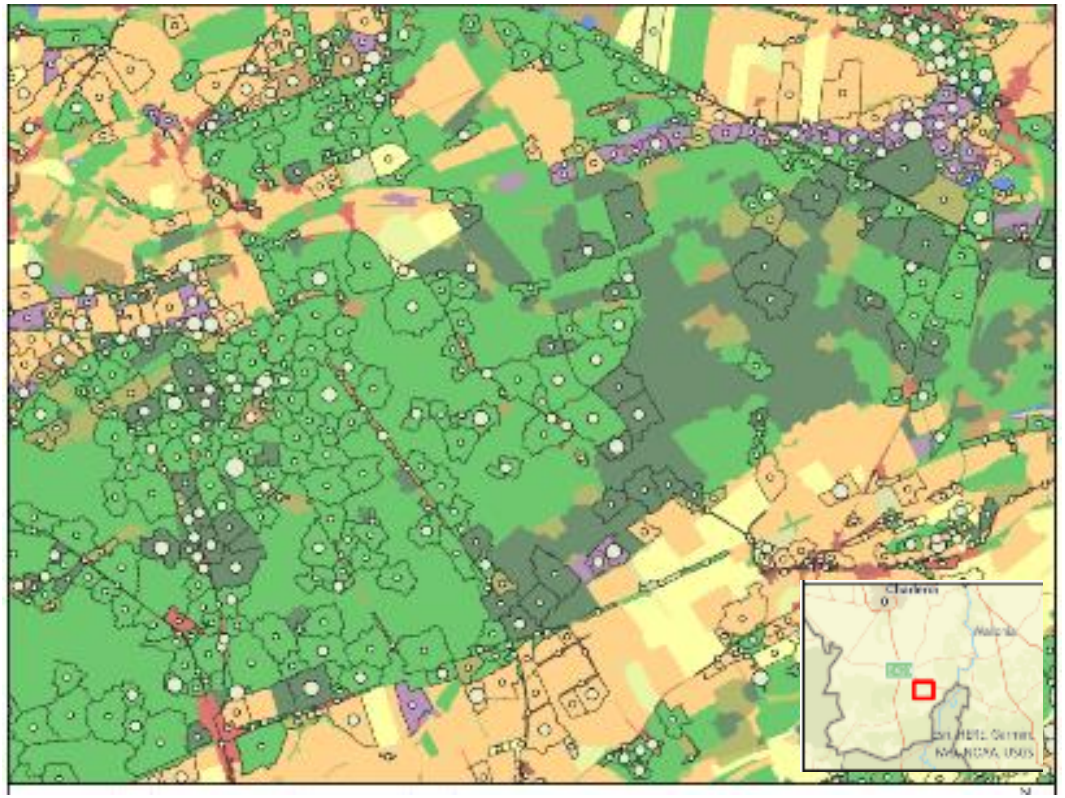
Biological indicators

- Estimation of sampling effort
- Identification of biodiversity hotspots

Number of protected species per square kilometer



Number of protected species per ecotope polygon



Conclusion and perspectives

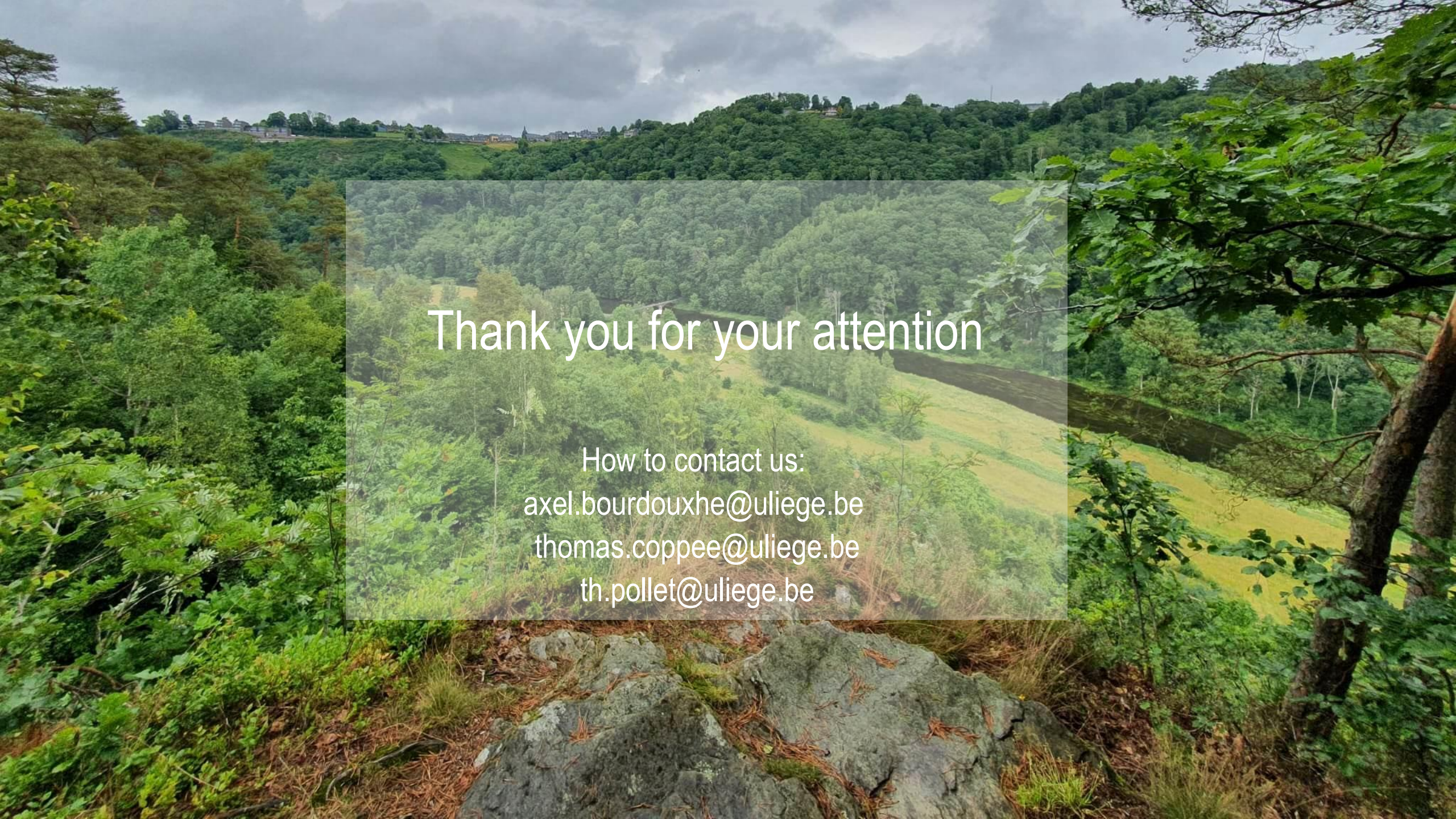
The first essential step in building an ecological network at the scale of the Walloon Region is creating a functional ecological network that considers only the current state of the landscape, and disregards socio-economic concerns.

Those followed steps have been followed:

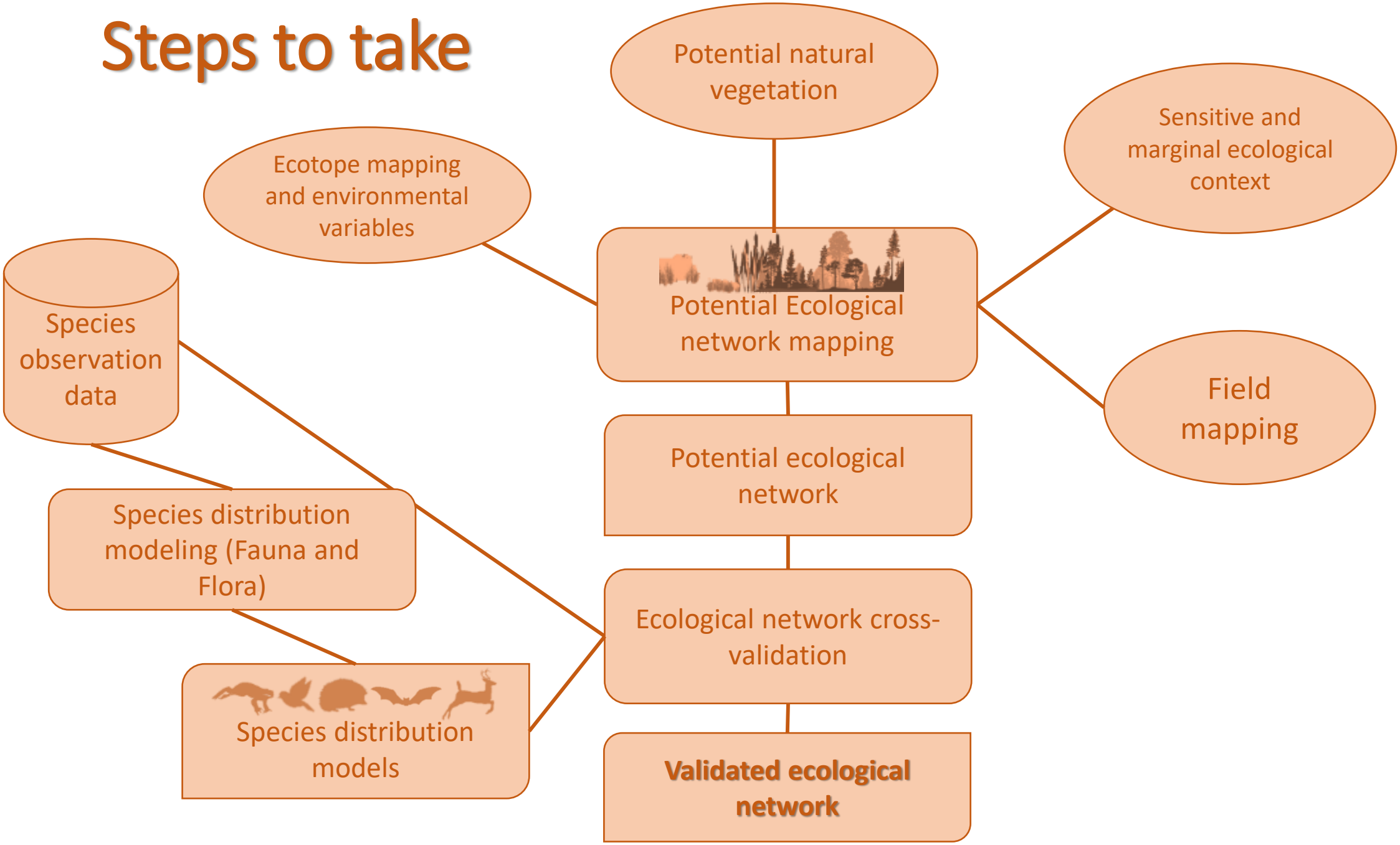
1. Diagnosis of existing habitat mapping
2. Diagnosis of existing biological and environmental data
3. Modelling of fauna and flora species and potential natural vegetation
4. Mapping a potential ecological network using only environmental data and habitat models
5. Validated this ecological network via species models and species observations data

Conclusion and perspectives

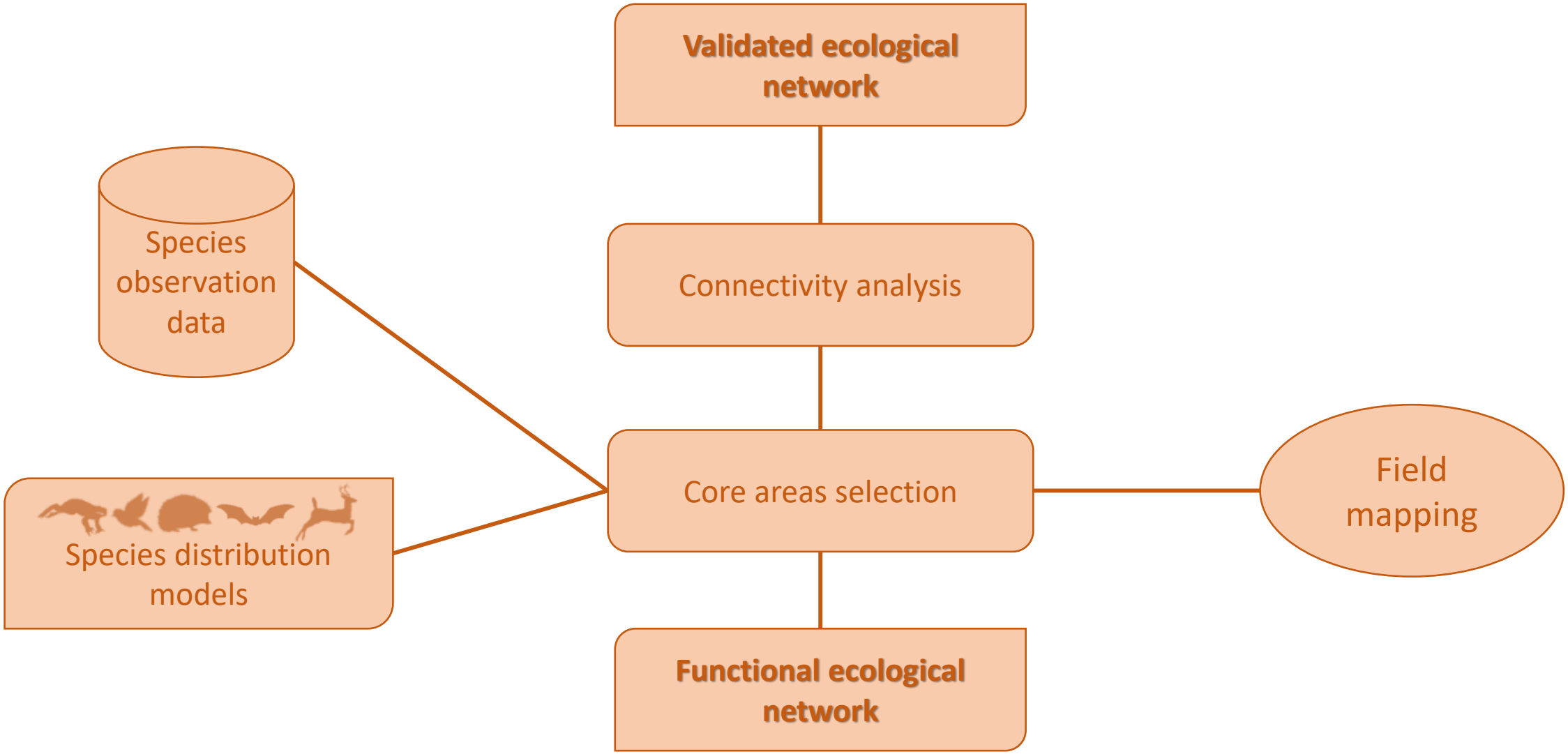
- A new convention has begun to improve the method and results.
- Taking into account new environmental and cartographic data
- Increasing the range of the ecological sub-network
- Highlighting of restorable areas
- Carrying out a full analysis of the connectivity between the elements of each sub-networks


Thank you for your attention
How to contact us:
axel.bourdouxhe@uliege.be
thomas.coppee@uliege.be
th.pollet@uliege.be

Steps to take

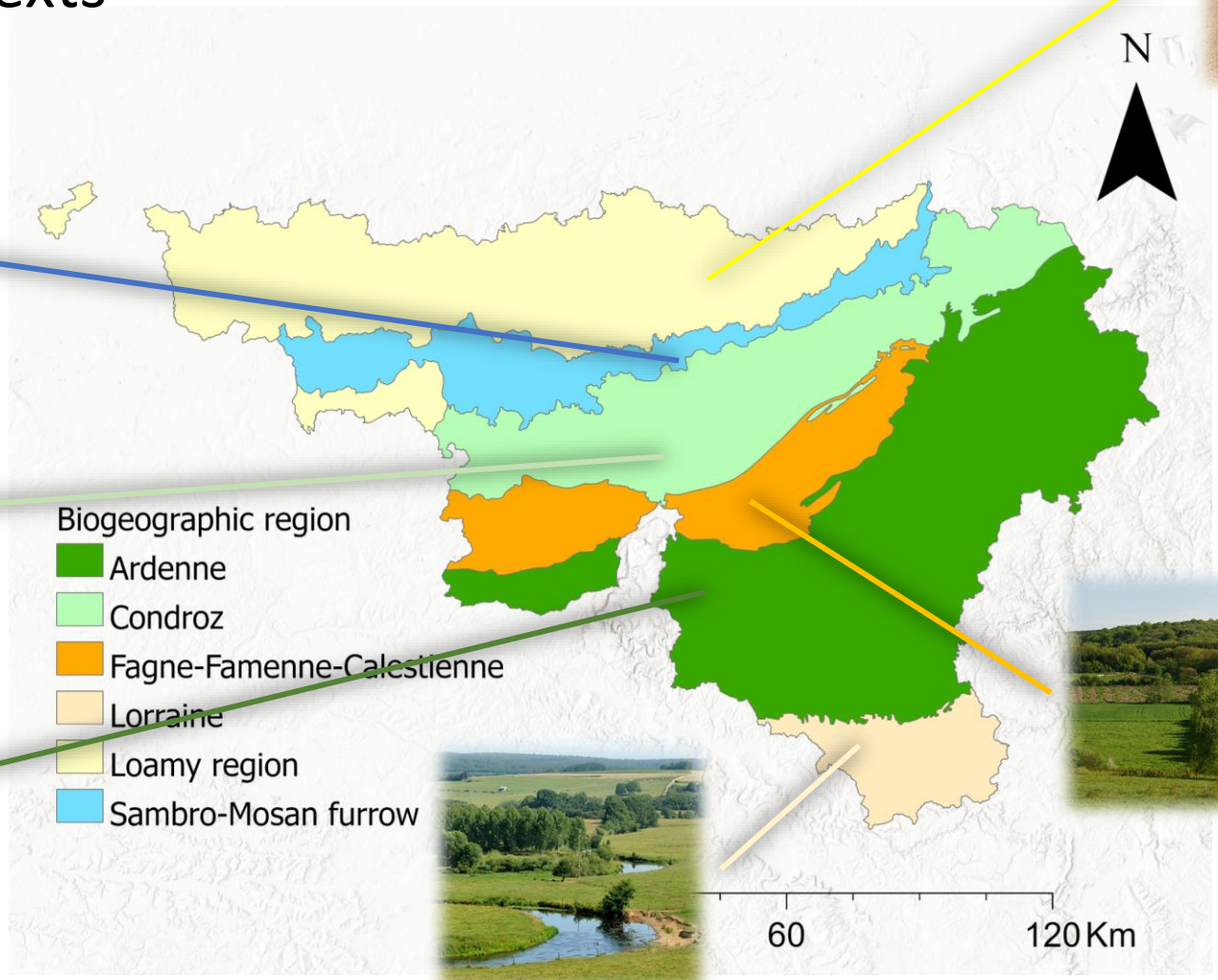


Steps to take



Context

- Walloon Region = **16 900km²** and six biogeographic regions with variated ecological contexts



Sub-networks

©Lionel Wibail

- Level 1: Spliting habitats according to main ecological gradients (vegetation heigh, Naturalness and humidity)

©Louis-Marie Delascaille

- Level 2: Spliting habitats according to fauna species and connectivity issues

©San Martin Gilles

©Simon Luc

Sub-networks

- Level 3: The most accurate level that can be mapped outside the Natura2k network using Potential natural vegetation and environmental variables

Calcareous beech-oak forests

Calcareous grasslands

II. Habitats modelisation

Potential natural vegetation modeling

E1.26 Mesophilic and meso-xerophilic calcareous grasslands

+

E1.27 Xerophilous calcareous grasslands

+

→ Climax of a vegetation succession

→ **Calcicolous Fagus and Quercus pubescens forests**

F3.1b Calcareous thermophilic thickets

+

G1.66 Medio-European calcareous beech forests

+

G1.71 Western Pubescent Oaks

+

G1.A17 Calciphilous sub-Atlantic oak-chestnut forest

II. Habitats modelisation

Advantages and benefits

- Better representation of rare habitats in the dataset
- Allows mapping of the ecological sub-networks habitats after combining with other data (land use for instance)
- Will also allow rapid identification of areas with high restoration potential

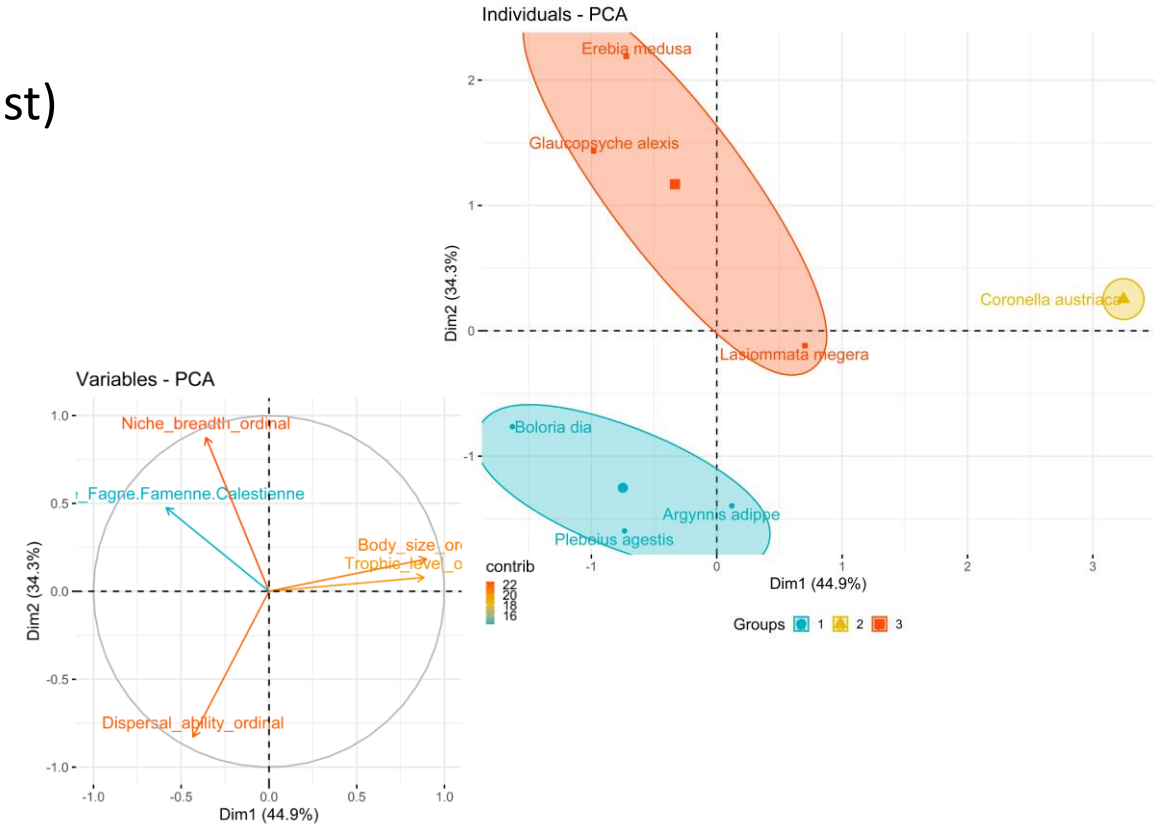
Connectivity analysis

Grouping of species via their life traits in relation to sensitivity to fragmentation:

1. Specialisation (Generalist, Intermediate, Specialist)
2. Size (Small, Medium, Large)
3. Dispersal capacity (Short, Medium, Long)
4. Trophic level (Low,Medium , High)
5. Rarity

→ **Focal species identification**

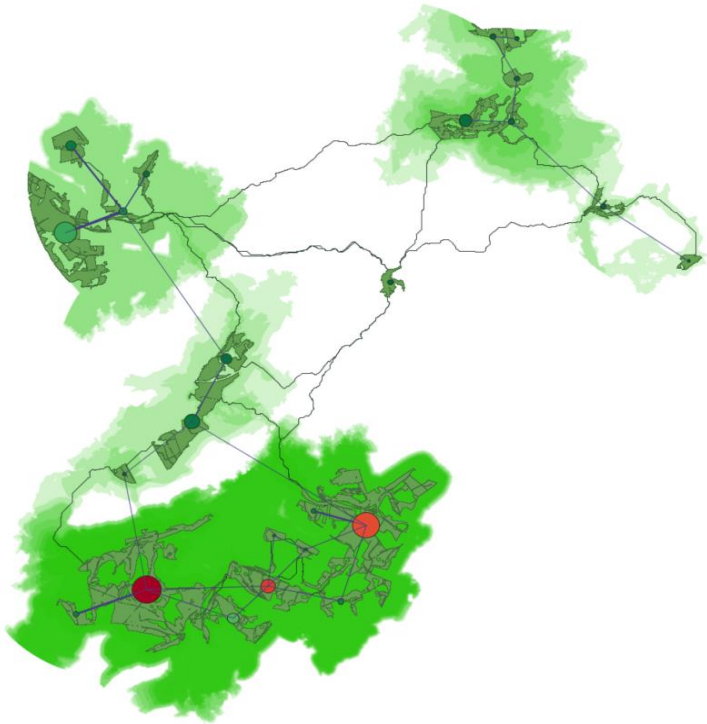
Focal species: Fragmentation-sensitive species representative of a species group with similar landscape connectivity needs



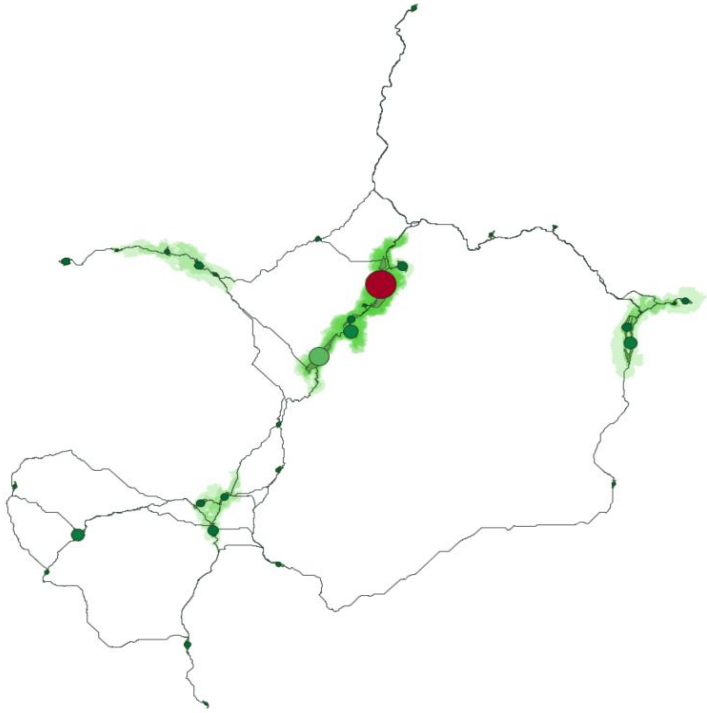
Connectivity analysis

graphab

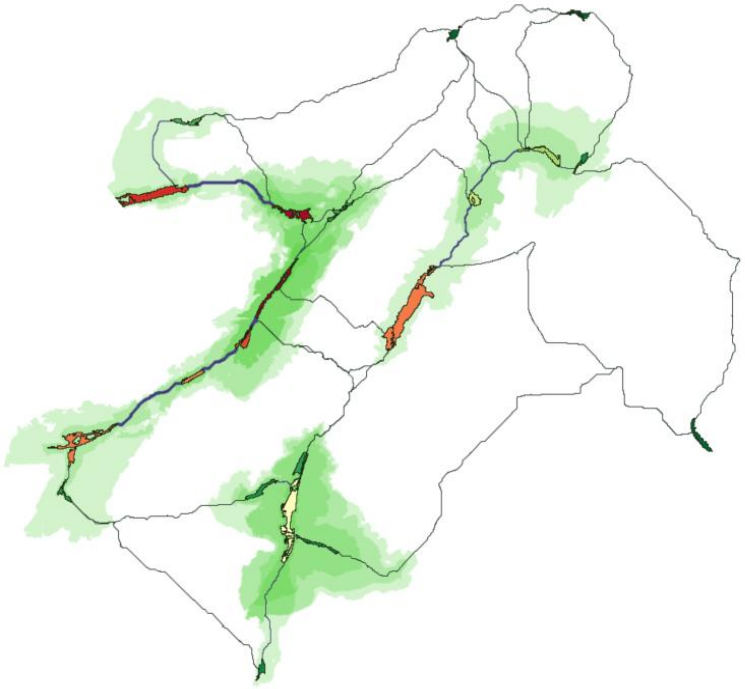
- Exemples of results



Mesophilic forests



Open wetlands



Alluvial and wet forests

Connectivity analysis

- Exemples of results

Mesophilic forests

Alluvial and wet forests

Open wetlands