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DIVA: the French research program on ecological networks

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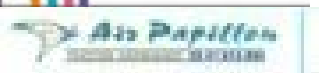


Forum on Guangdong Greenway 2011
Beijing, April, 27 - Beijing

DIVA: the French research program on ecological networks

Invited lecture

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Plaine Fougères 2008

Lauray Pierre (30)

Vigoux Virel

23 juillet 2008

Perspective
Océanique

B08_10_APU5409.jpg



What is DIVA?

Public Action, Agriculture, Biodiversity

It is a research program of the Ministry of Ecology and Sustainable Development (MEDDTL)

It is in its third phase (2011-2014), the new theme is *“ecological networks in the agricultural landscapes and their interfaces”*



How does DIVA work?

Like all programs of the ministry, DIVA aims at providing scientific evidences to define policies and management strategies on topics relevant to environmental maangement

This is done with

- 1) A call for proposals
- 2) A selection of projects
- 3) A continuous animation of the research teams
- 4) Work on selected topics involving all teams



My presentation

A glimpse at the ecological diversity of France

Nature protection policies in the European Union and France

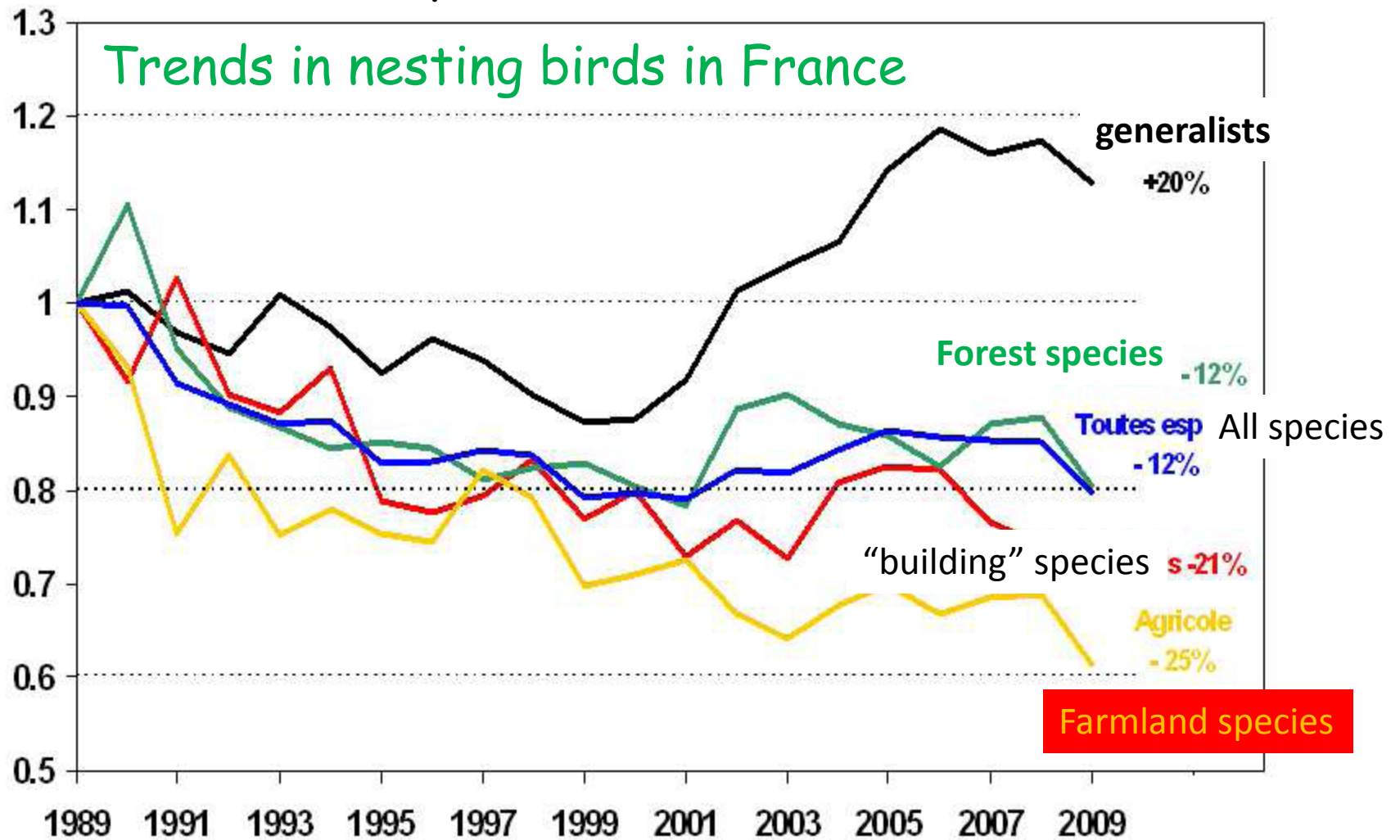
From nature reserves to ecological networks

The ongoing research projects in DIVA

Connectivity as a landscape scale function
Mapping ecological networks
Social and policy issues



The problem: the loss of biodiversity, especially in agricultural landscapes



A major cause: Habitat fragmentation



The goal of the program: to policies to restore ecological networks

France (550,000 sq km) is a diverse country

Biogeographic Zones

Alpine zone

Mediterranean zone

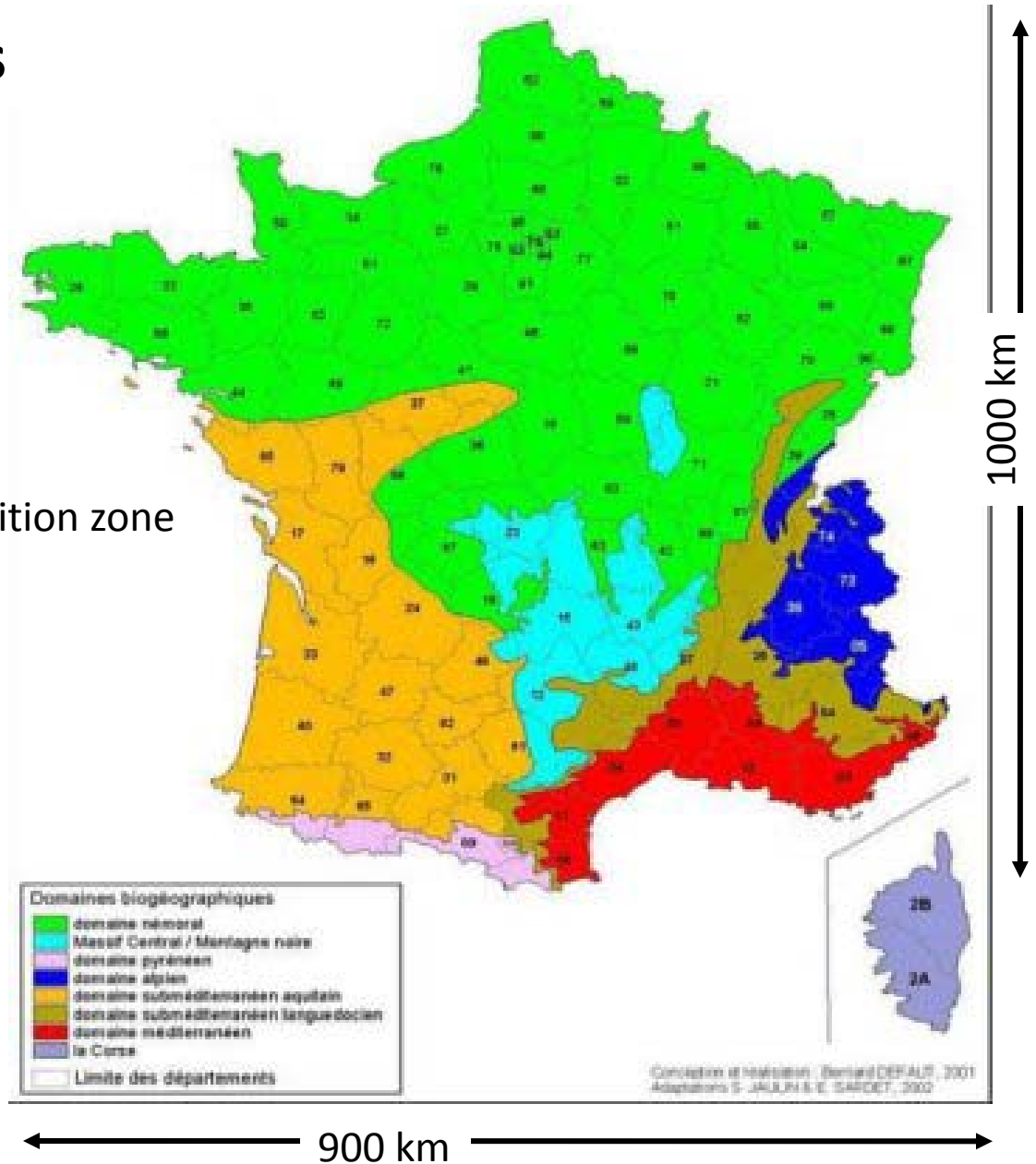
Alpine / Mediterranean transition zone

Central mountain zone

Pyrénées (mountain) zone

Northern plains

Southern plains



Biogeographic and landscape diversity



A diversity of landscapes within a zone



A diversity of landscape elements
A diversity of land use and management

A diversity of habitat mosaics



A diversity of species

France, as all western Europe is made of cultural landscapes

Protected areas must be managed to maintain their characteristics, there is not such thing as “wilderness”

Ecological corridors go through farmland, productive forest, periurban areas



Nature protection policies in the European Union and France

Two main policies

Natura 2000: an environmental policy

http://ec.europa.eu/environment/nature/natura2000/index_en.htm

A set of **habitats** of ecological value that must be maintained by the member states

Agri-environment schemes and cross compliance within the Common Agricultural Policy (CAP)

http://ec.europa.eu/agriculture/envir/biodiv/index_en.htm

Policies that aim at counteracting the negative effects of agriculture on the environment, especially biodiversity

From nature reserves to ecological networks

Nature protection in reserves is not sufficient for several reasons

Most species live outside reserves



Sarrazin

vulture



squirrel

Burel



Bretagnolle

Little bustard



Dragon fly

From nature reserves to ecological networks

A new French law (Grenelle 2) to promote ecological networks

to

Foster **species movement** between protected areas or biodiversity hotspots

Sustain **ecosystem services** (pollination, water purification, flood and erosion control, pest control etc.

From nature reserves to ecological networks

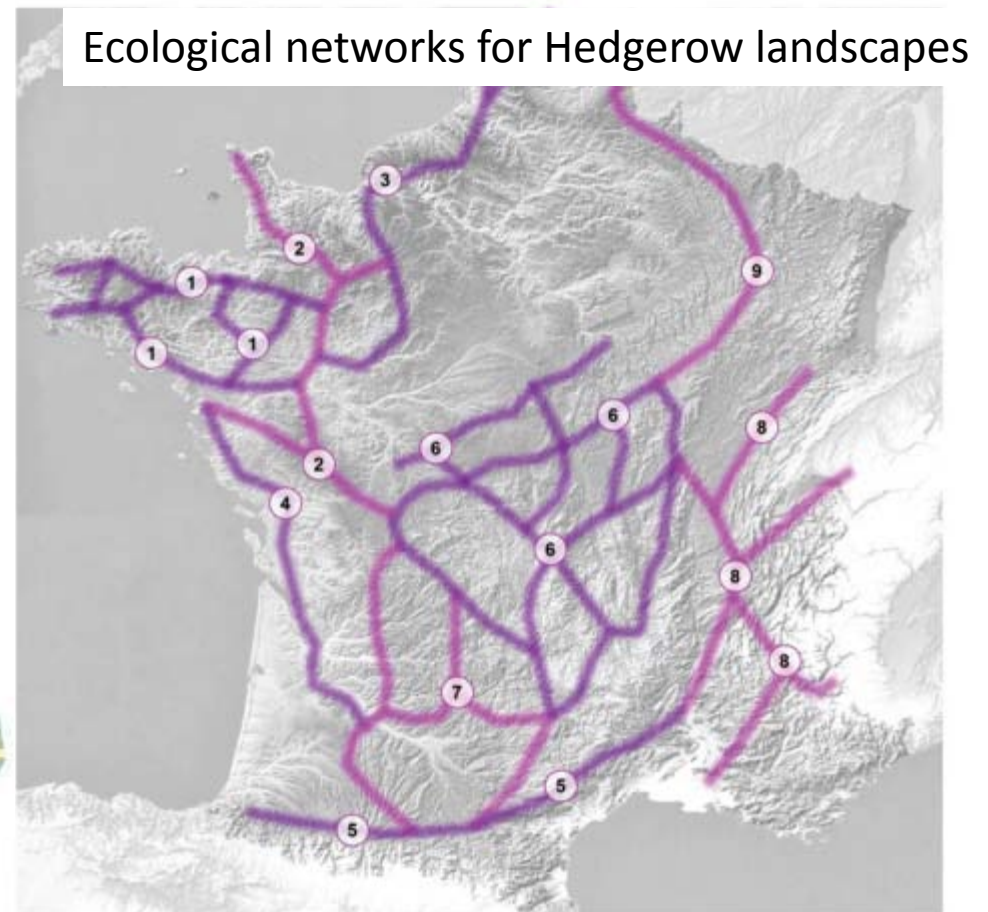
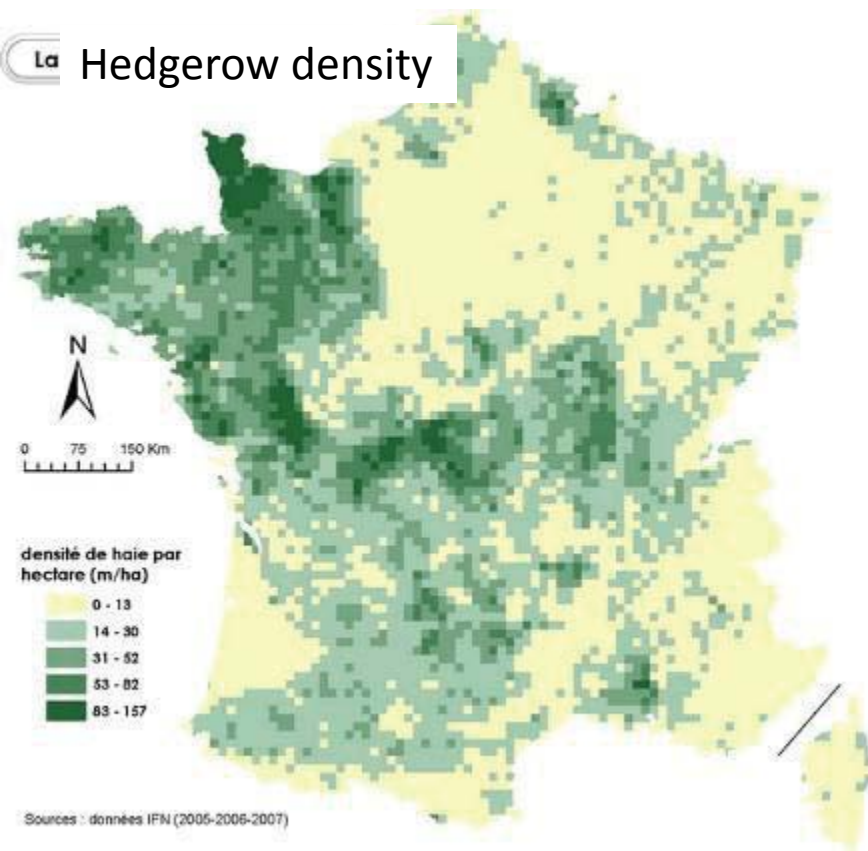
A paradigm shift in terms of Nature Conservation

Nature reserves/ protected areas: they are designed, set up according to a pre-existing list of threatened species, high ecological value habitats. **They are based on observation**

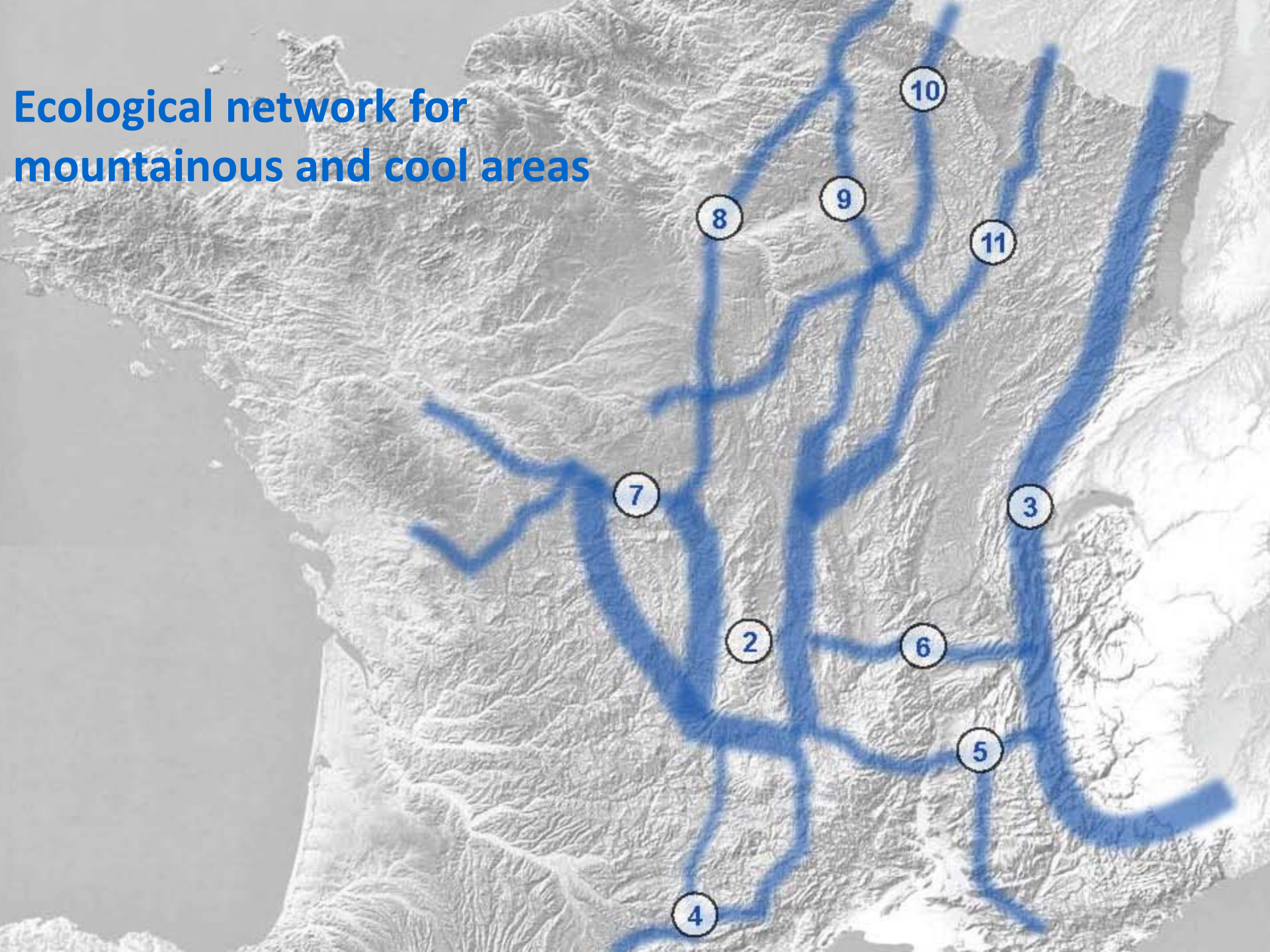
Ecological networks: they are designed, set up according to an estimated (modeled) capacity to permit the movement of a range of species, not (or rarely) on actual observation of movement, **they are based on the best current ecological theory**

Back to the ecological diversity of France, therefore, to the diversity of biodiversity issues

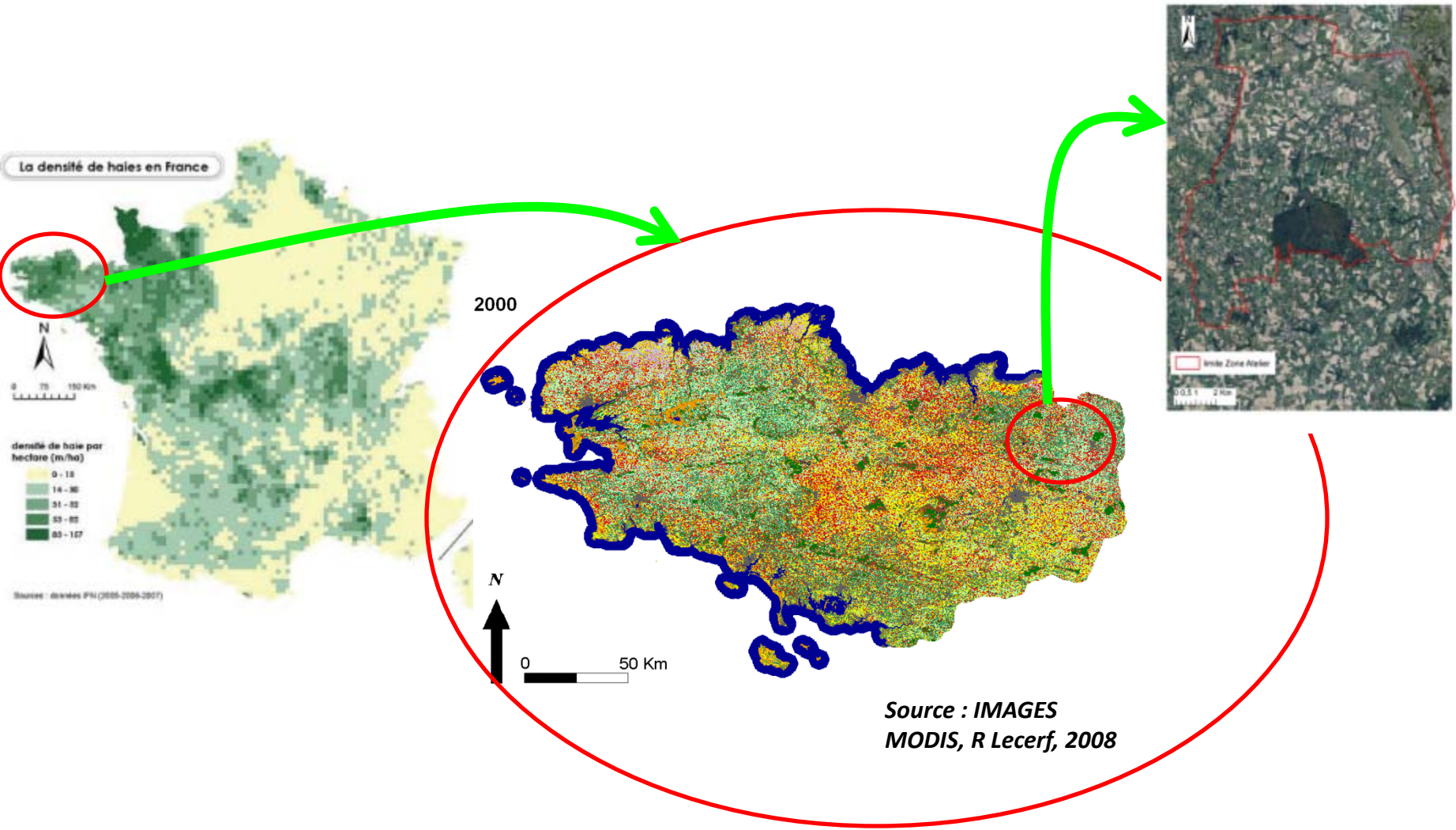
At the national level, the National Museum of Natural History has set up a series of maps of ecological networks at the national scale



Ecological network for mountainous and cool areas



The French law requires that the ecological networks be designated at the regional scale, then be taken into account in land planning at the municipality scale.



The ongoing research projects in DIVA are at regional and local scales (beginning 2012, ending 2015)

Research on ecological processes

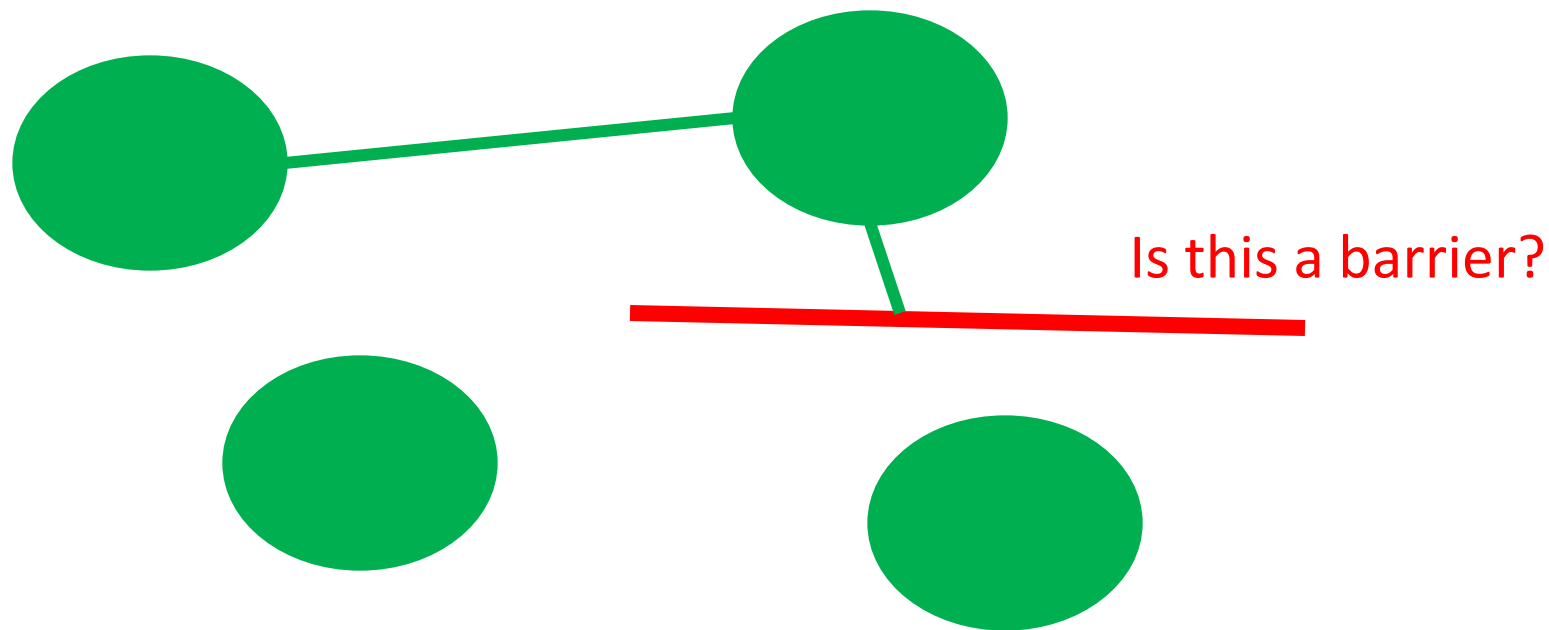
Research on ecological networks mapping

Research on policies and the social integration of networks



Research on ecological processes

How do we know that species use landscape connectivity?



Are those patches of habitat connected?

Why do we want connected habitats?

To maintain a metapopulation (compensate local extinction) within an area

To permit the colonization of novel habitats

To enhance genetic exchanges

Why do we want to impede connectivity between habitats?

To prevent the dissemination of diseases and invasive species

Research on ecological processes

The three main research options

The following of actual movements

The correlation between landscape metrics and biological data

The use of landscape genetics

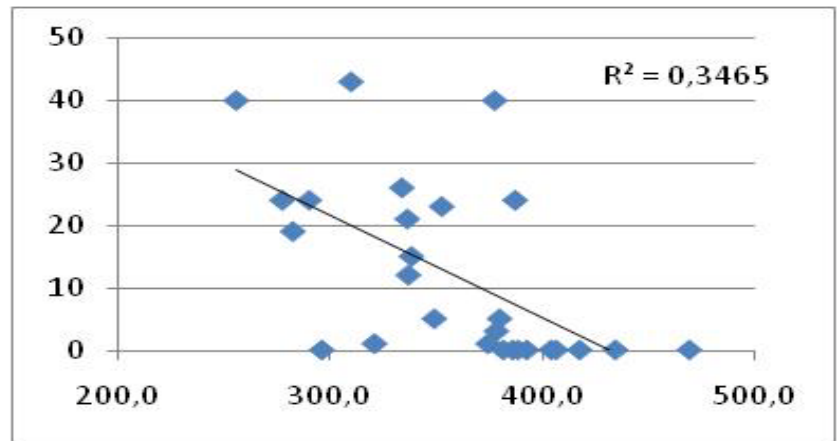
The following of actual movements



The correlation between landscape metrics and biological data

Ex: squirrel abundance

abundance



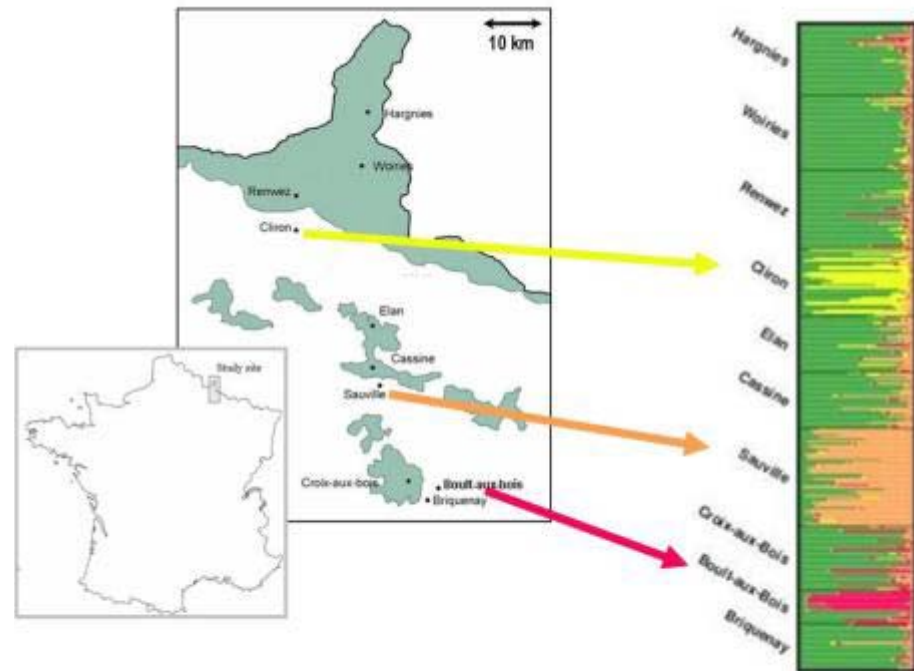
Mean distance between woods with a 5 km² window



The use of landscape genetics

Question : the role of bank vole (*Myodes glareolus*) metapopulation dynamics in the epidemiology of *Puumala hantavirus*

The hantavirus is less prevalent in fragmented landscapes



Guivier, E., M. Galan, et al. (2011). "Landscape genetics highlights the role of bank vole metapopulation dynamics in the epidemiology of *Puumala hantavirus*." Molecular Ecology **20**: 3569–3583.

Research on networks mapping

How to “translate” observations (satellite images, aerial photos, etc.) into maps of corridors?

- 1) The different sources of data
- 2) The extent, spatial and temporal resolutions
- 3) The mapping categories

But, first of all, the geometry of ecological networks is diverse

Research on networks mapping

Hot spot 1



Corridor



Hot spot 2



Stepping stones



Images with different spatial, temporal & spectral resolutions

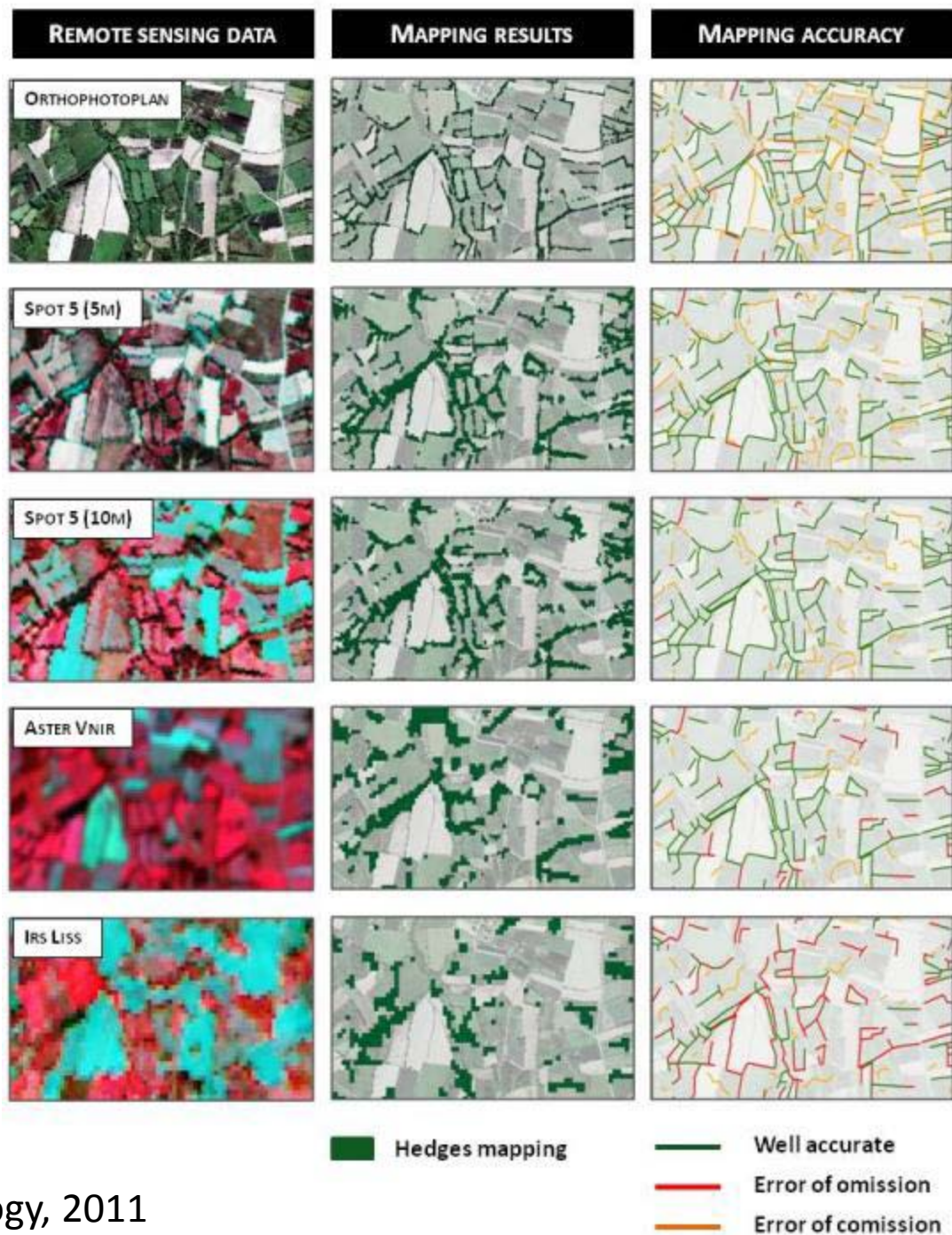
Orthophotos

Spot5

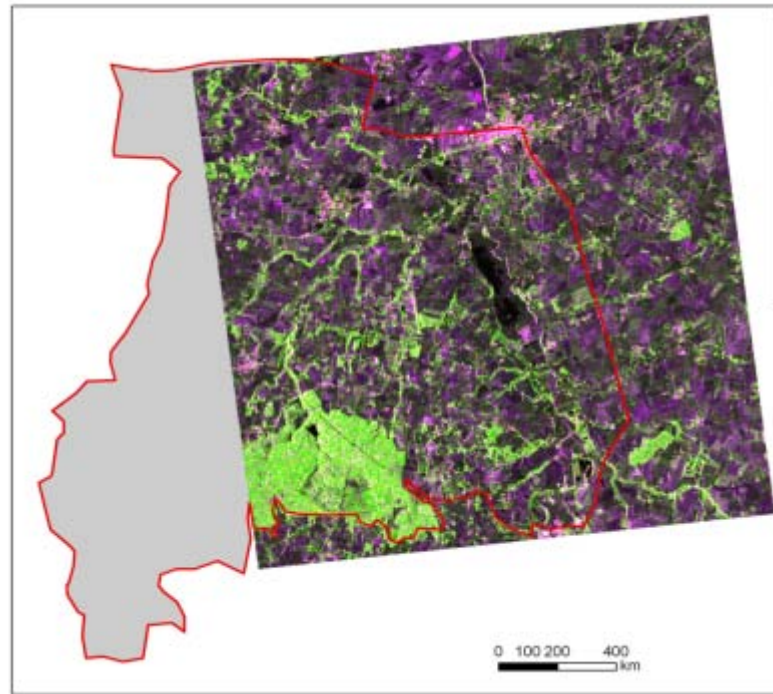
Spot10

Aster

IRS

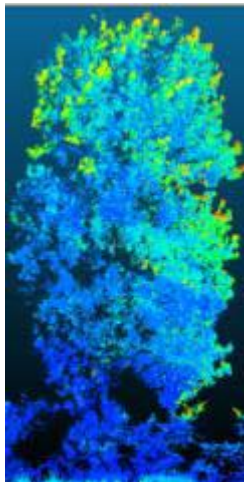


Radar images



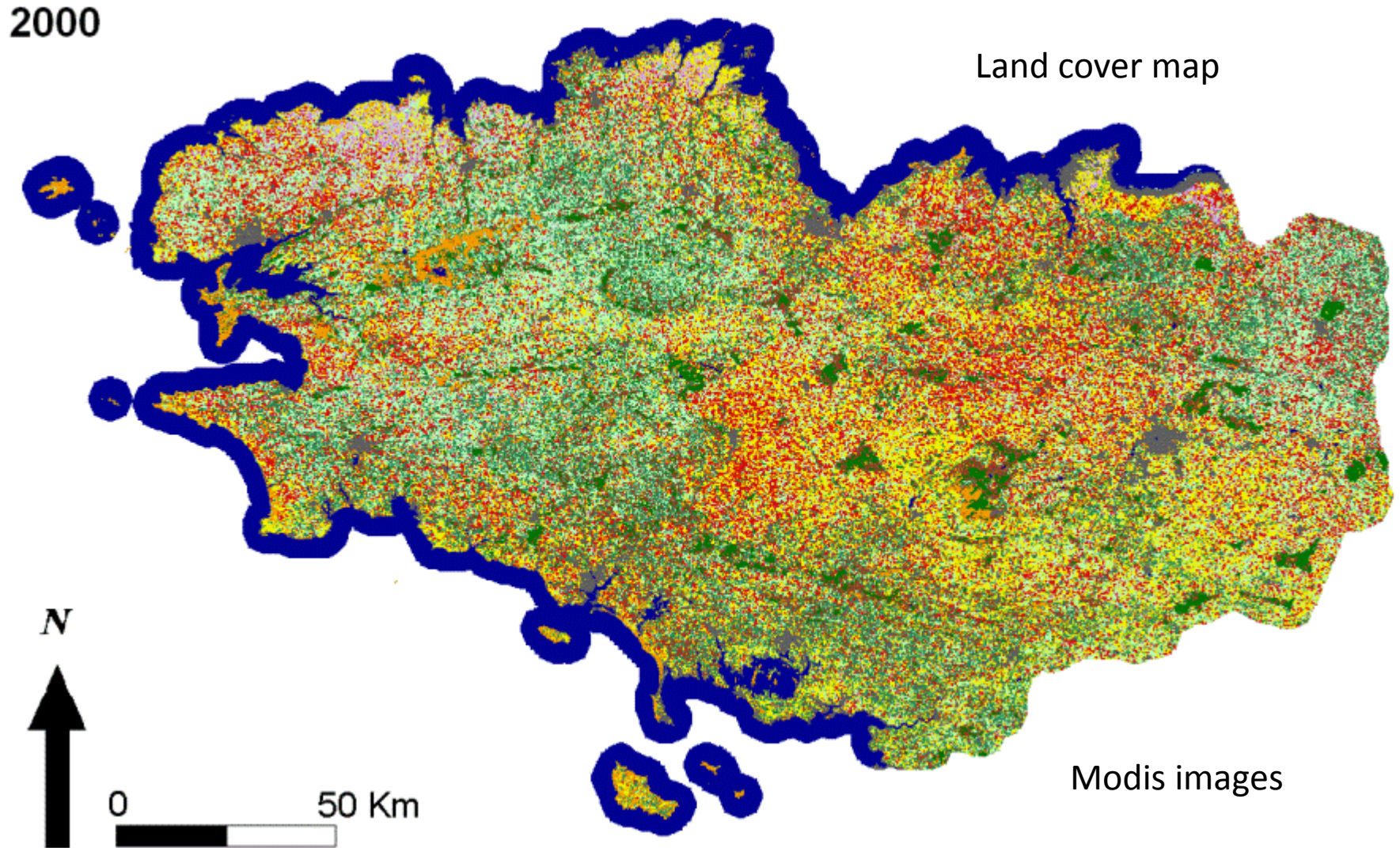
Information about the structure of land covers

Lidar images

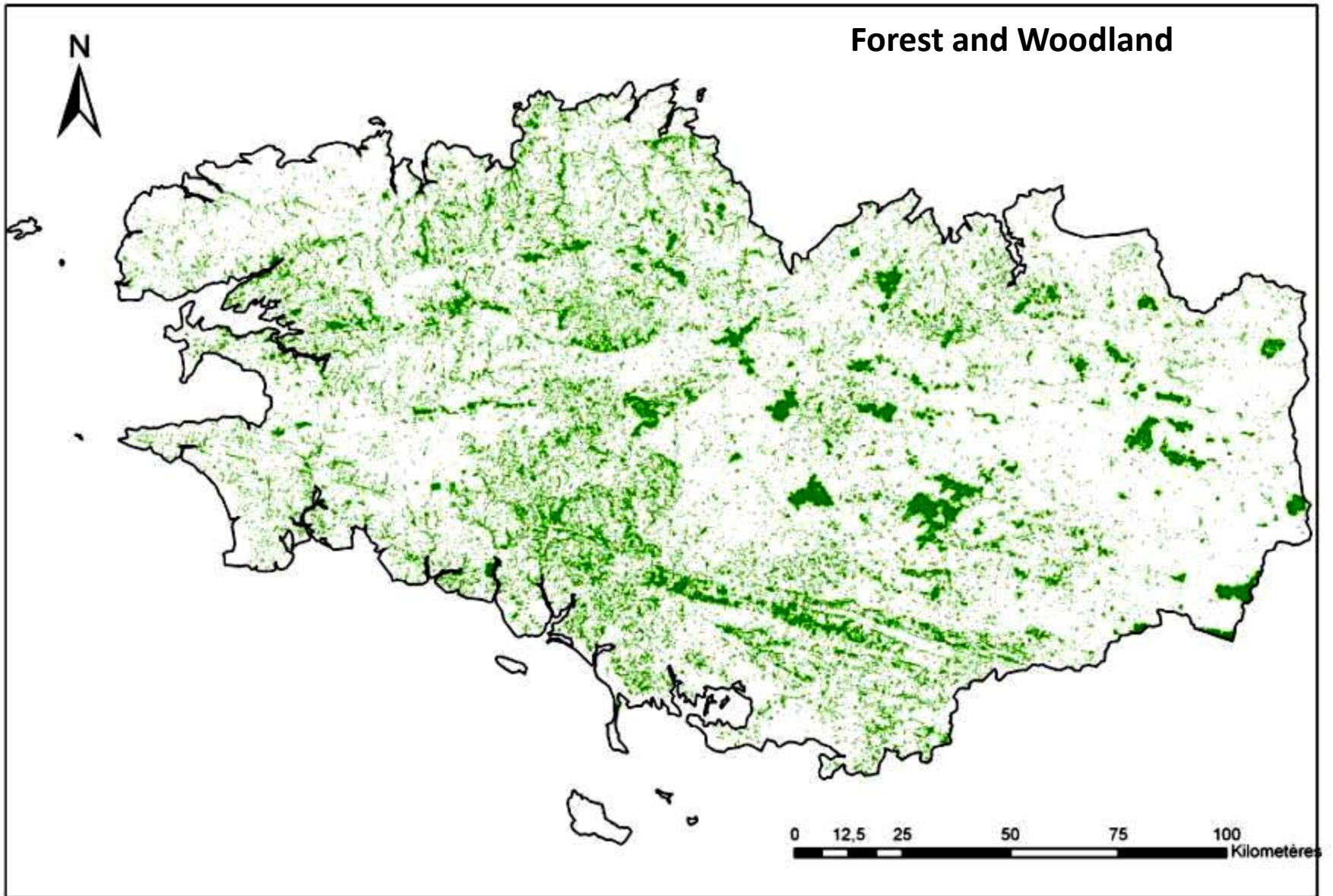


LETG Rennes

An example of corridor mapping at a regional scale



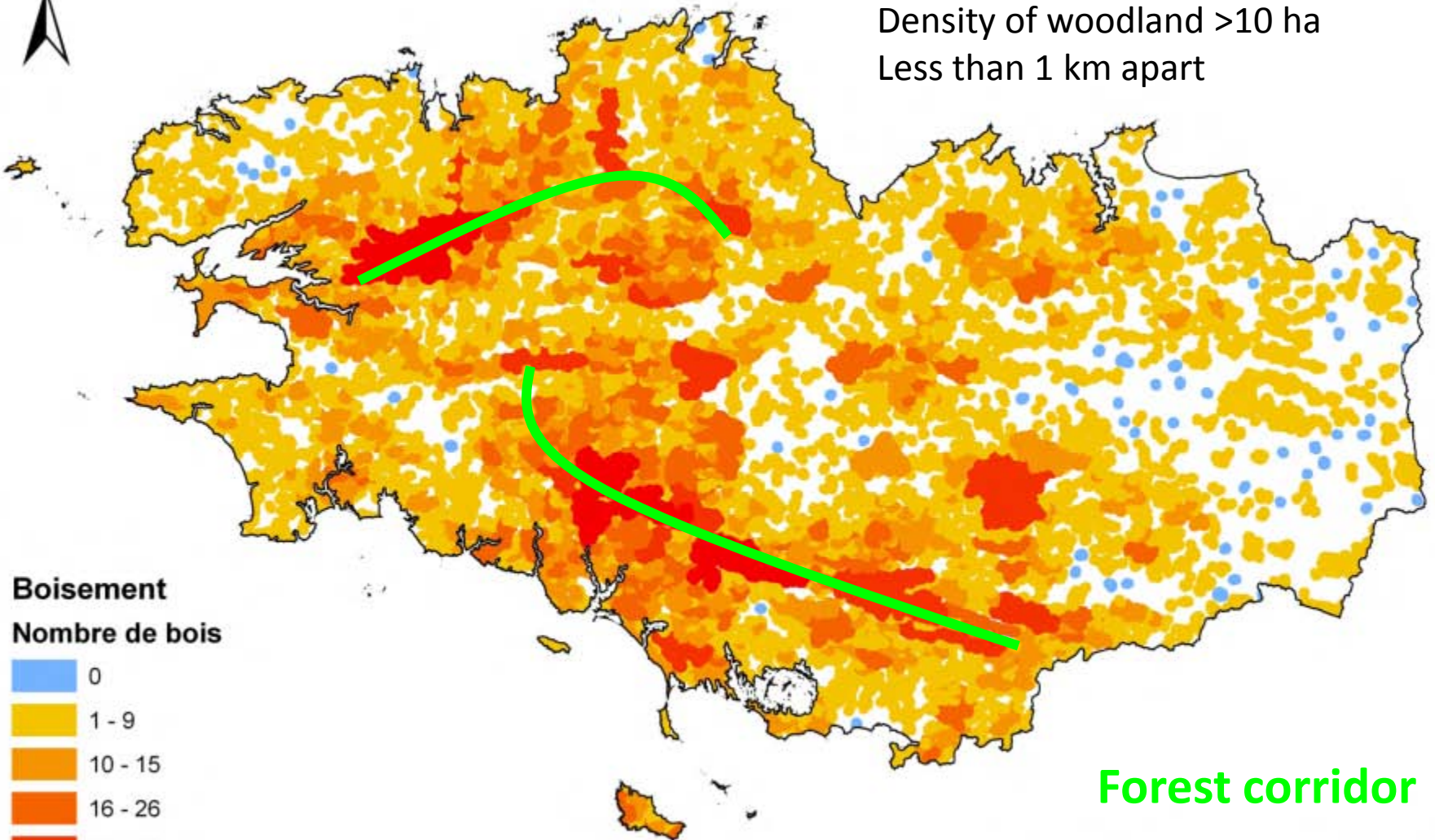
Source : IMAGES MODIS, R Lecerf, 2008



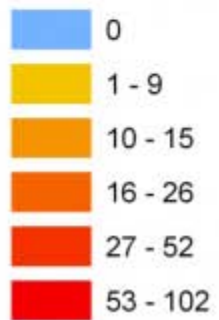
J. Nabucet, P. Dusseux, C. Vannier, B. Clément, L. Hubert-Moy



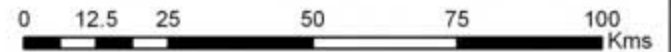
Density of woodland >10 ha
Less than 1 km apart



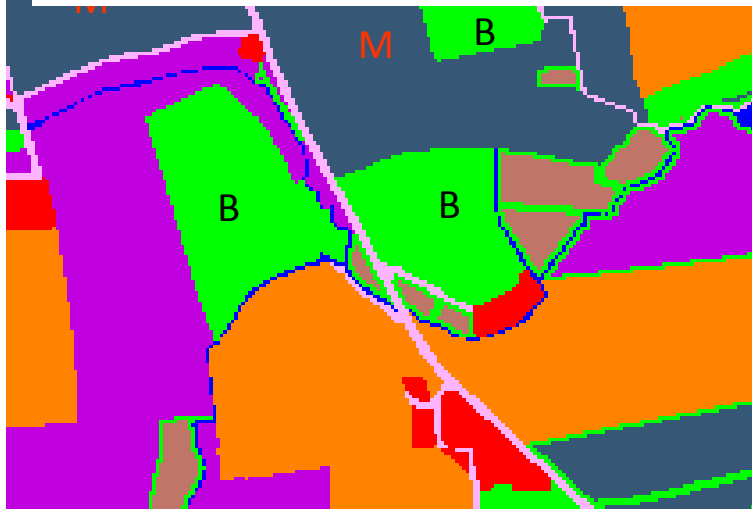
Boisement
Nombre de bois



Forest corridor

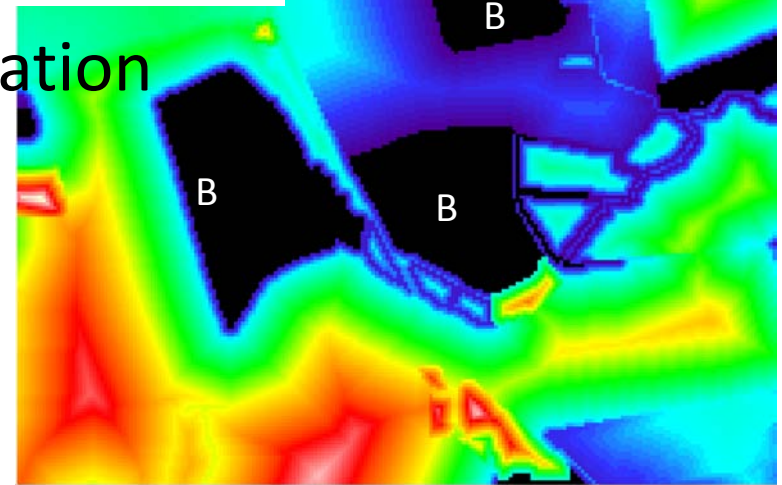


Landscape scale modeling of movements



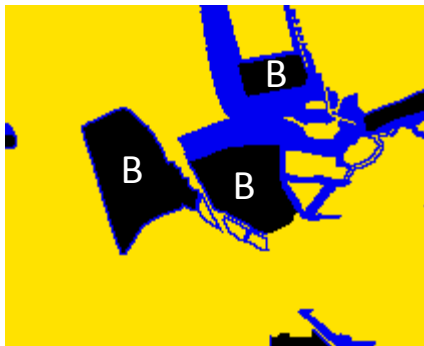
Land cover hedgerows

computation



Increasing cost of movement

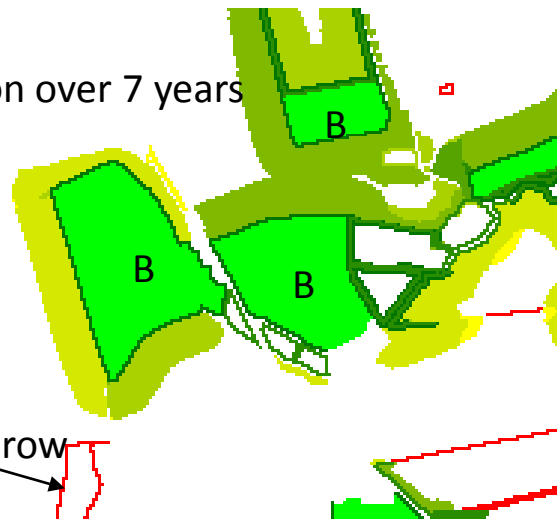
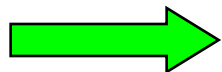
Definitio of a cost threshold



Connectivity year 1

connected

Computation over 7 years



Isolated hedgerow

Connectivity over 7 years



Increasing connectivity

Research on policies and the social integration of networks

The questions:

How do ecological networks can be implemented under the current laws and regulations?

How do the management requirements to maintain the corridor function fit the current land use systems?

What is the involvement of the stakeholders and the general public during the process of designing ecological networks?

What are the scientific information flow from science to policy makers and land managers?

How do ecological networks can be implemented under the current laws and regulations?

Land planning is ruled by many laws and regulations from building permits to river protection

How to use what exist to implement sustainable ecological networks?

How to have multiple land use at a site?

What are the novel legal tools that would be useful?

What are the interactions between rural and peri-urban landscapes?



Urban extension in a rural landscape



How to integrate those landscape features in their new environment?

How do the management requirements to maintain the corridor function fit the current land use systems?



Agricultural landscapes and practices are highly diverse



How do the management requirements to maintain the corridor function fit the current land use systems?

The maintenance or restoration of ecological networks may require several types of changes

In type land cover (shift to permanent grassland from annual crops)

In the localization of crops

Crop management (date of harvesting, ban of the use of pesticide)

Etc.



Farming system scholars conduct surveys among farmers to understand their systems and to evaluate the possible changes and their technical, economical and social feasibility



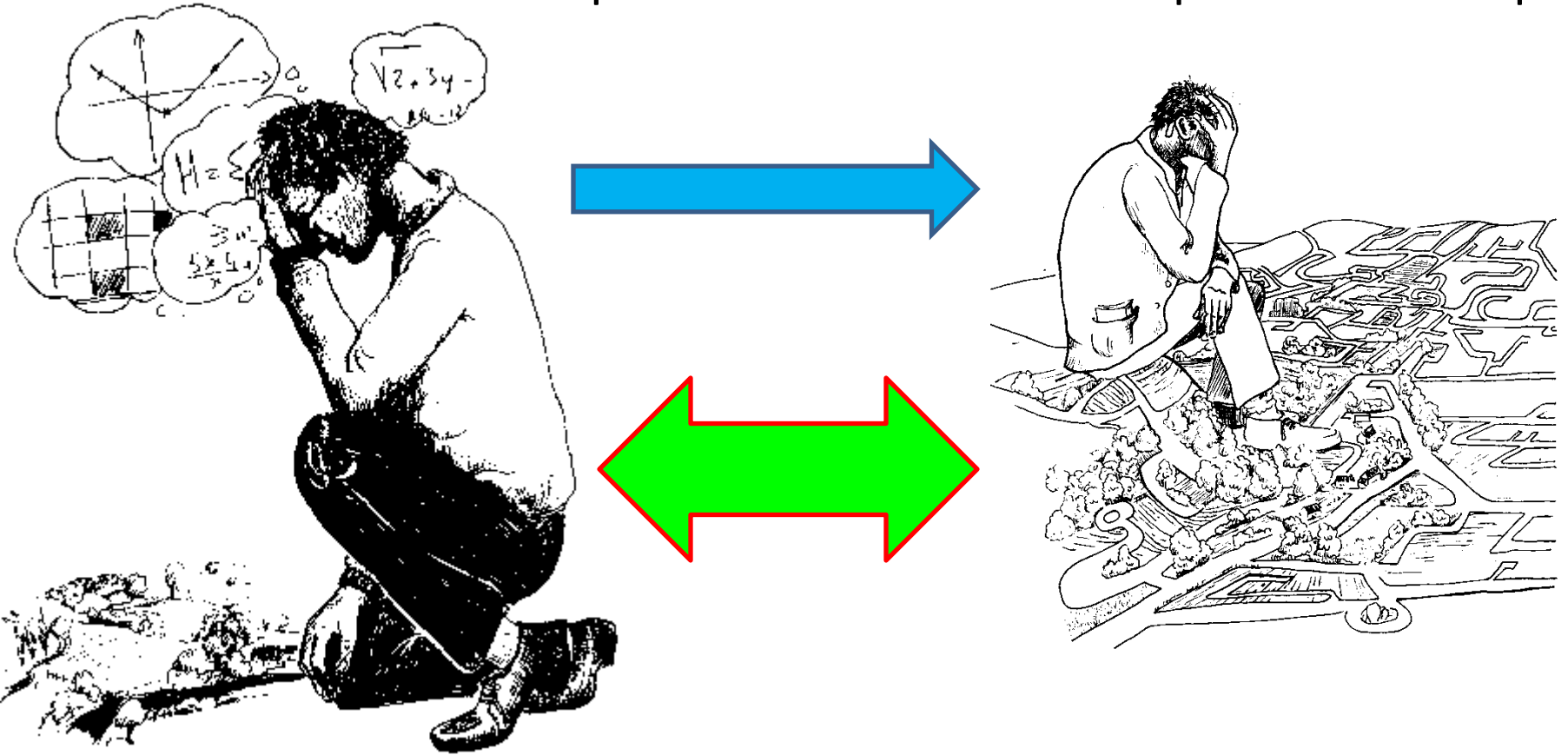
What is the involvement of the stakeholders and the general public during the process of designing ecological networks?

Ecological networks are implemented on private land



What are the scientific information flow from science to policy makers and land managers?

The development of evidence based policies in Europe



Specially for nature conservation <http://www.cebc.bangor.ac.uk/>



Thank you for your attention

The scales of planning: from region to municipalities

