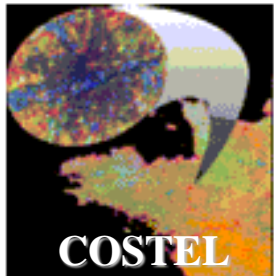




*First BreTel Workshop, May 31 - June 1st 2012, Saint-Malo, FRANCE*

# Contribution of remote sensing for Regional plan of ecological coherence Green and blue belt networks

L. Hubert-Moy, J. Nabucet, S. Dufour  
C. Vannier, S. Corgne, J. Betbeder



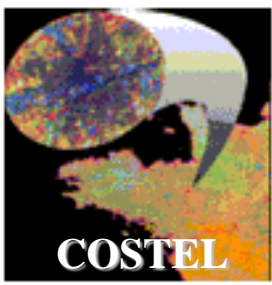
**COSTEL UMR CNRS 6554 LETG/ OSUR**

**UMR 6554 CNRS**



**Observatoire**  
des Sciences de l'Université  
**de Rennes**





# COSTEL UMR CNRS 6554 LETG/ OSUR

## Current applications



UMR 6554 CNRS

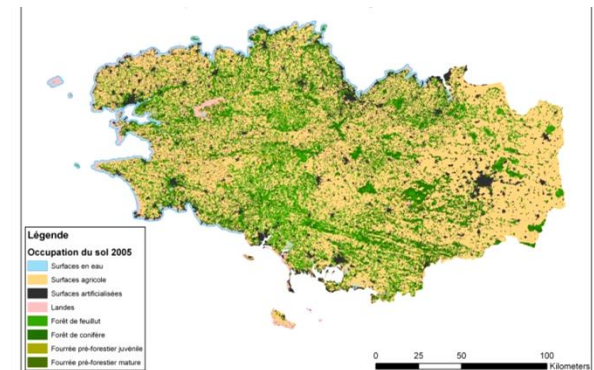
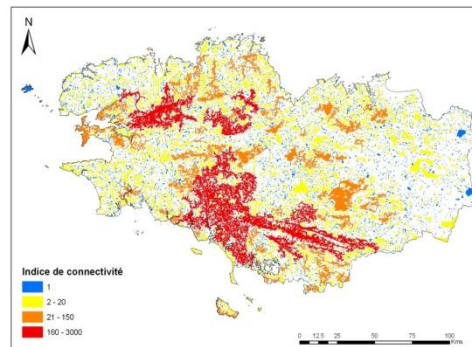
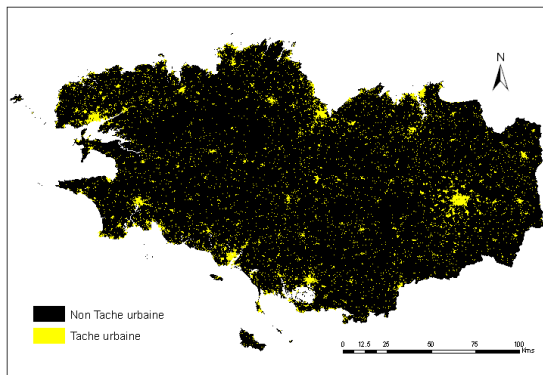
**National scale** : Identification of grassland (Carhab, MEEDTL)

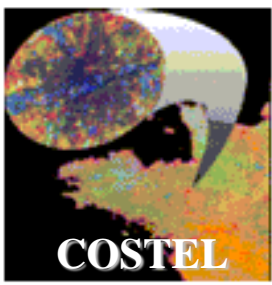


**Régional scale** : Urban sprawl (Agences d'urbanisme)

**Green and blue belt networks (DREALs, Region);**

Wetlands (Region) ; Habitats (Conservatoire botanique de Brest);  
Land cover/Land use (DREALs)





# COSTEL UMR CNRS 6554 LETG/ OSUR

## Current applications



UMR 6554 CNRS

### Local scale:

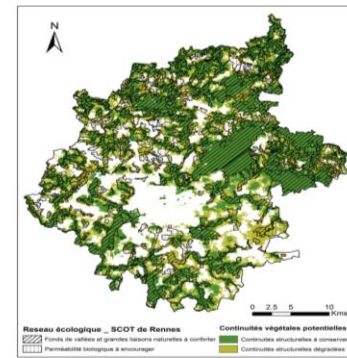
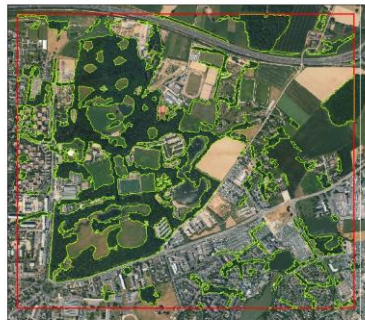
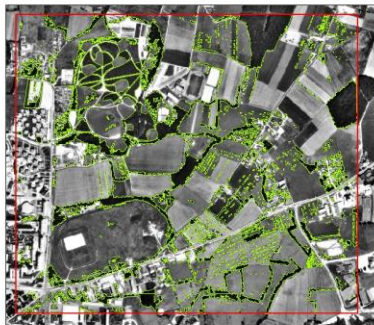
#### Wetlands (EPIDOR)



Soil vegetation cover (Communauté de communes de Lannion; Syndicat de bassin-versant du Scorff)

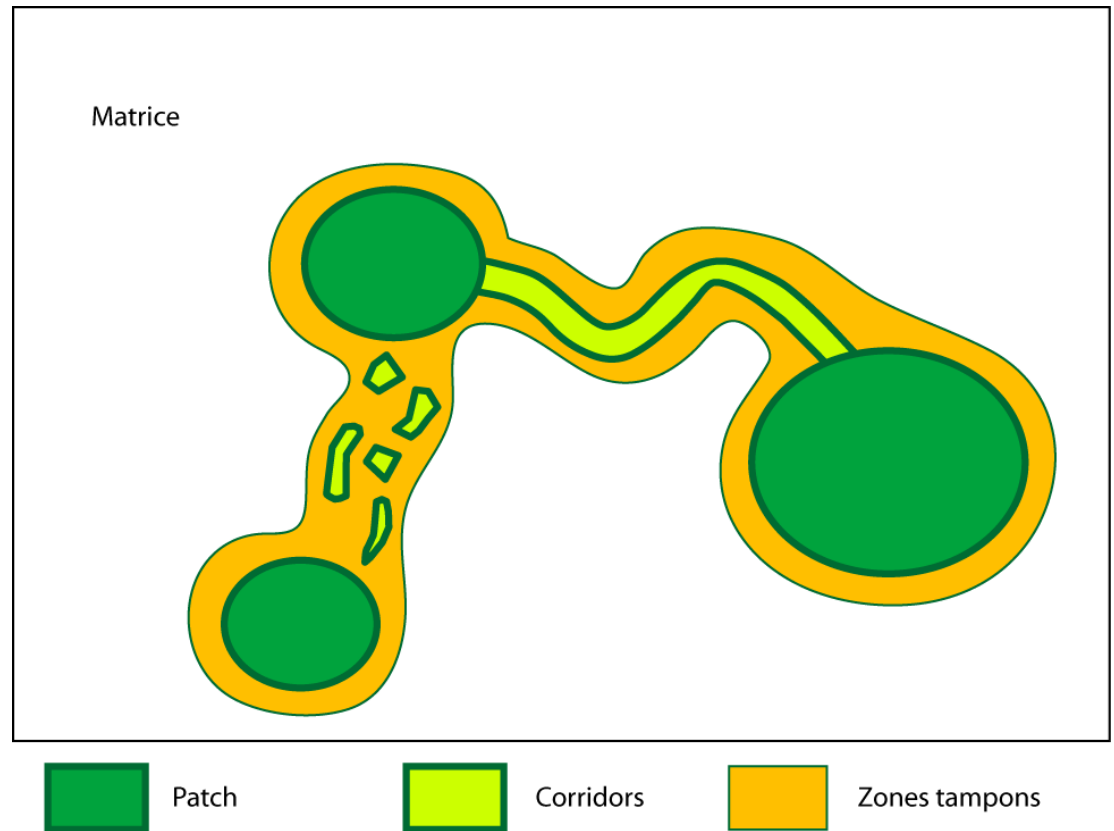


#### Urban green network (AUDIAR)



# GREEN BELT NETWORKS

- **The green belt network** is an ecological network that combines corridors and nuclear zones
- **Nuclear zones** : ecological reservoirs (large woodlands)
- **Corridor** : element of functional connection between two nuclear zones (Wooded hedges, isolated trees)



## Corridor mapping and monitoring at a regional scale and a local scale

→ *DIVA Programmes (MEED)- Project « Corridors »- F. Burel ECOBIO UMR 6553*

→ *NEREUS network*

## Mapping and monitoring of green belts in urban areas

→ *ANR Villes Durables Programme - Project «Green belts»- P. Clergeau MNHN*



- Remote Sensing data are suitable for biological continuities identification and monitoring at different scales
- Maps of ecological corridors derived from remote sensing data can be used as support mapping of green and blue belt networks

→ Research questions:

How to define a corridor at different scales?

What type of remote sensing data have to be used?

Which methods of image processing have to be primarily investigated?

Can we link the corridors at different scales?



# GREEN BELT NETWORKS and REMOTE SENSING

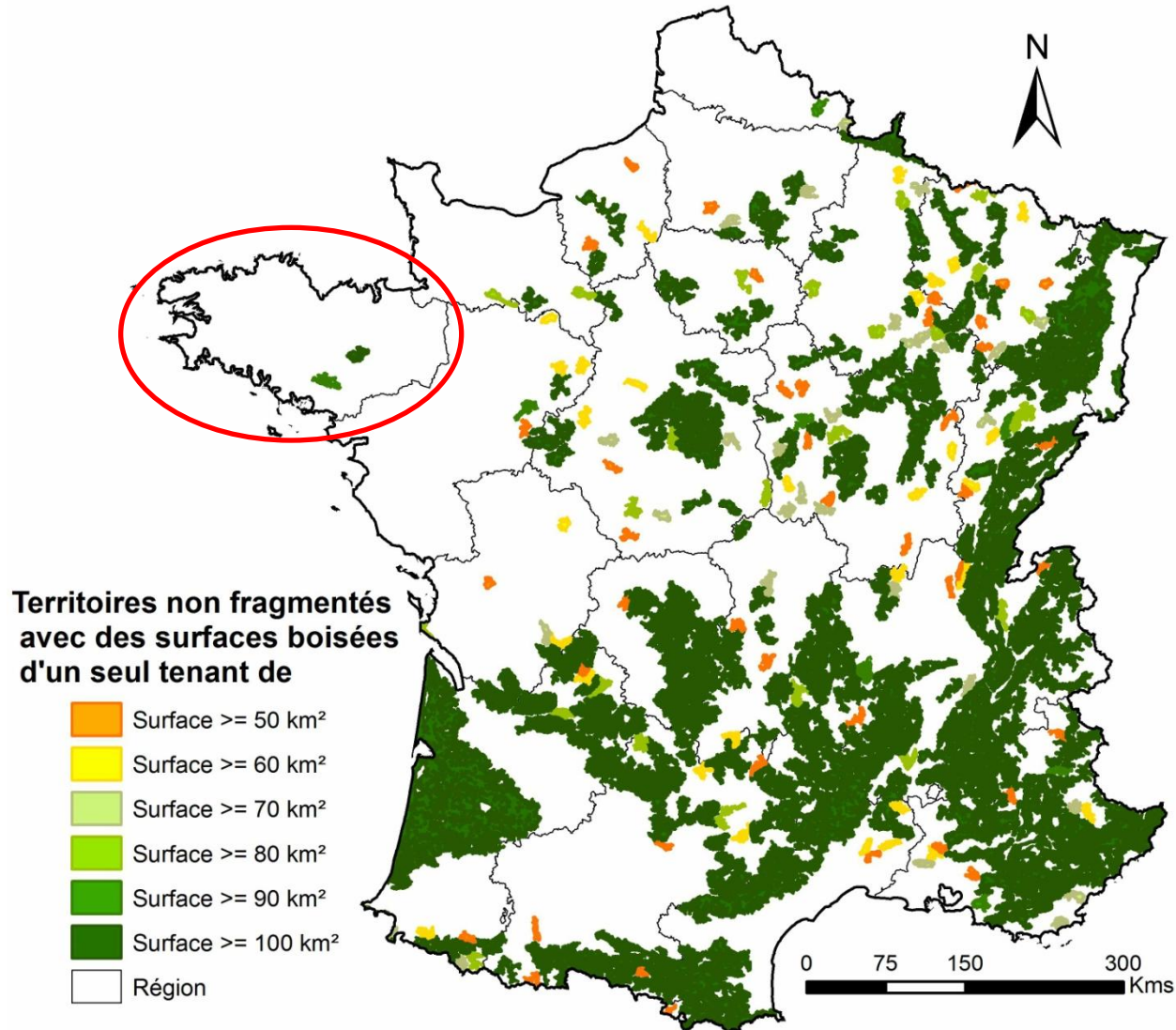
- Layers used to map green and blue belt networks

Scale	National databases		Regional databases
	Raster	Vector	
1/100 000	<b>SCAN100 (IGN ®)</b>	<b>Corine Land Cover (IFEN ®)</b> <b>BD CARTO (IGN ®)</b>	<b>Carte des ZNIEFF</b> <b>Carte des espaces protégés</b> <b>Carte Natura 2000</b>
1/25000	<b>SCAN25 (IGN ®)</b>	<b>Carte nationale des habitats (MEDDTL)</b> <b>BD CARTHAGE (IGN ®)</b>	
1/10000	<b>Bd Ortho (IGN ®)</b>	<b>Bd Topo (IGN ®)</b> <b>Carte nationale forestière (IGN ®)</b>	<b>Carte locale des habitats</b>

*D'après B. DAVID (DNP), C. FEUILLET (IFEN), M. DESHAYES (Cemagref)*

# GREEN BELT NETWORKS and REMOTE SENSING

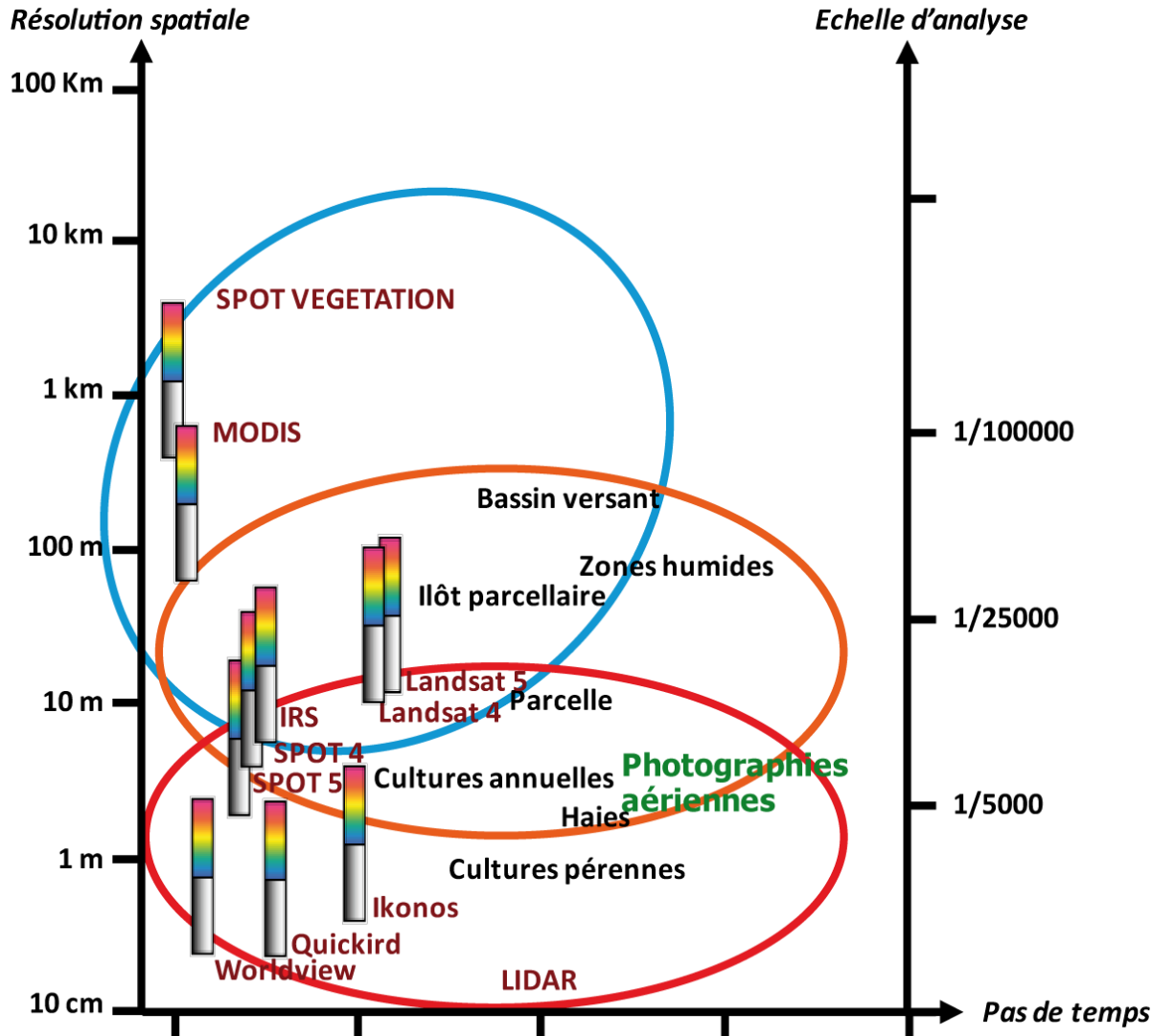
## • Distribution of connected terrestrial « natural » areas



(Source : Corine Land Cover, d'après Deshayes, 2006)

# GREEN BELT NETWORKS and REMOTE SENSING

## Remote sensing data



## Regional scale




→ MSR images: MODIS

→ HSR images: Landsat/IRS

## Local scale

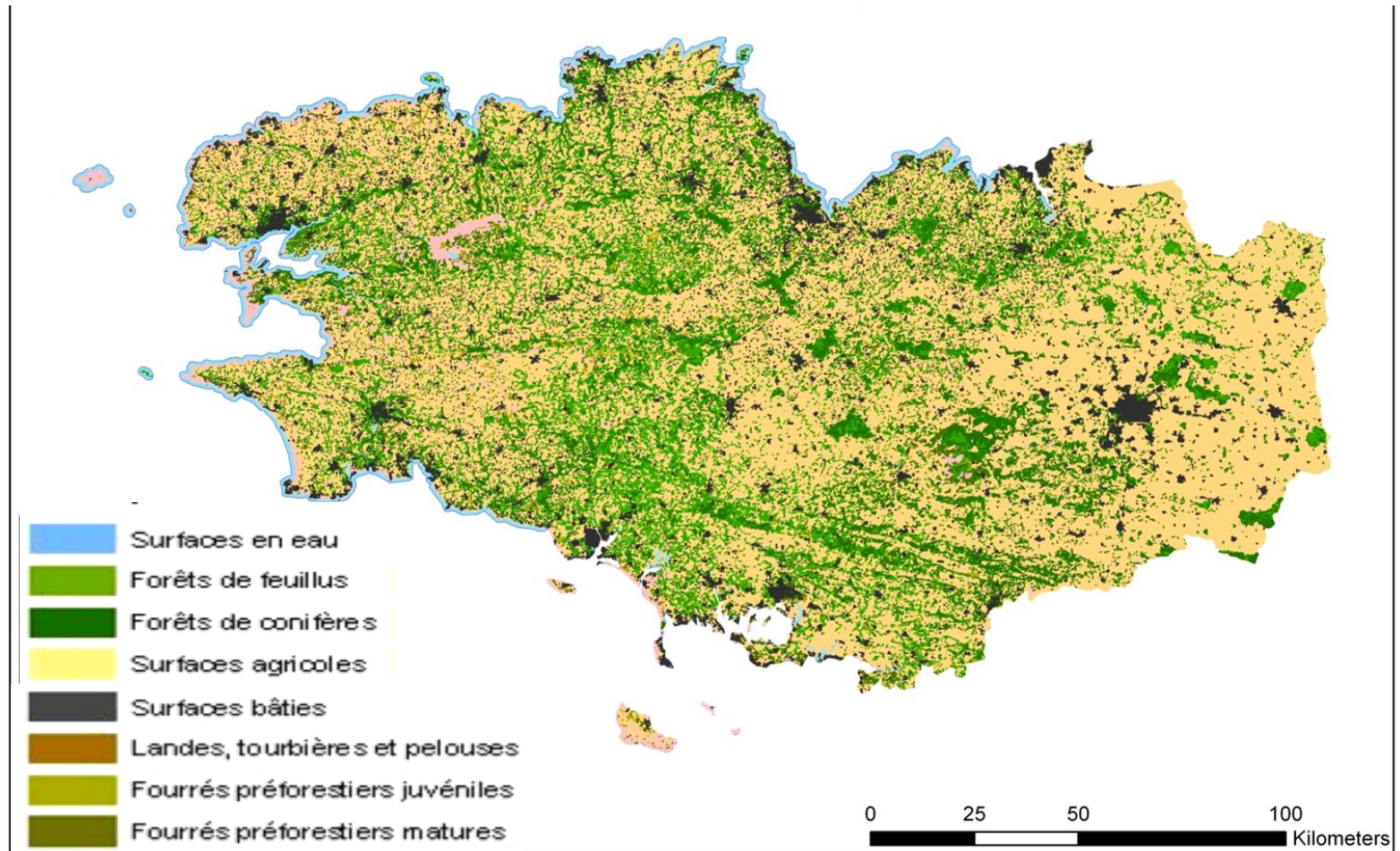
→ VHSR satellite images : SPOT 5, Quickbird, Kompsat, Worldview 2

→ VHSR Airborne data: aerial photos, LiDAR data

-  Echelle régionale
-  Echelle intercommunale
-  Echelle communale



- Land cover map (Brittany, 2005)

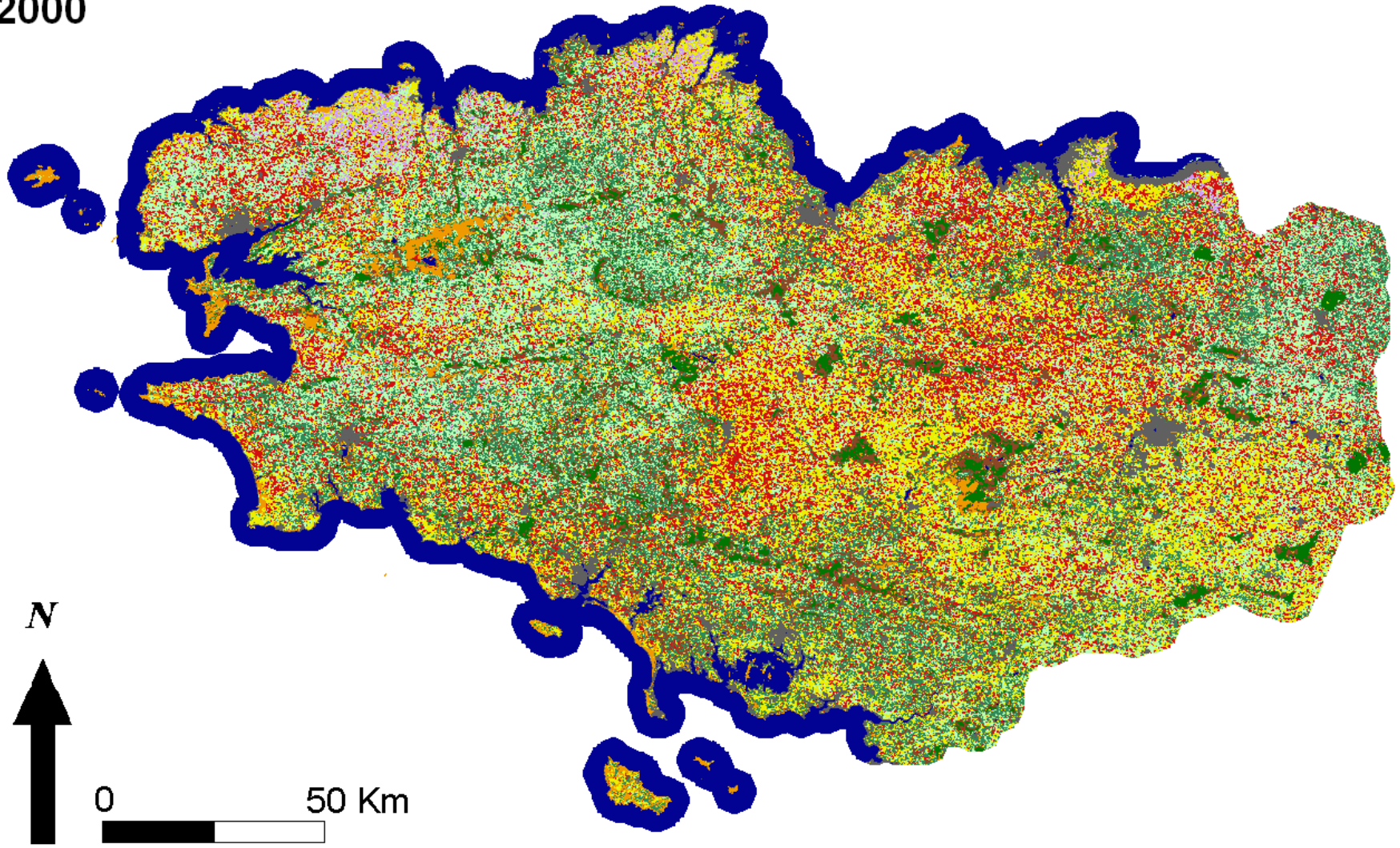


Source : IMAGES LANDSAT, J. Nabucet, P. Dusseux, C. Vannier, B. Clément, L. Hubert-Moy

# THE REGIONAL SCALE

• Land cover map (Brittany, 2001-2012)

2000

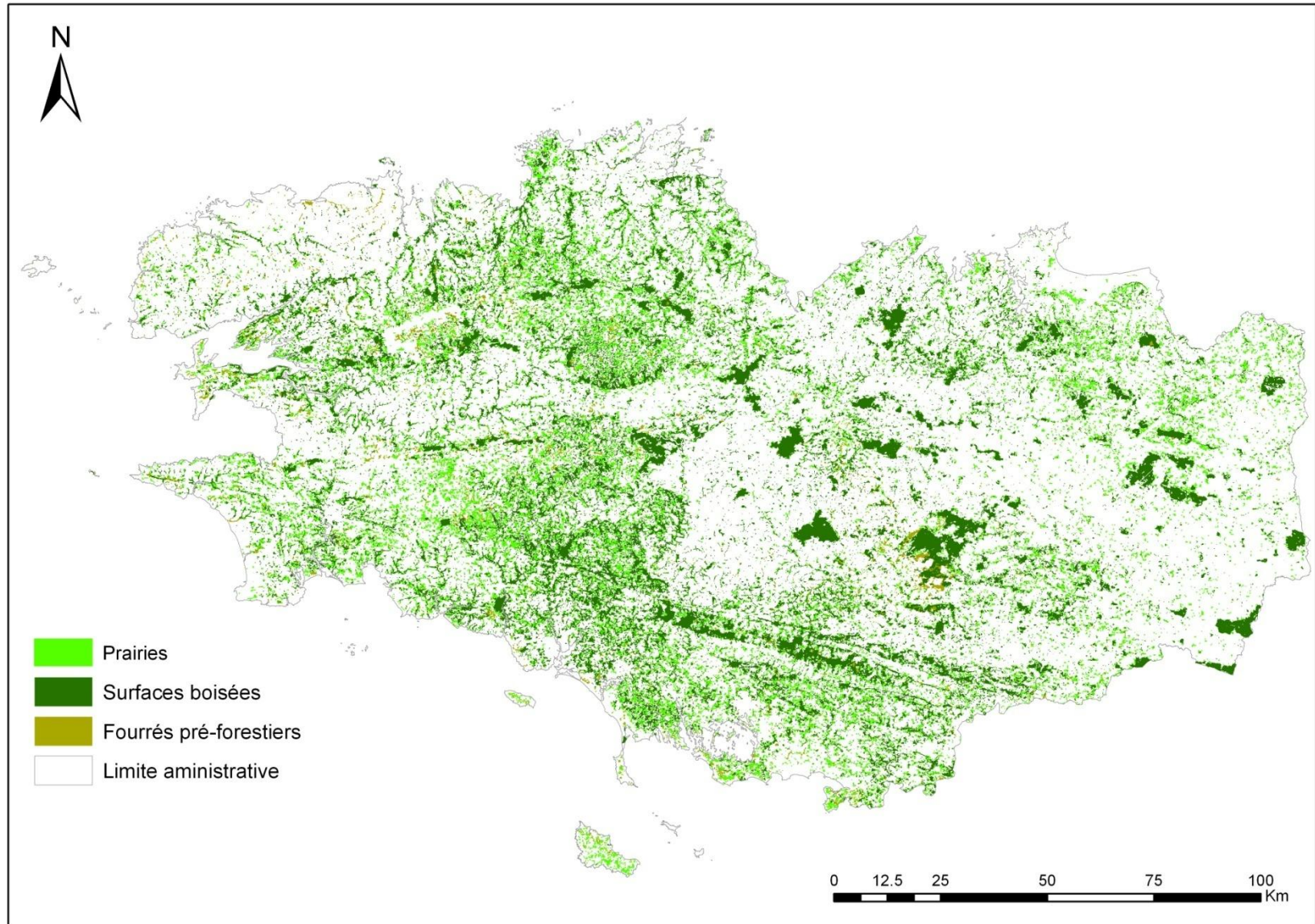


Source : IMAGES MODIS, R Lecerf



# THE REGIONAL SCALE

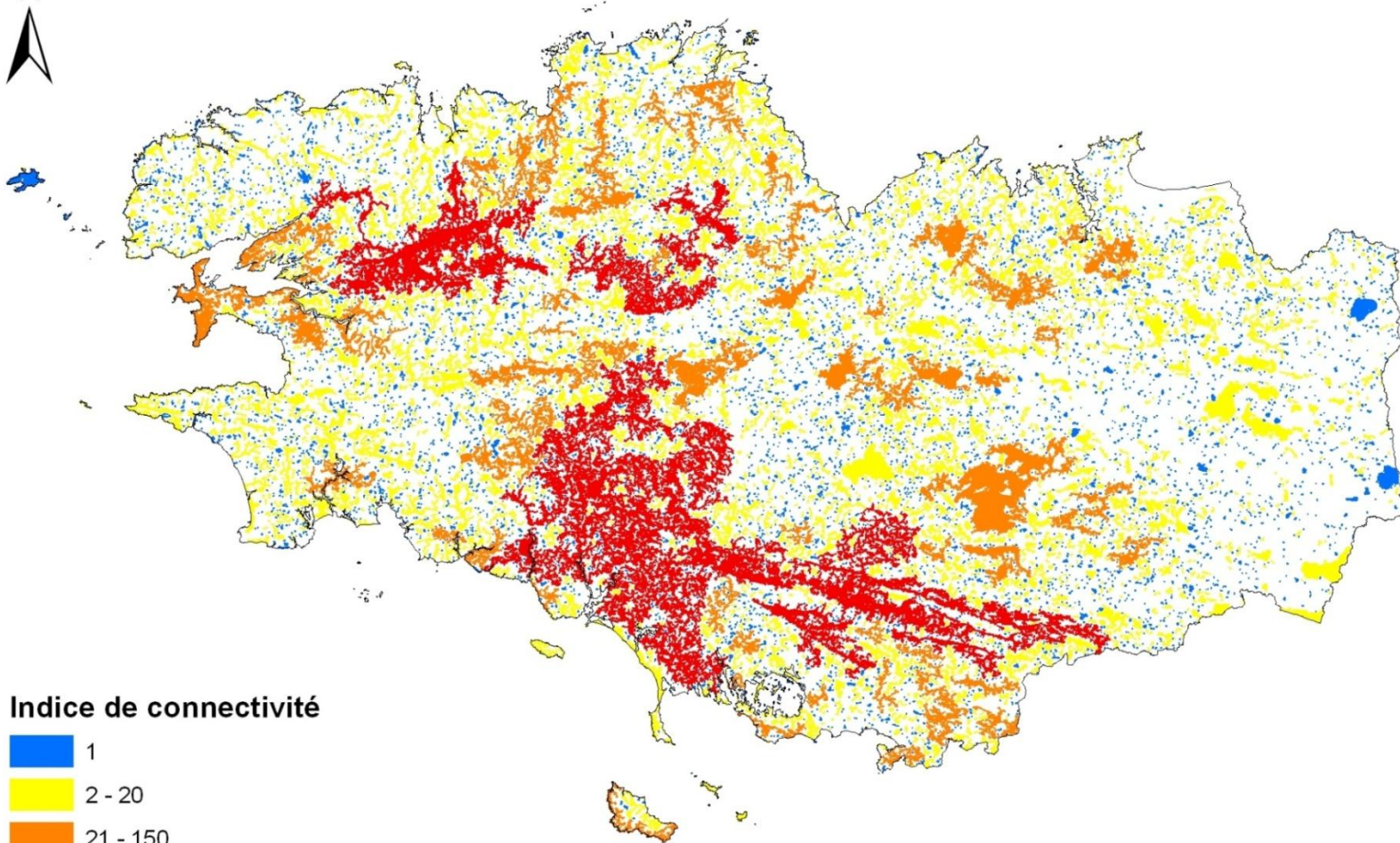
- Map of wooded surfaces and grassland (Brittany, 2005)



# THE REGIONAL SCALE

- **Connectivity map of wooded surfaces (Brittany, 2005)**

Number of wooded elements > 1Ha connected with a distance < 100m

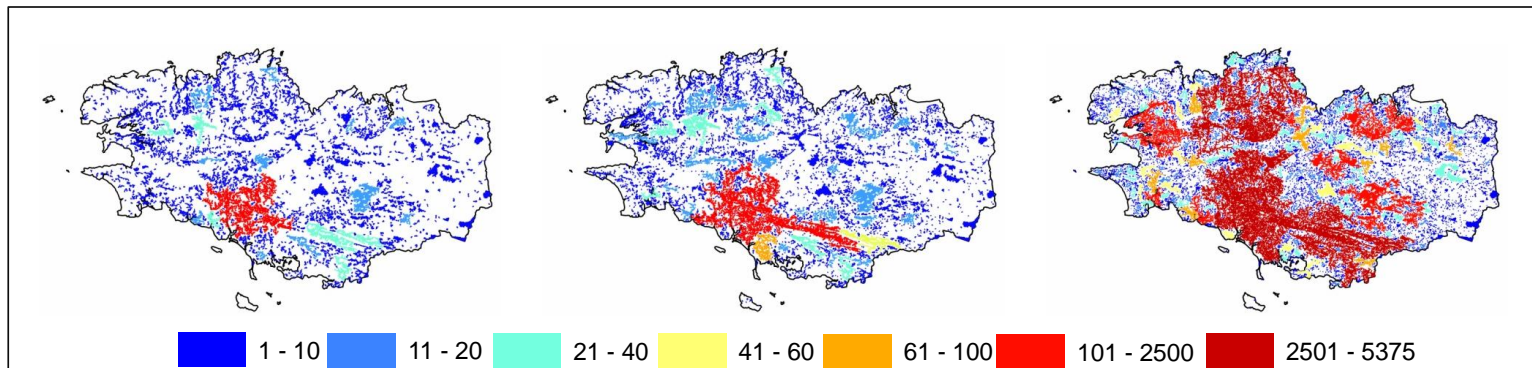
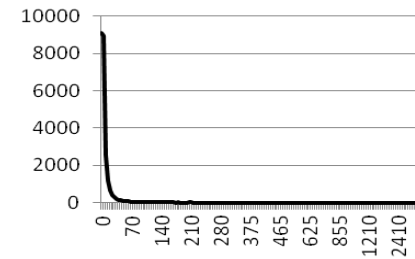
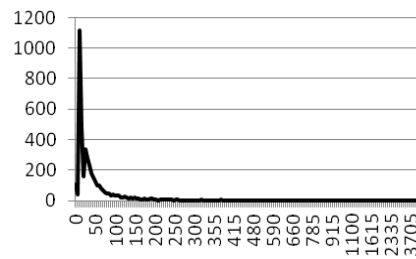
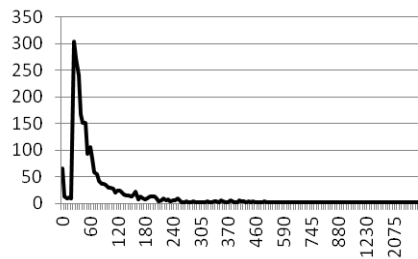
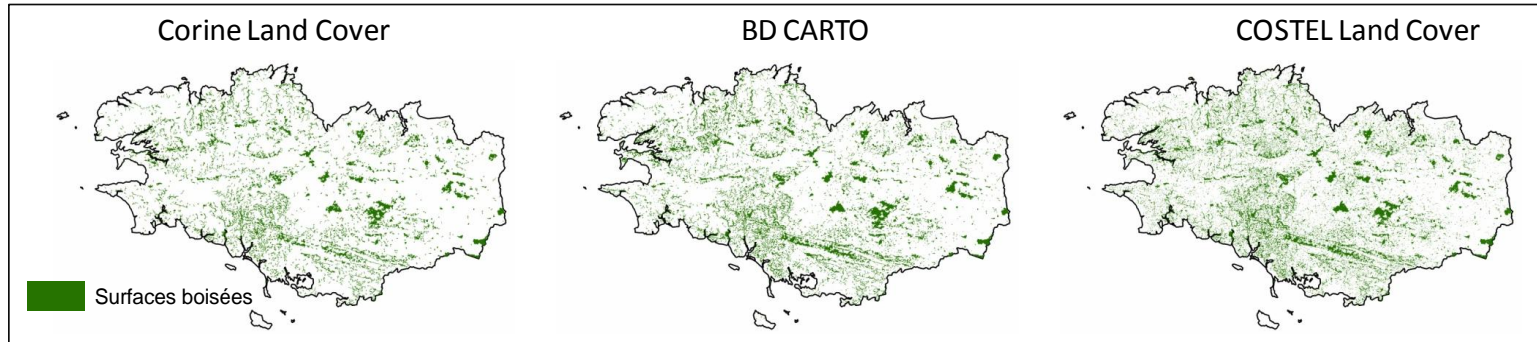


Indice de connectivité

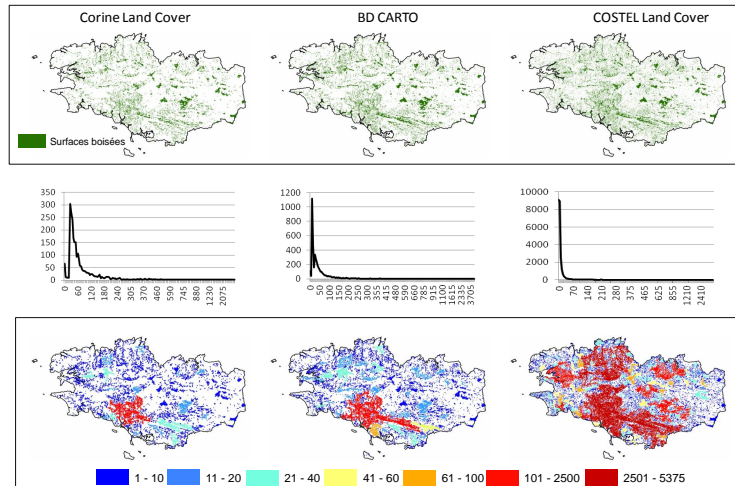




- Connectivity maps of wooded surfaces from different sources

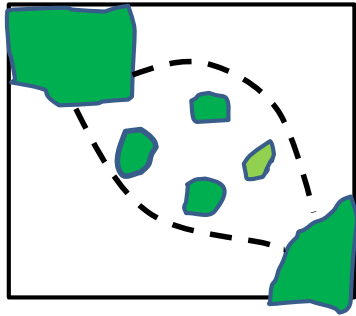


- Connectivity maps of wooded surfaces from different sources

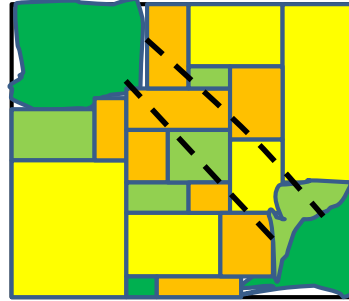


Data	Dominant surface class (ha)	Number of connected wooded elements	Surface of the larger wooded element (ha)	Mean surfaces of wooded elements (ha)
Corine Land Cover	25-30	272	10020	110.3
BD CARTO IGN ®	10-15	1116	10870	77.1
COSTEL Land Cover	0-5	9092	7695	15.8

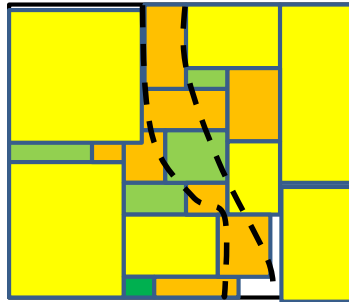
- 3 types of ecological corridors



Type 1: Trame éléments semi naturels + prairies permanentes



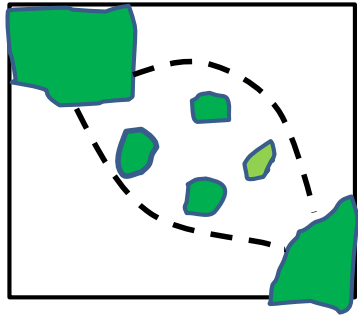
Type 2: Trame agricole entre éléments naturels



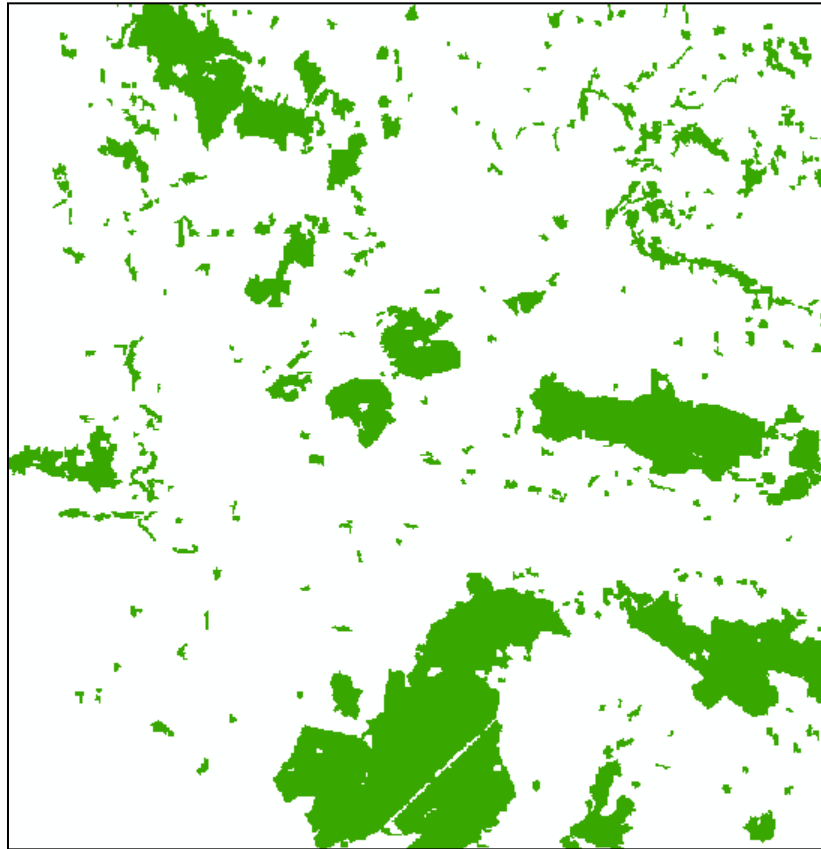
Type 3: Trame agricole dans une zone cultivée



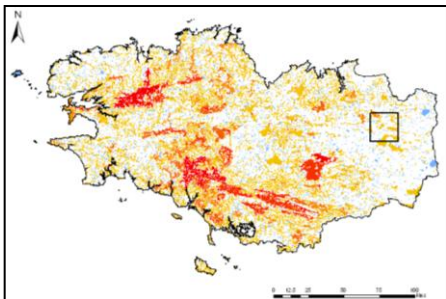
# THE LOCAL SCALE



Type 1: Trame éléments semi naturels+ prairies permanentes

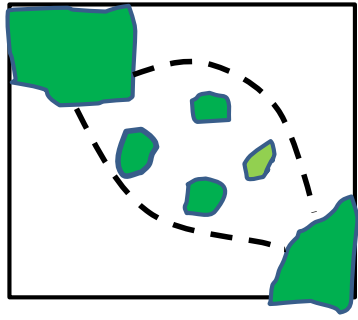


Nabucet & Hubert-Moy

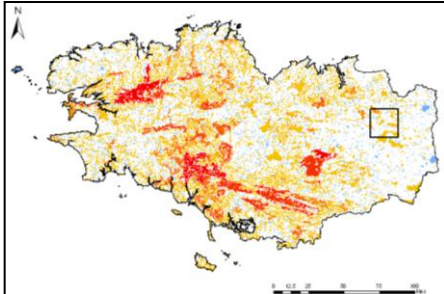
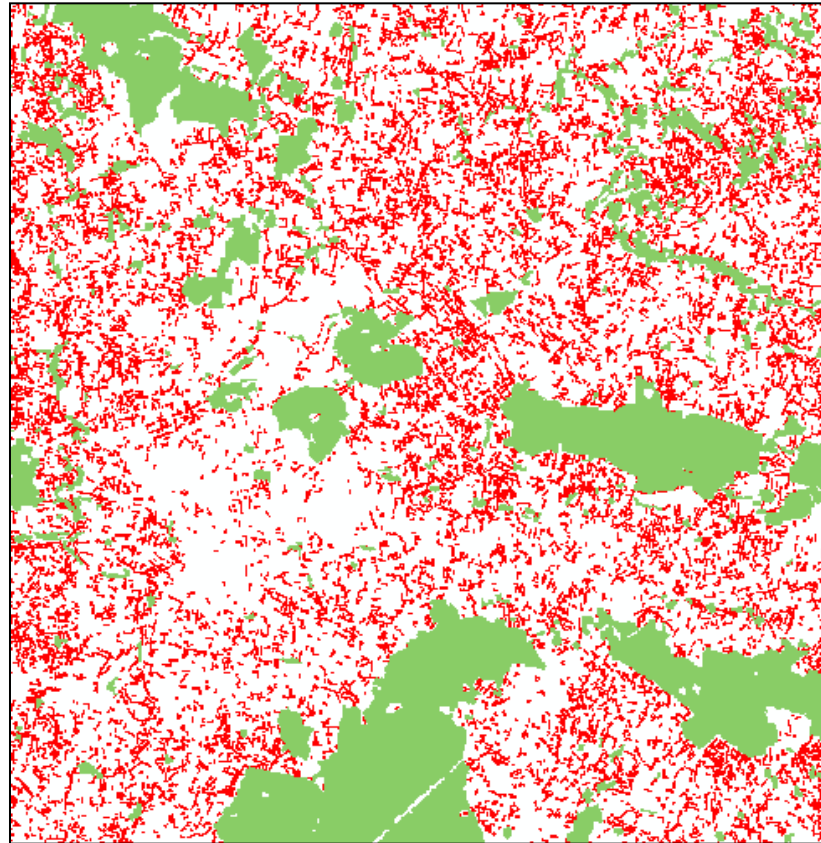




# THE LOCAL SCALE

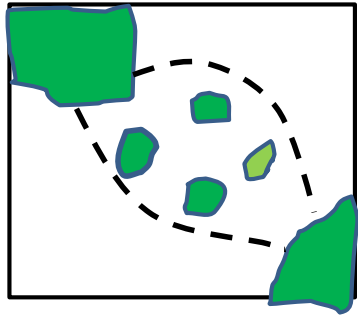


Type 1: Trame éléments semi naturels+ prairies permanentes

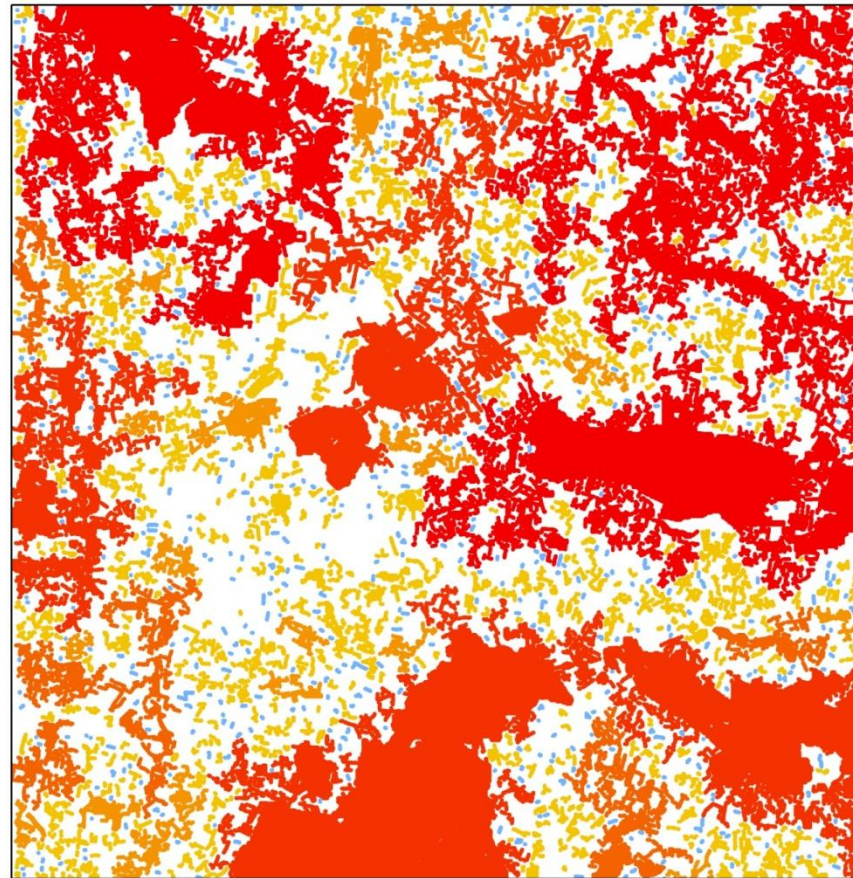
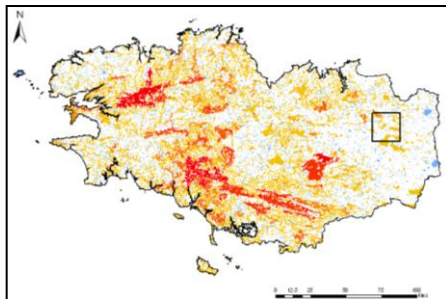


Nabucet & Hubert-Moy

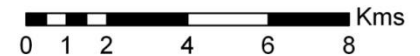
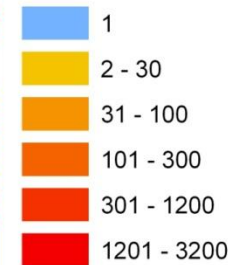
# THE LOCAL SCALE



Type 1: Trame éléments semi naturels + prairies permanentes



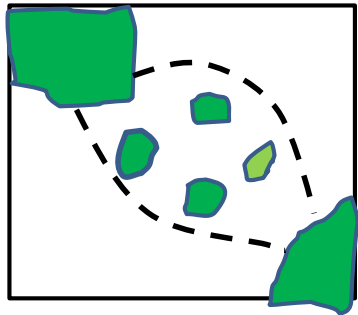
Eléments boisés (50m)  
Nombre d'éléments



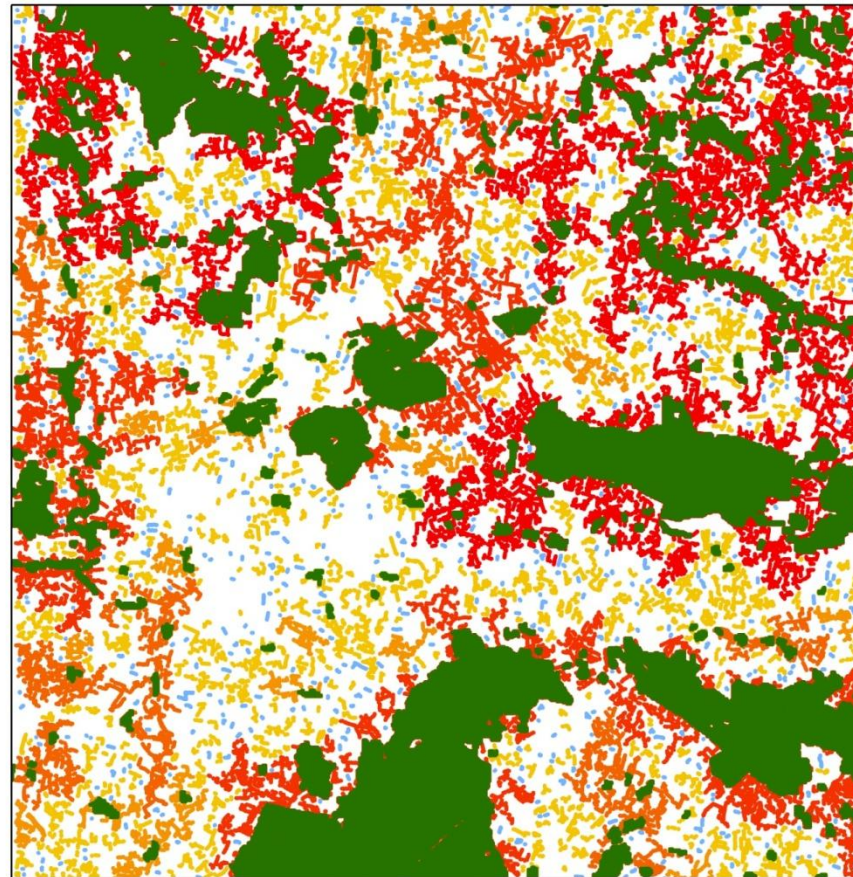
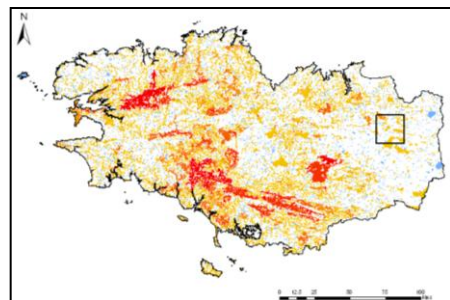
Nabucet & Hubert-Moy



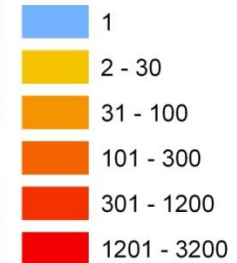
# THE LOCAL SCALE



Type 1: Trame éléments semi naturels + prairies permanentes



**Éléments boisés (50m)**  
**Nombre d'éléments**

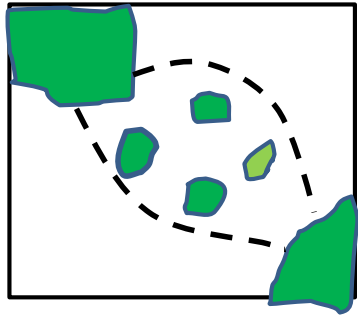


**Boisements supérieurs à 1 Ha**

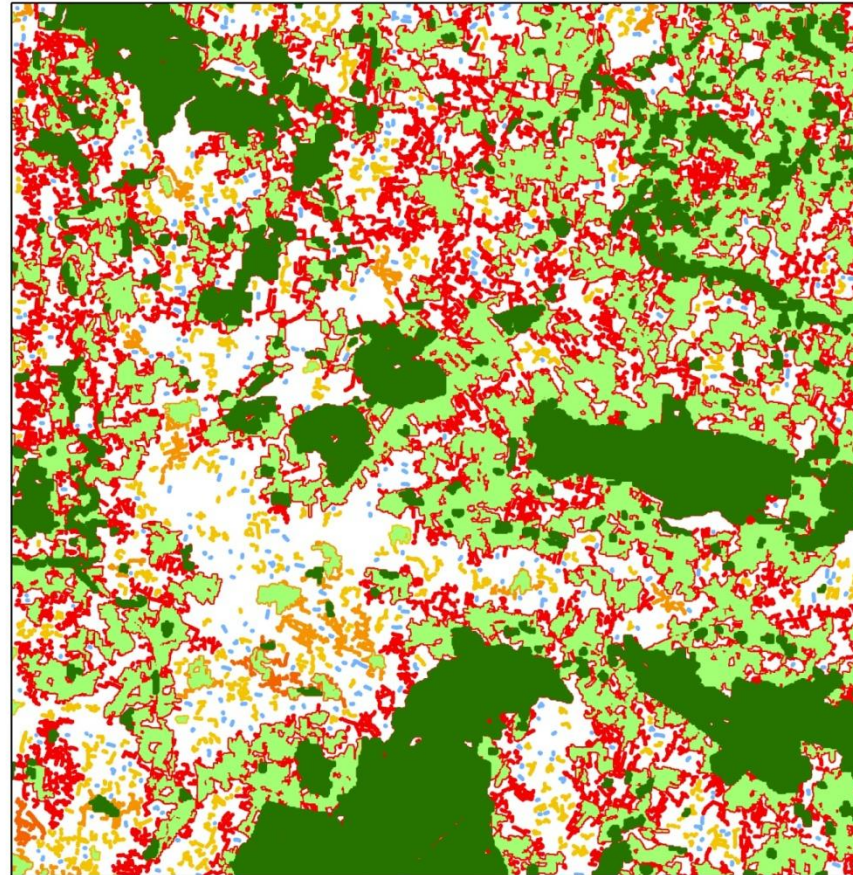
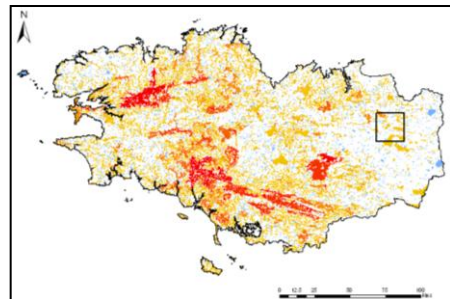


Nabucet & Hubert-Moy

# THE LOCAL SCALE

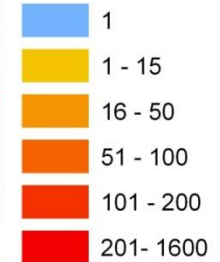


Type 1: Trame éléments semi naturels + prairies permanentes



**Éléments structurants (50m)**

**Nombre d'éléments**



**Boisements supérieurs à 1 Ha**



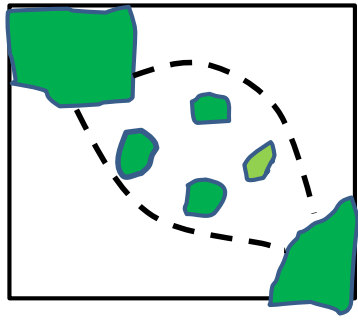
**Prairie longue durée (MODIS)**



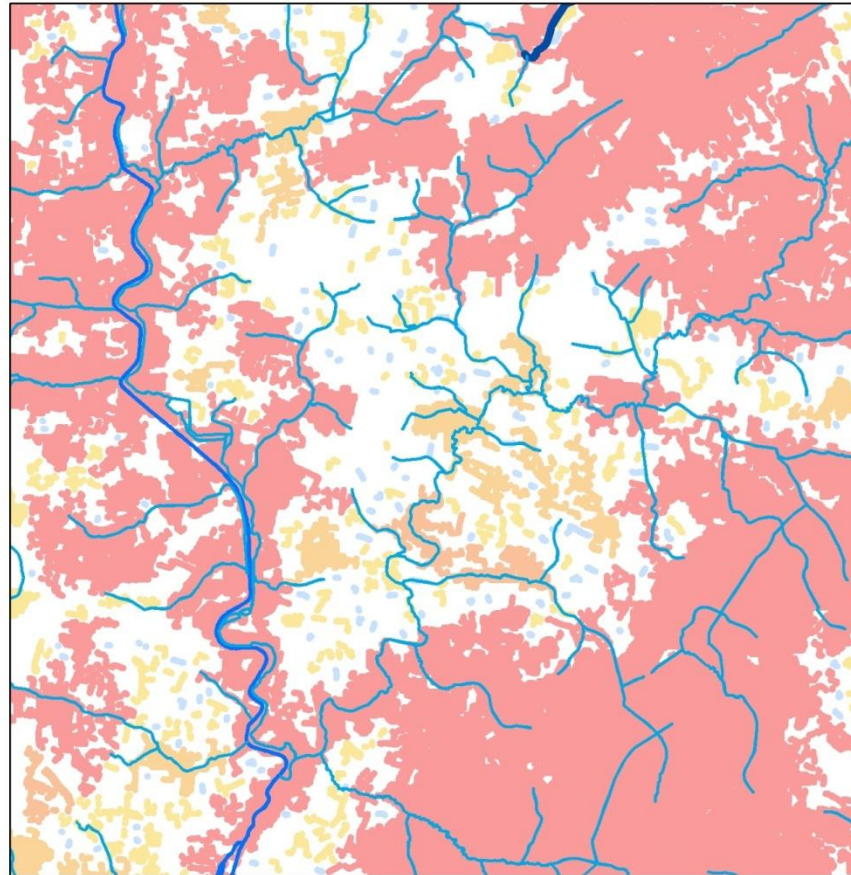
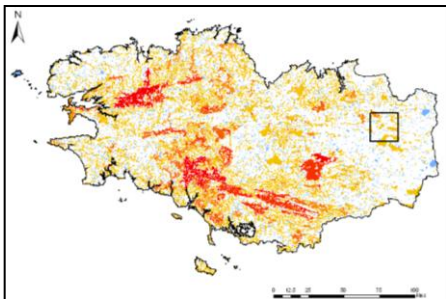
Nabucet & Hubert-Moy



# THE LOCAL SCALE



Type 1: Trame éléments semi naturels+ prairies permanentes



Réseau hydrographique

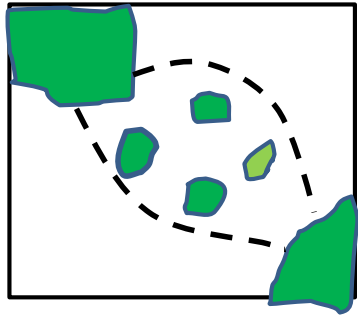
Largeur

- de 0 à 15 mètres
- Entre 15 et 50 mètres
- Plus de 50 mètres

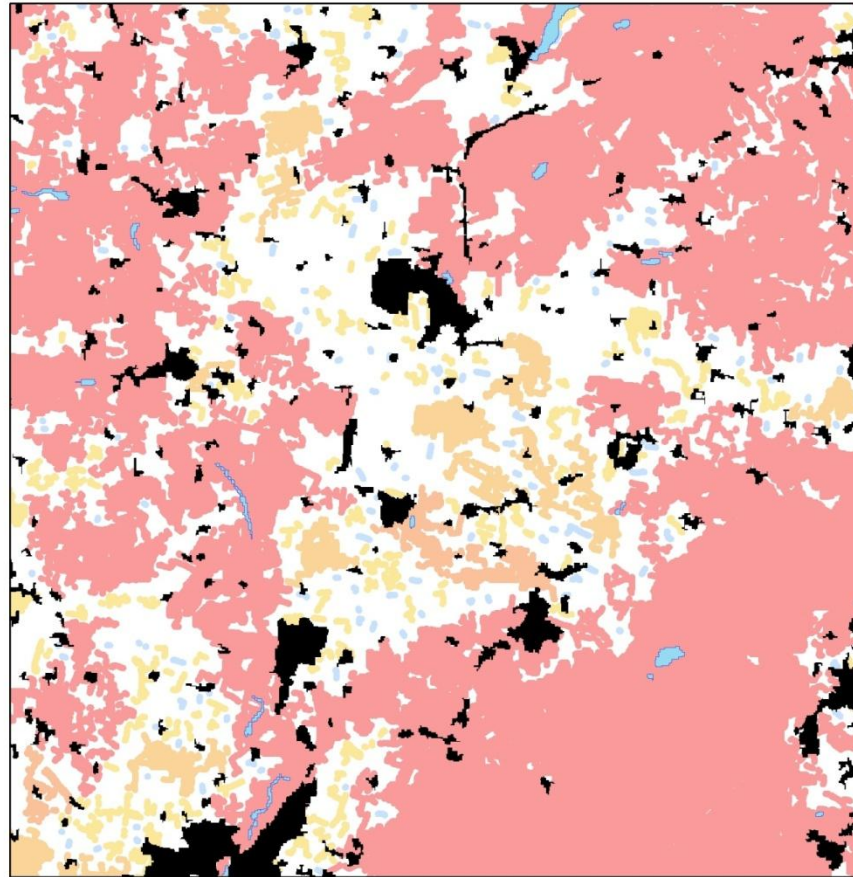
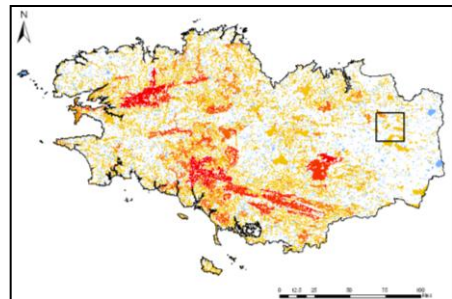
0 0.5 1 2 3 4 Kms

Nabucet & Hubert-Moy

# THE LOCAL SCALE

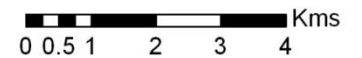


Type 1: Trame éléments semi naturels+ prairies permanentes



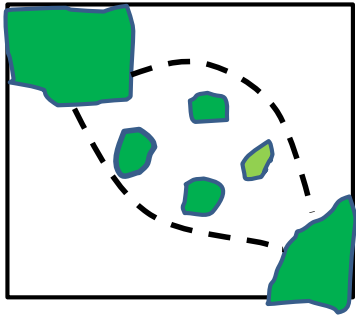
### Classes de ruptures

- Surfaces en eau
- Surfaces Bâties

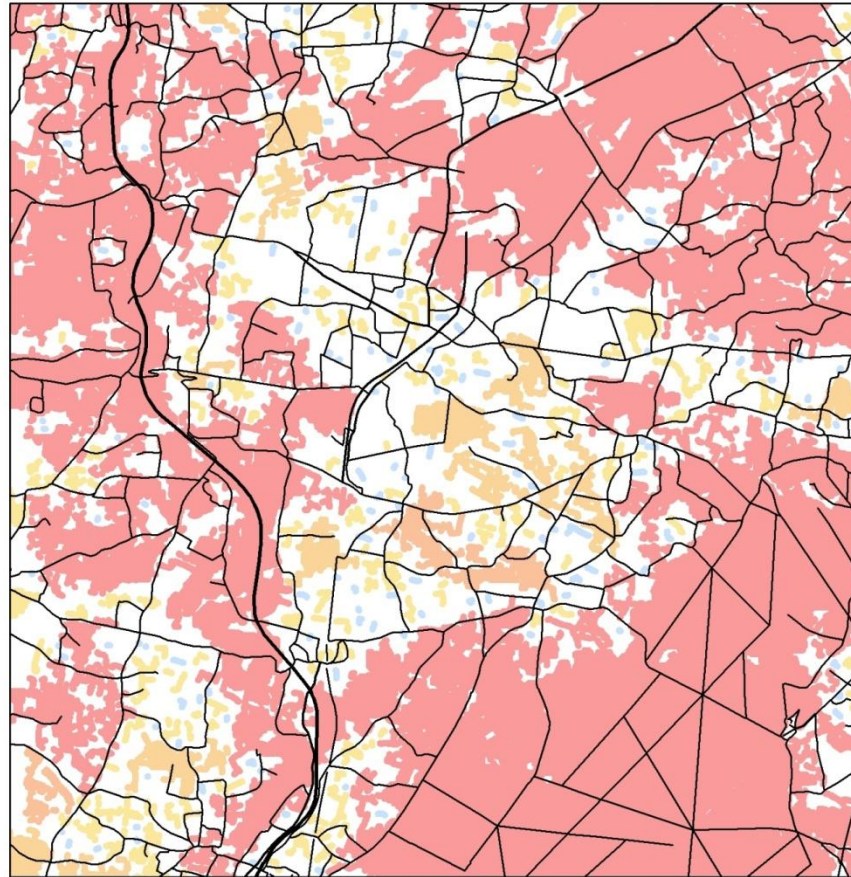
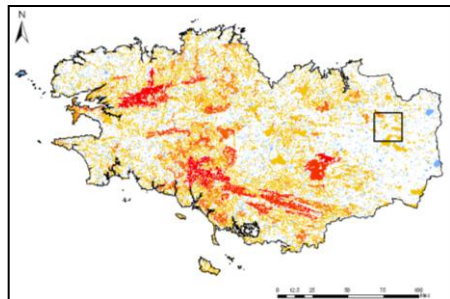


Nabucet & Hubert-Moy

# THE LOCAL SCALE

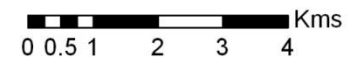


Type 1: Trame éléments semi naturels+ prairies permanentes



## Réseaux routiers

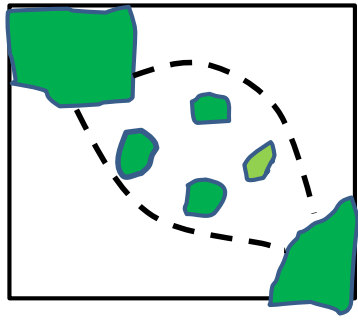
- 1 voie ou 2 voies étroites
- 2 voies larges
- 4 voies



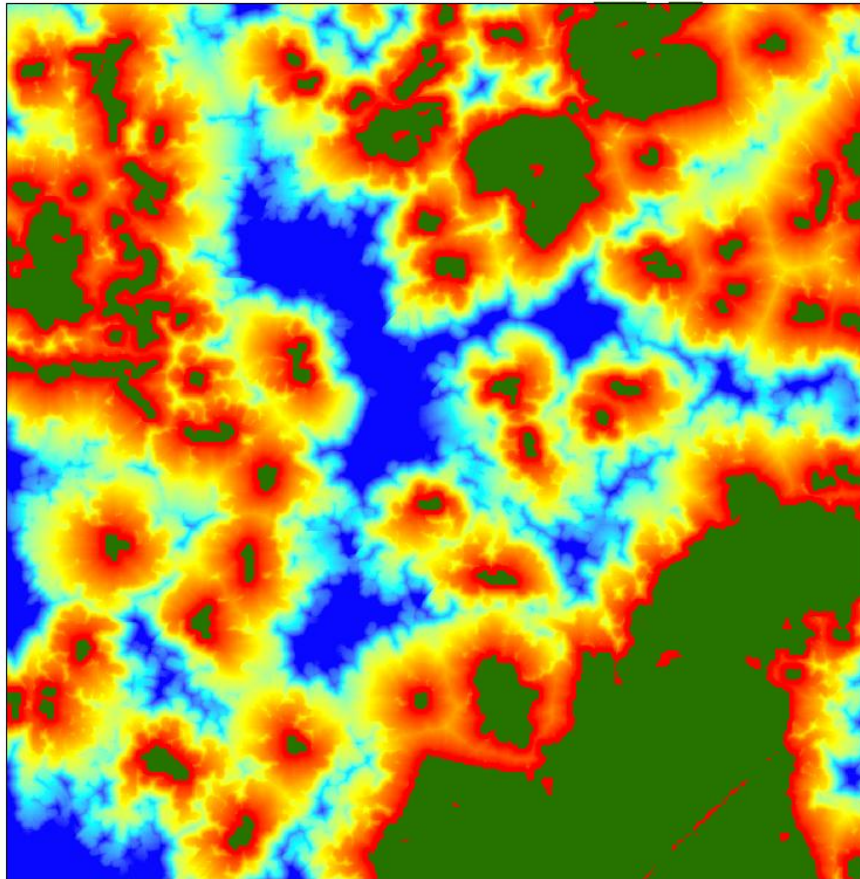
Nabucet & Hubert-Moy



# THE LOCAL SCALE



Type 1: Trame éléments semi naturels+ prairies permanentes



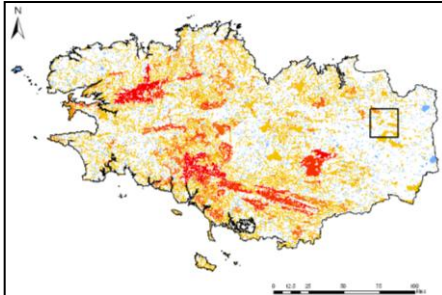
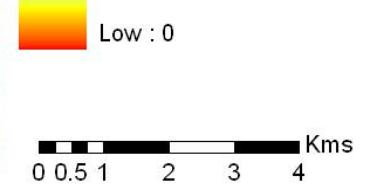
Boisements supérieurs à 1 Ha



Cout de circulation

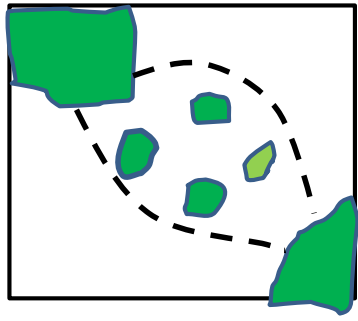
High : 903.409

Low : 0



Nabucet & Hubert-Moy

# THE LOCAL SCALE

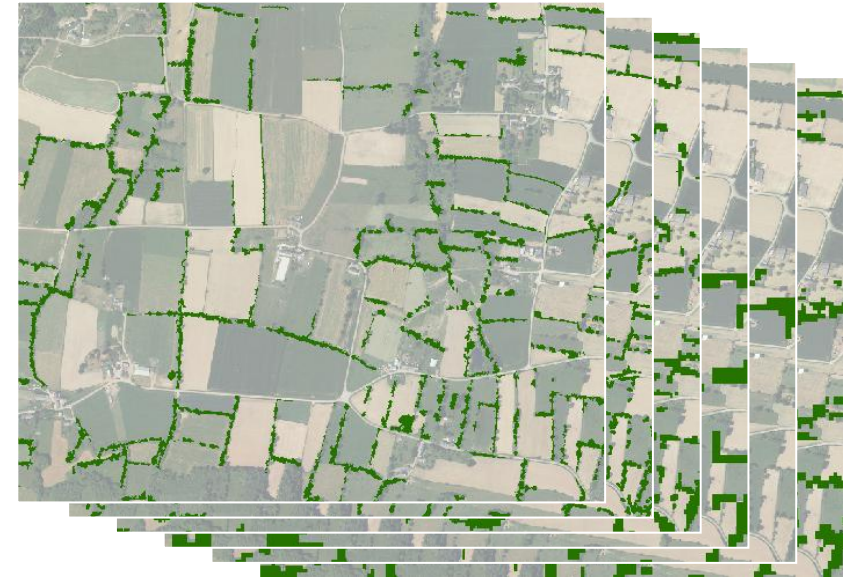


Type 1: Trame éléments semi naturels+ prairies permanentes

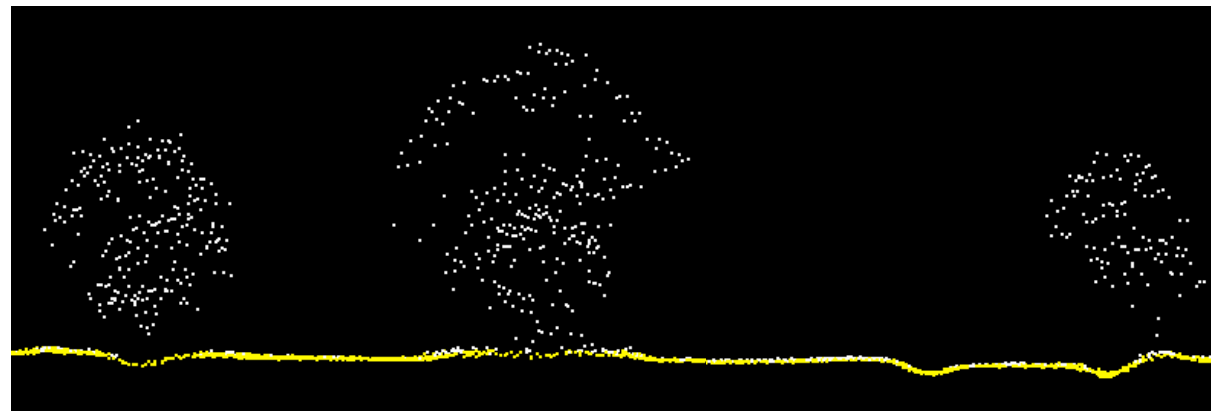
## VHSR IMAGES



LID	ORT	Ko	SP	SP	AS	IRS
AR	HO	MPS	OT	OT	TE	LIS
(0.2	(0.5	AT	5	5	R	S
5 M)	M)	(1	(5	(10	(15	(23
		M)	M)	M)	M)	M)

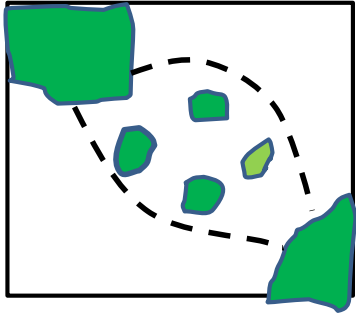


Vannier, Hubert-Moy, 2010

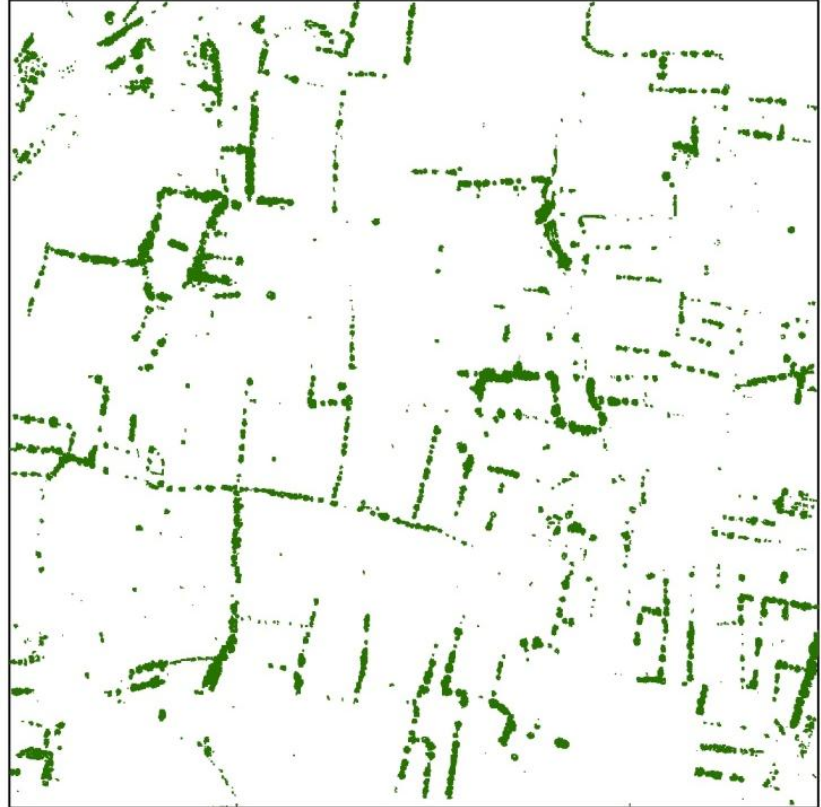
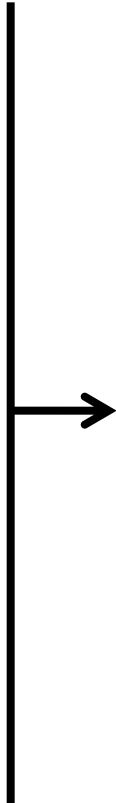
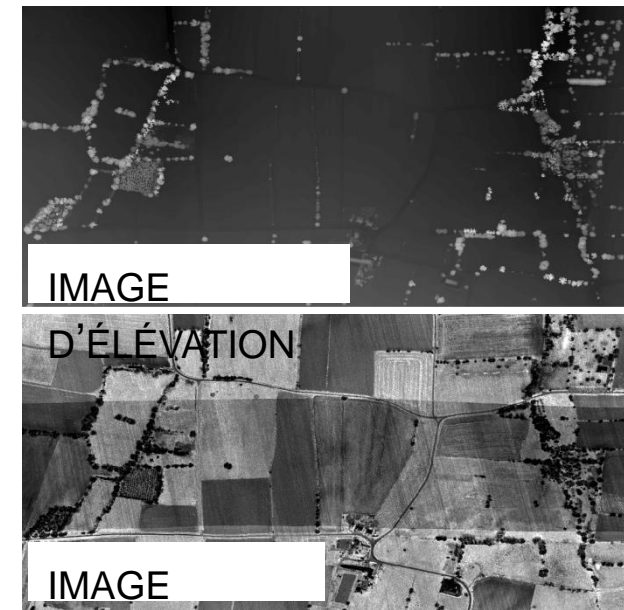


Nabucet, Hubert-Moy

# THE LOCAL SCALE



Type 1: Trame éléments semi naturels+ prairies permanentes



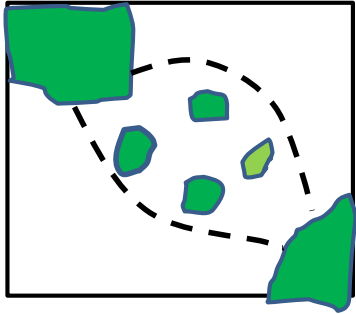
**LIDAR: 98% D'EXTRACTION  
AUTOMATIQUE**

**CARACTÉRISATION DES BORDURES DE**  
1- CARTE DU TAUX DE COUVERTURE DES  
2- CARTE DE LA LONGUEUR DES TROUÉES

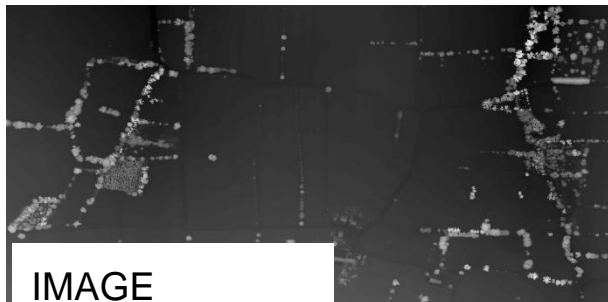
**Thèse C. Vannier, 2011**



# THE LOCAL SCALE



Type 1: Trame éléments semi naturels+ prairies permanentes



IMAGE



IMAGE

D'INTENSITÉ



## CARACTÉRISATION DES BORDURES DE

1- CARTE DU TAUX DE COUVERTURE DES

2- CARTE DE LA LONGUEUR DES TROUÉES

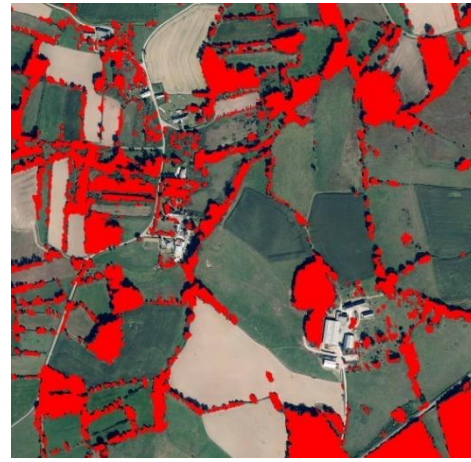
# THE LOCAL SCALE



Bd Veg



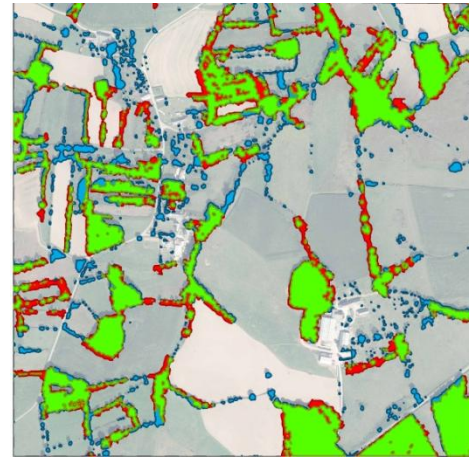
Kompsat



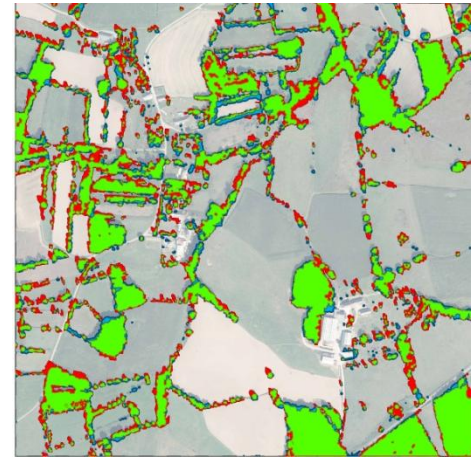
LIDAR



Bd Veg/LIDAR

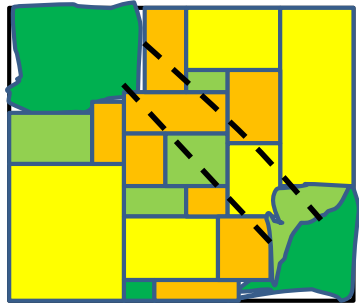


Kompsat/LIDAR

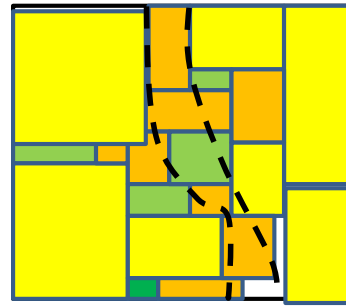


	LiDAR (ha)	Kompsat (ha)	Bd Veg (ha)
Sous détecté	0	3.46	4.73
Bien détecté	18.1	14.66	13.39
Sur détecté	0	6.69	5.28

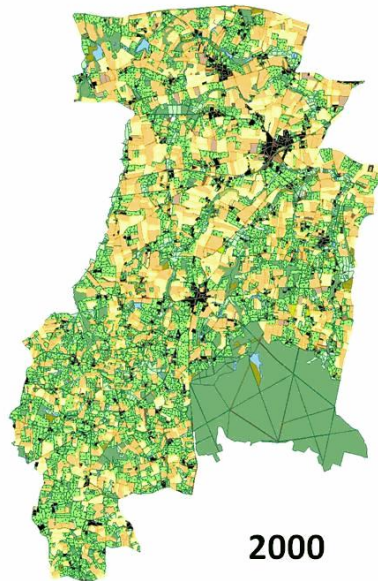
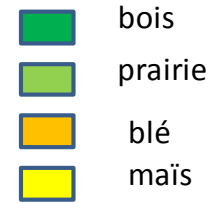
# THE LOCAL SCALE



Type 2: Trame agricole entre éléments naturels



Type 3: Trame agricole dans une zone cultivée

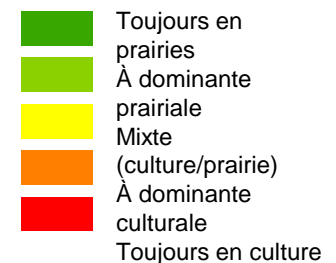
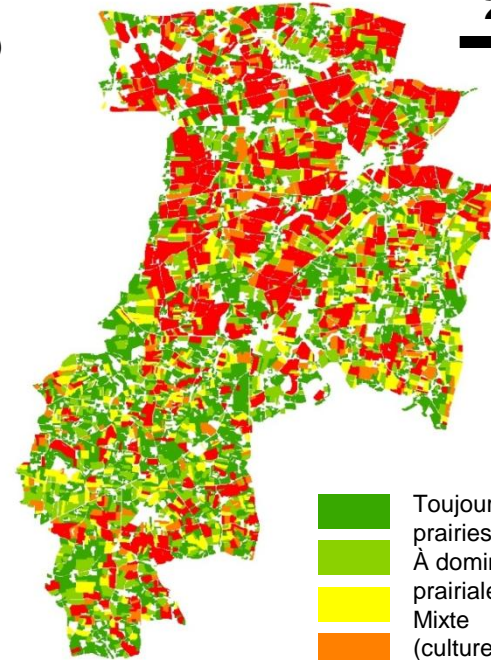


2000

PARCELLES  
TOUJOURS EN  
CULTURE (> 1 HA)

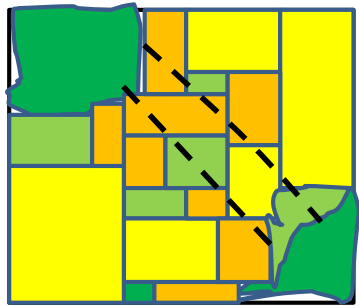


PARCELLES  
TOUJOURS EN  
PRAIRIES (< 1 HA)

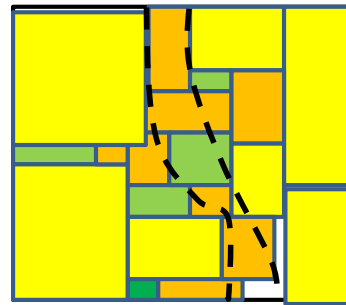


C. Vannier, 2011





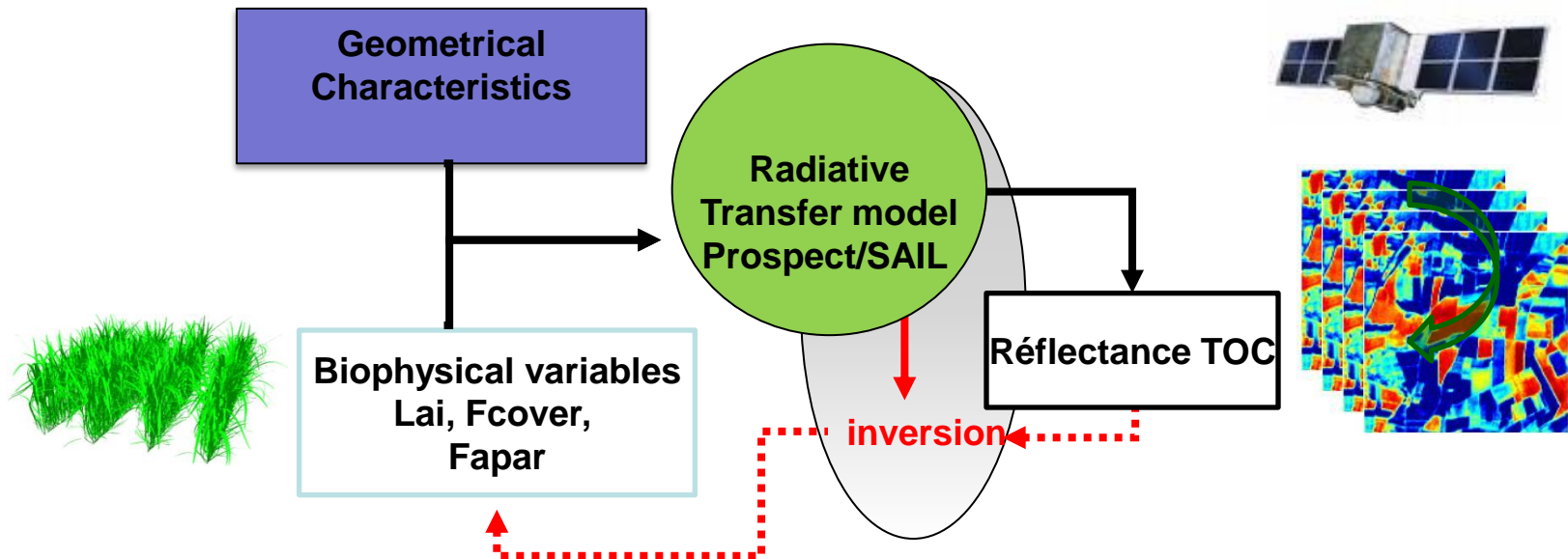
Type 2: Trame agricole entre éléments naturels



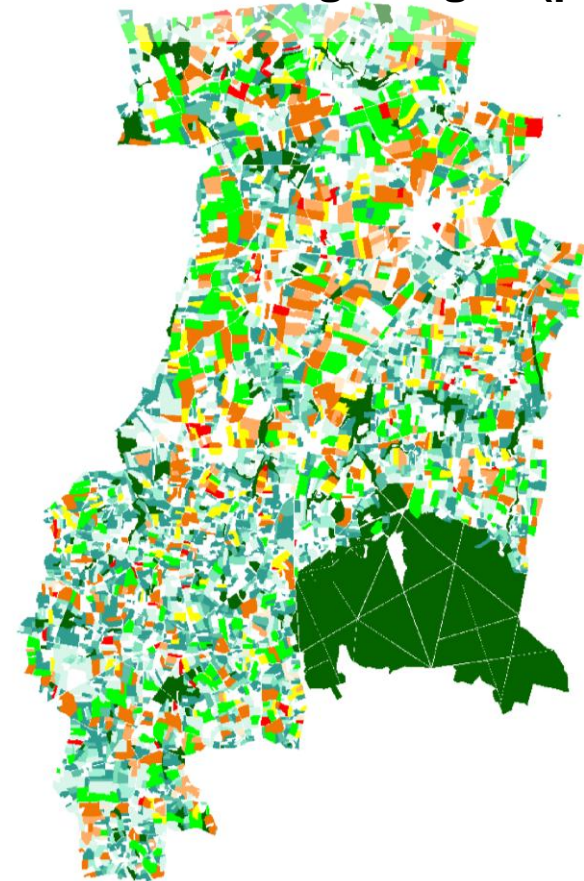
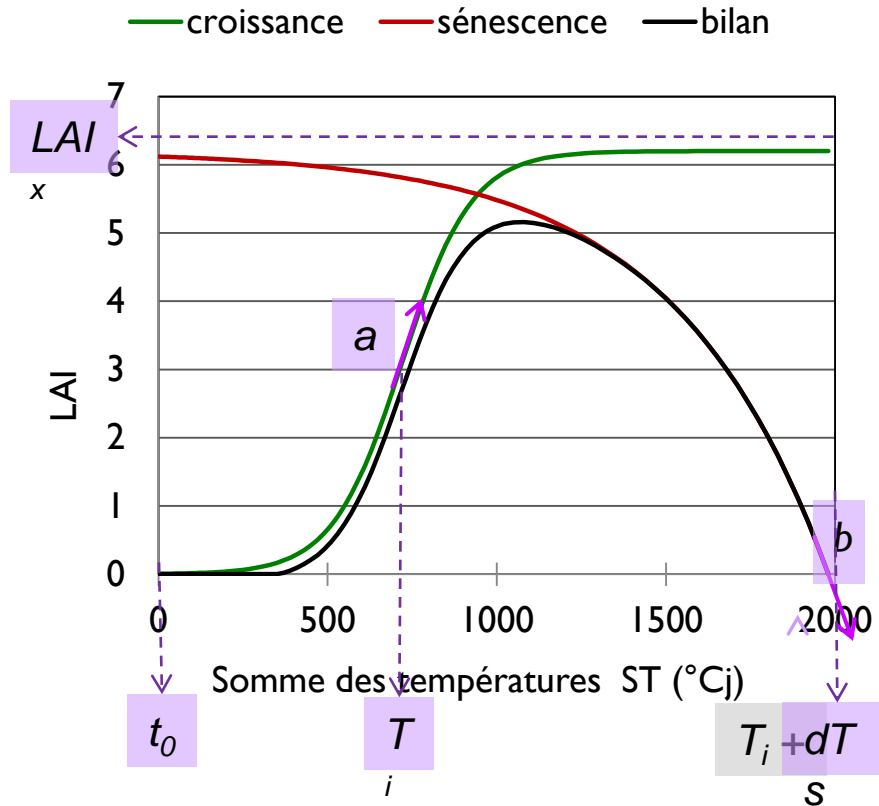
Type 3: Trame agricole dans une zone cultivée



## Intra-annual dynamics of cover crops from remote sensing images (phenology)



## Intra-annual dynamics of cover crops from remote sensing images (phenology)



### Légende

#### Maïs

- 8 mars - 30 juin
- 30 juin - 30 juillet
- 15 août - 30 juillet

#### Céréales

- 30 octobre - 11 mars
- 11 mars - 4 juin
- 4 juin - 29 juillet

#### Prairies

- 
- 
- 
- 

Zones Boisées

Cyrielle Guérin, 2009 (EMMAH)



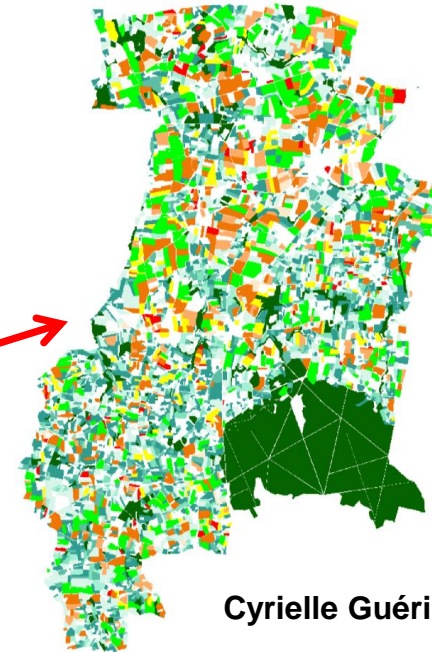
## Intra-annual dynamics of cover crops



*Pterostichus  
melanarius*  
crop field species



Synergy optical /RADAR data



Cyrielle Guérin, 2009 (EMMAH)

### Légende

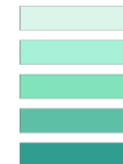
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#### Prairies



Zones Boisées



**Thank you!**

