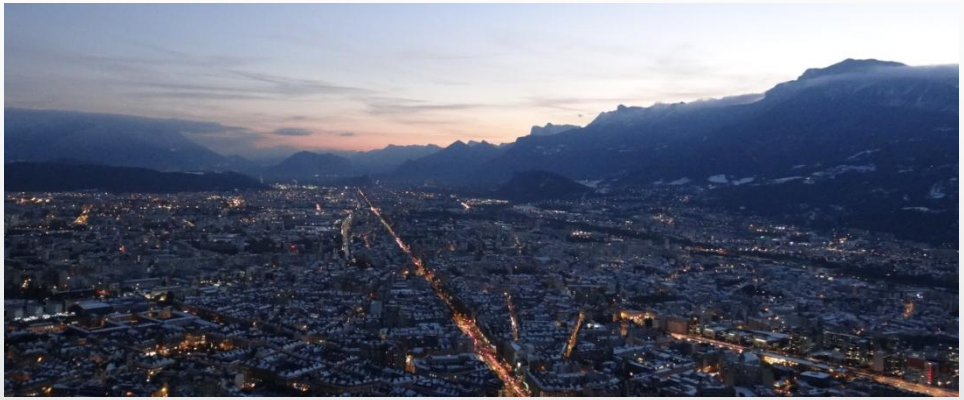
OPERAs

Ecosystem Science for Policy & Practice

Ecosystem Services Mapping in the Grenoble region - Alps



Vannier C., Lasseur R., Lefebvre J., Byczek C., Crouzat E., Cordonnier T., Longaretti PY., Lavorel S.

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Université Joseph Fourier Sciences Technologie Médecine

FRB

LECA Laboratoire d'Écologie Alpine

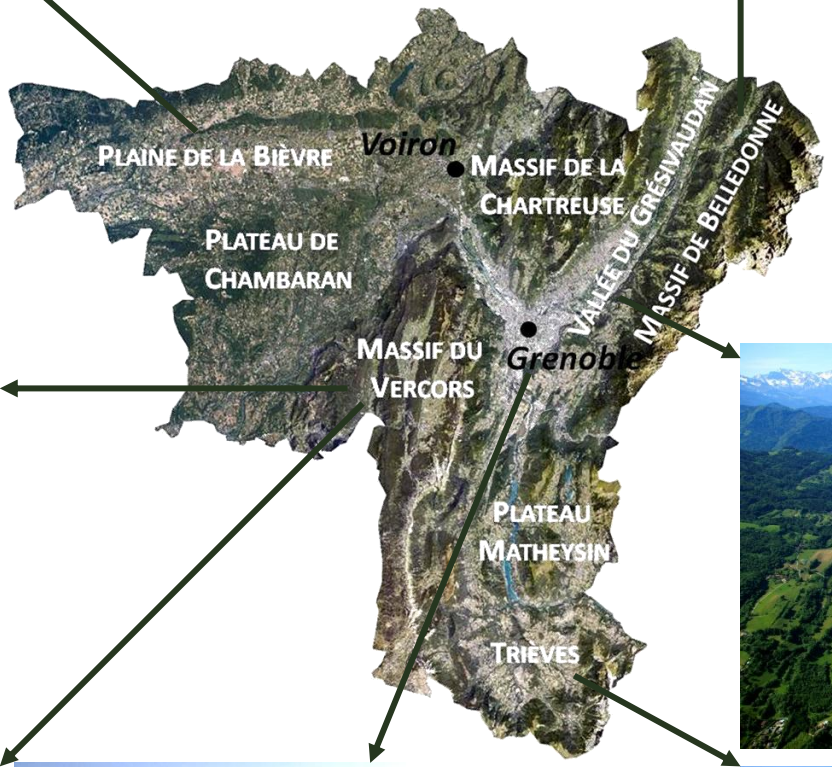
irstea

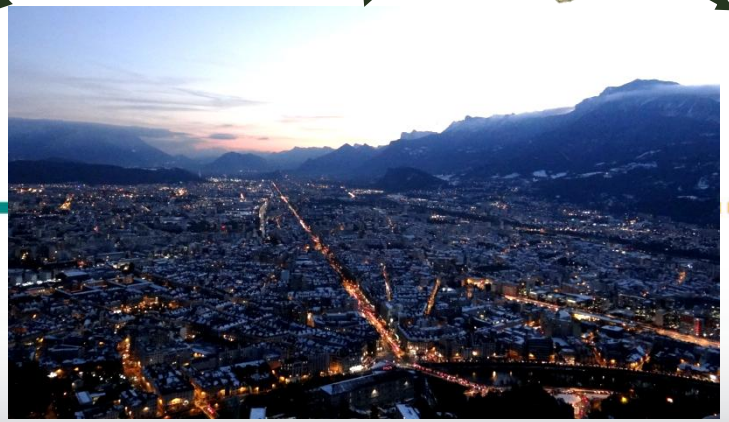
OSUG Observatoire des Sciences de l'Univers de Grenoble

ZA Zone Atelier LTER France Alpes

Seventh Framework Programme

Various landscapes





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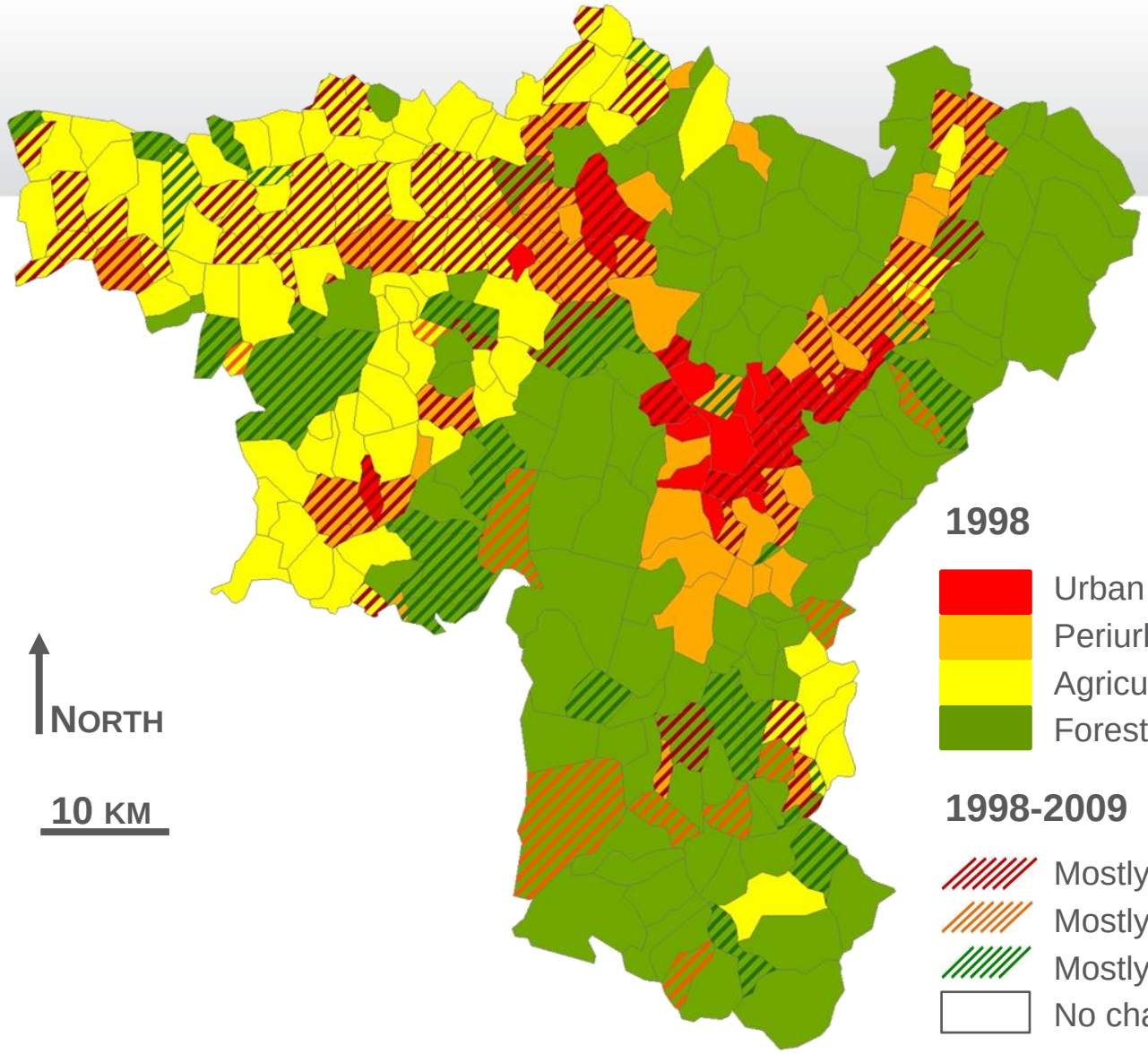
Landscape dynamics: Urban sprawl pressure



1998

- Urban municipality (>30%)
- Periurban munucipality (urban 15 to 30%)
- Agricultural municipality (>50%)
- Forest or seminatural municipality (>50%)

1998-2009

- Mostly growing urban areas
- Mostly growing agricultural areas
- Mostly growing fallow/forest areas
- No change (<1%)

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A typology of models for the incorporation of biodiversity effects into ES models

Spatial proxy models

- Land cover
- Terrain
- Soils
- Vegetation
- Infrastructure

Phenomenological models

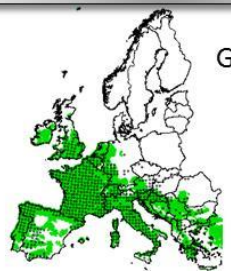
Landscape spatial structure

Trait-based models

PhotosyntheticPathway
Respiration LeafArea NfixationCapacity
SLA RegenerationCapacity PlantLifespan
WoodDensity GrowthForm
PhenologyType LeafN
LeafP LeafLongevity PhotosyntheticCapacity
MaxPlantHeight SeedMass

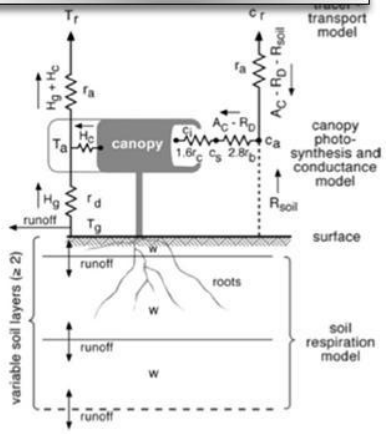
Representation of functional processes

Macro-ecological models



Geographic model of Ecosystem Service Providing species distribution

Process models



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Lavorel et al. 2014, OPERAs FP7 project Deliverable 3.1

A typology of models for the incorporation of biodiversity effects into ES models

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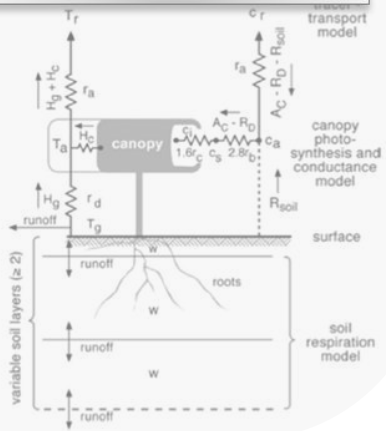

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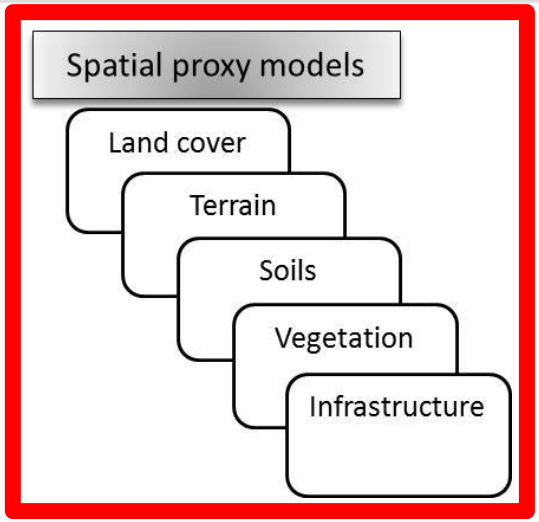
A typology of models for the incorporation of biodiversity effects into ES models



- **Provisionning services**
  - → *Forage production*
  - → *Crop production*
  - → *Volume of standing wood*

- **Regulation service**
  - →*Carbon Stock*

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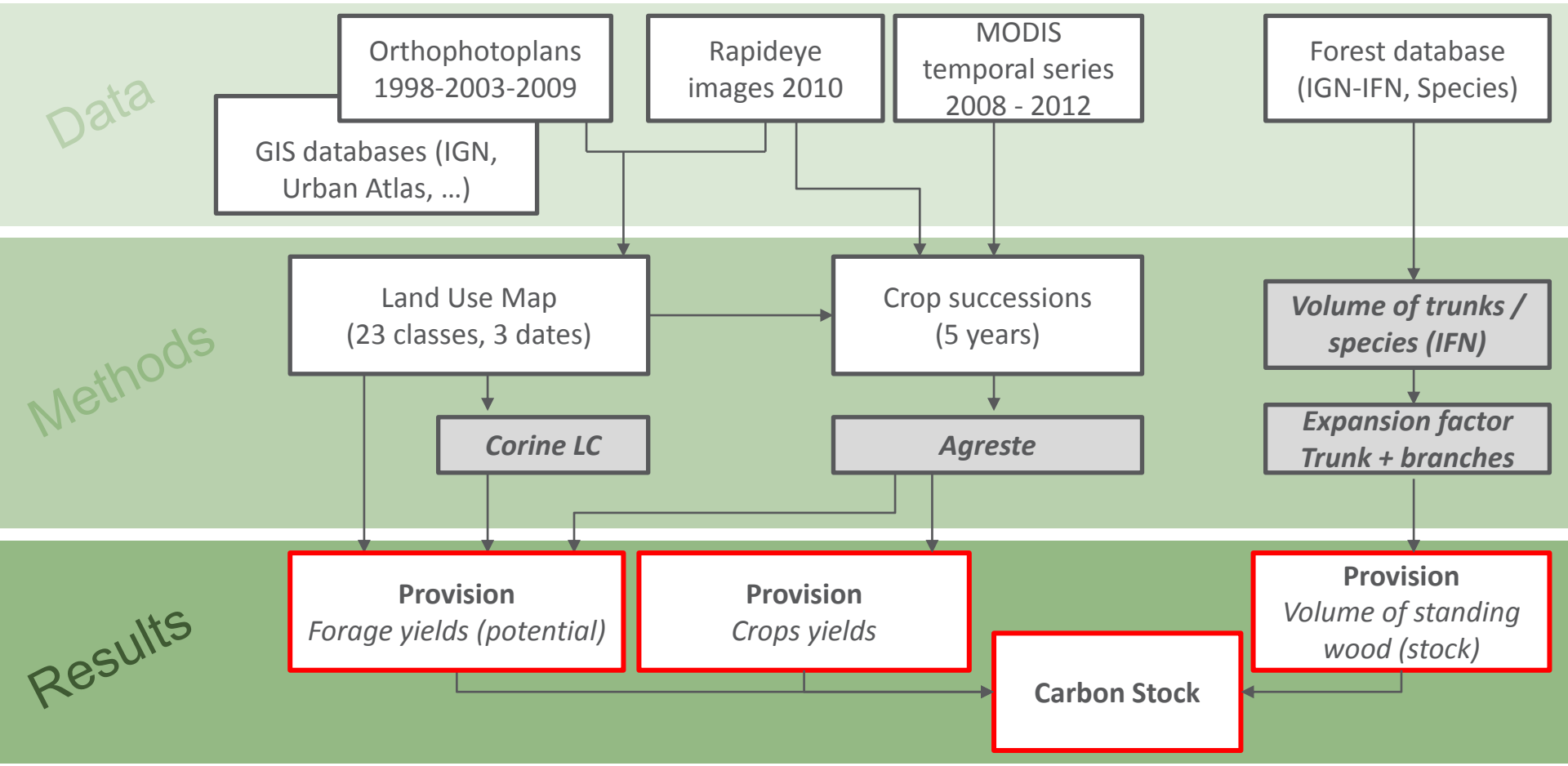
Lavorel et al. 2014, OPERAs FP7 project Deliverable 3.1

Ecosystem Services models and mapping



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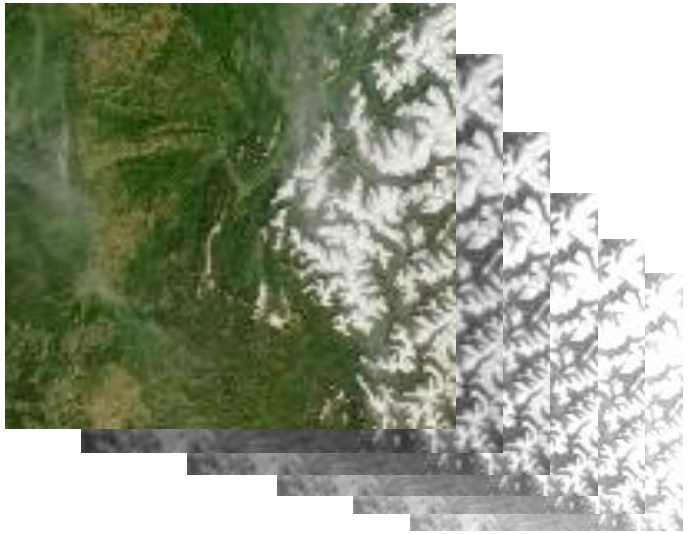
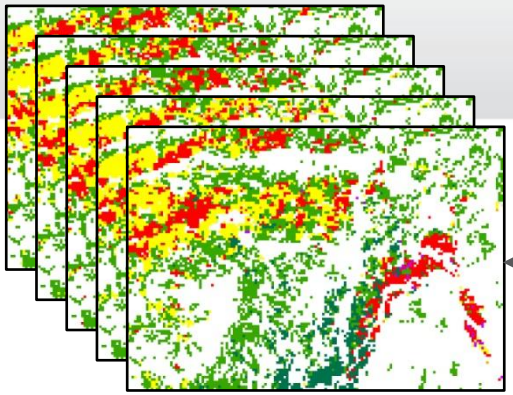
Forage and crop yields mapping

MODIS time-series, MOD13Q1
2008-2012 : 115 images
Enhanced Vegetation Index (EVI)
+
Meteorological data
Digital Elevation Model
‘Registre Parcellaire Graphique’ (RPG)
Land Cover 2009 map



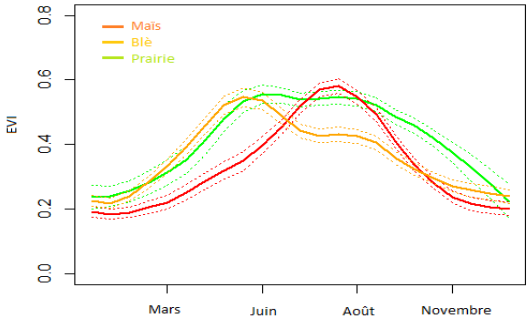
OPERAs

Forage and crop yields mapping



- Grassland
- Spring crop
- Mixt (spring-winter crops)
- Winter crop (wheat, barley, colza)
- Gardening
- Permanent crop (orchard, vine)
- Undefine

Process automatisation



Temporal classification
(phenological stages of crops)

MODIS time-series, MOD13Q1
2008-2012 : 115 images
Enhanced Vegetation Index (EVI)
+
Meteorological data
Digital Elevation Model
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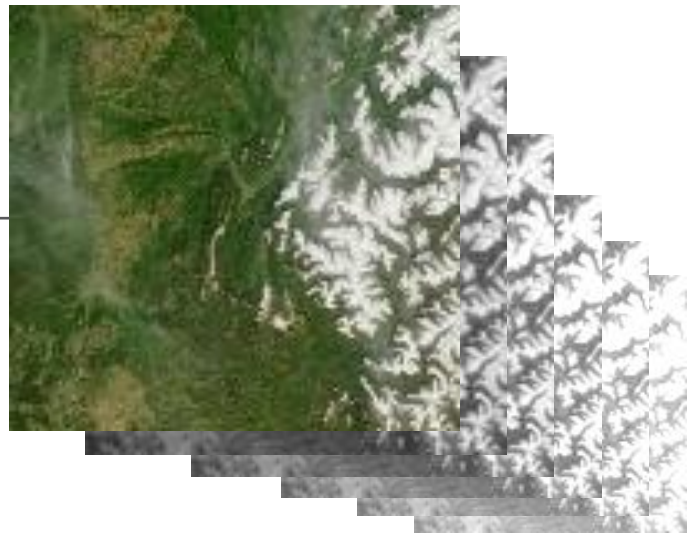
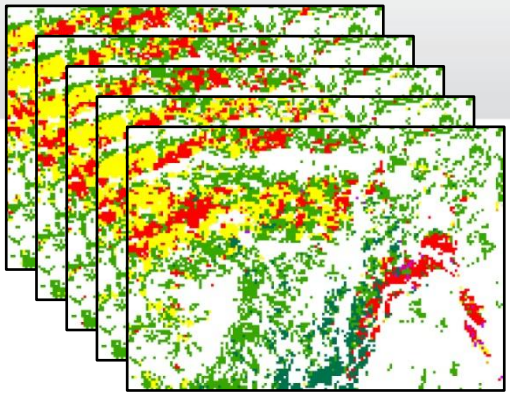


Validation
Kappa: 0.78-0.82
Klocation: 0.78-0.83
GP%: 0.85-0.87

OPERAs

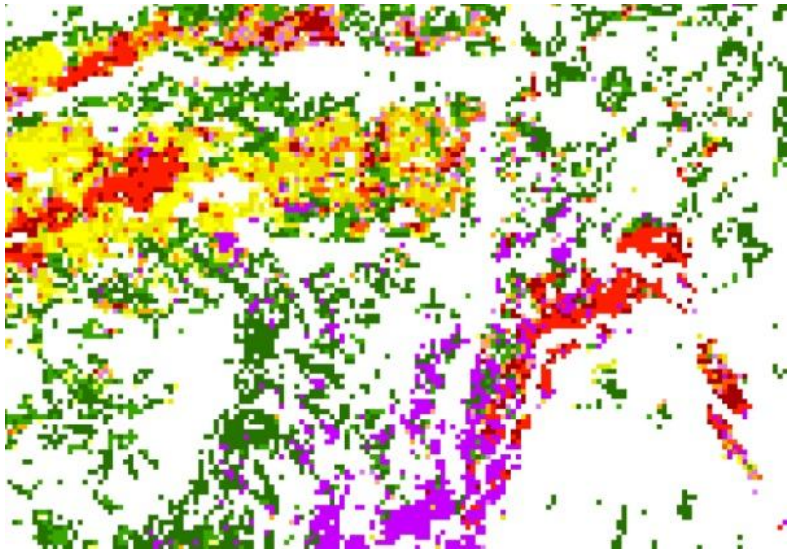
Forage and crop yields mapping

2008 - 2012



- Grassland
- Spring crop
- Mixt (spring-winter crops)
- Winter crop (wheat, barley, colza)
- Gardening
- Permanent crop (orchard, vine)
- Undefine

Crop succession classification →



- Permanent Grassland
- Continuous spring crop
- Continuous winter crop
- Gardening
- Permanent crop
- Meadow/Spring crop
- Meadow /Winter crop
- Spring/Winter crop
- Dominant meadow
- Dominant spring crop + 1 meadow
- Dominant spring crop (without meadow)
- Dominant winter crop + 1 meadow
- Dominant winter crop (without meadow)
- Equivalent meadow/spring crop
- Equivalent meadow/winter crop
- Equivalent maize/winter crop
- other

17 succession types

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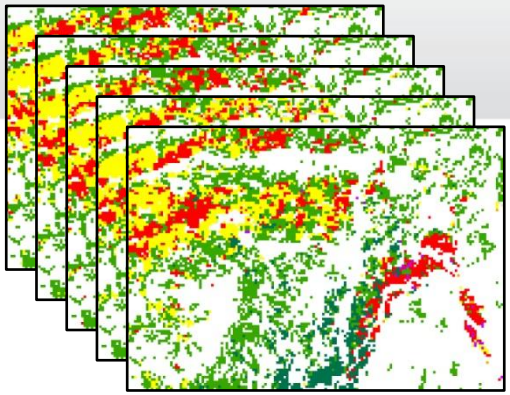
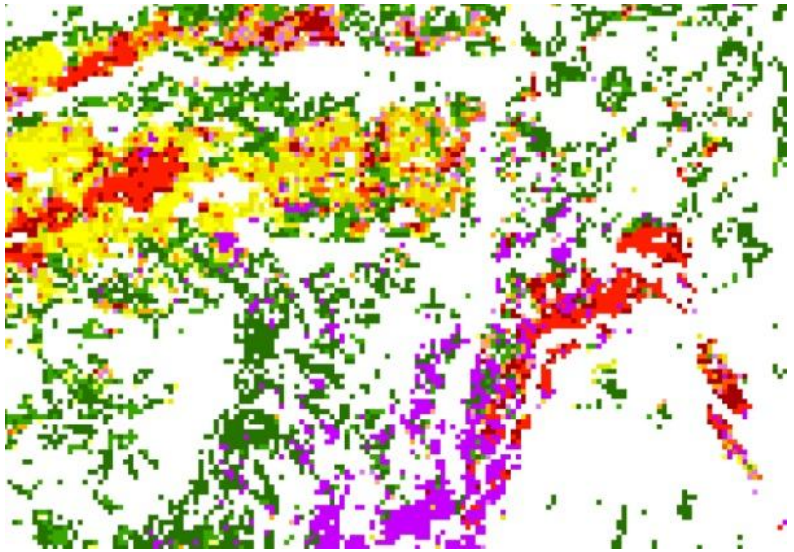
Forage and crop yields mapping



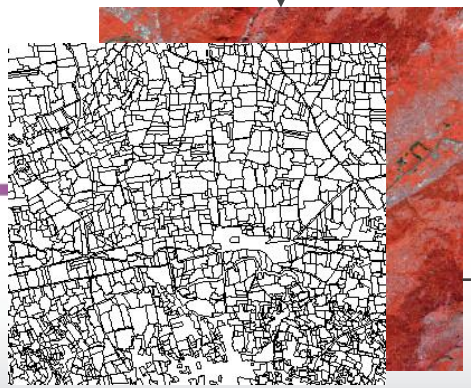
- Grassland
- Spring crop
- Mixt (spring-winter crops)
- Winter crop (wheat, barley, colza)
- Gardening
- Permanent crop (orchard, vine)
- Undefine

Crop succession classification

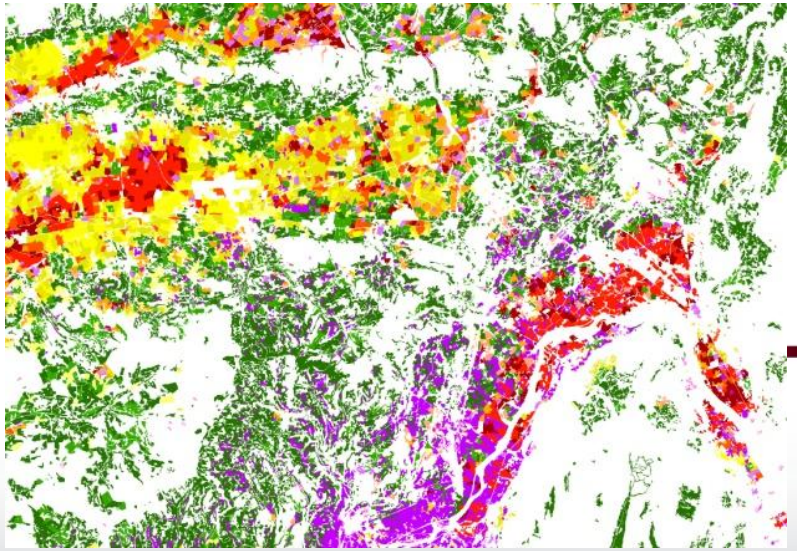
- Permanent Grassland
- Continuous Maize
- Continuous winter cereals
- Gardening
- Permanent crop
- Meadow/Maize
- Meadow /Winter cereal
- Maize/Winter cereal
- Dominant meadow
- Dominant maize + 1 meadow
- Dominant maize (without meadow)
- Dominant winter cereal + 1 meadow
- Dominant winter cereal (without meadow)
- Equivalent meadow/maize
- Equivalent meadow/winter cereal
- Equivalent maize/winter cereal
- other



RapidEye multiresolution segmentation



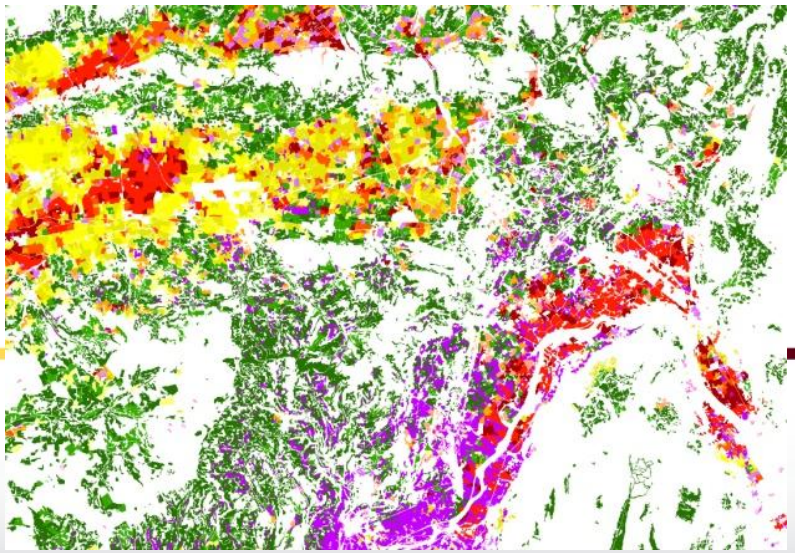
MODIS crop succession downscaling + validation



Forage and crop yields mapping

At field scale 1:15000

Combination with agricultural statistics



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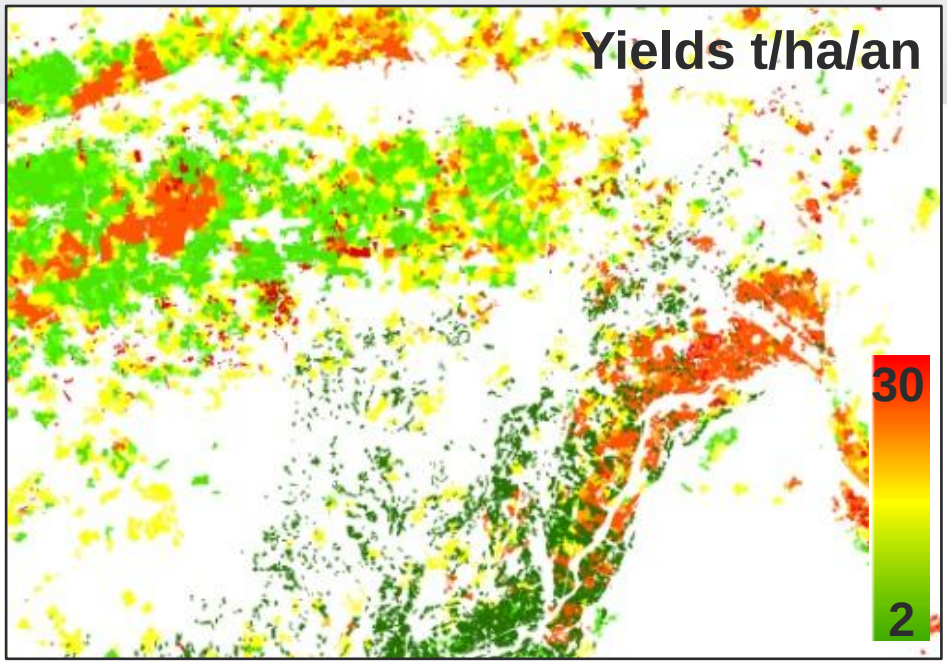
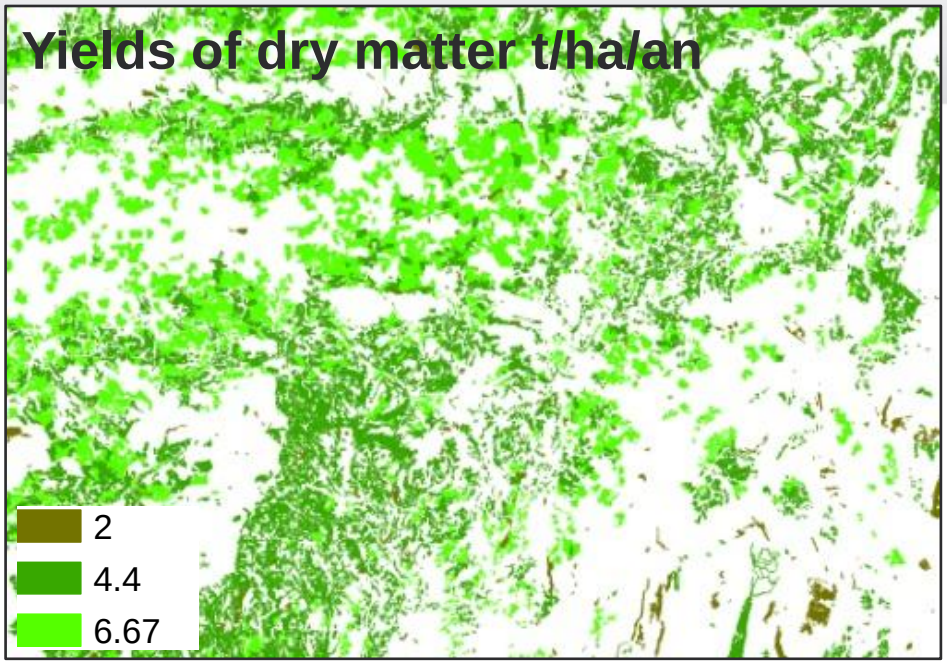
Crop Yields map

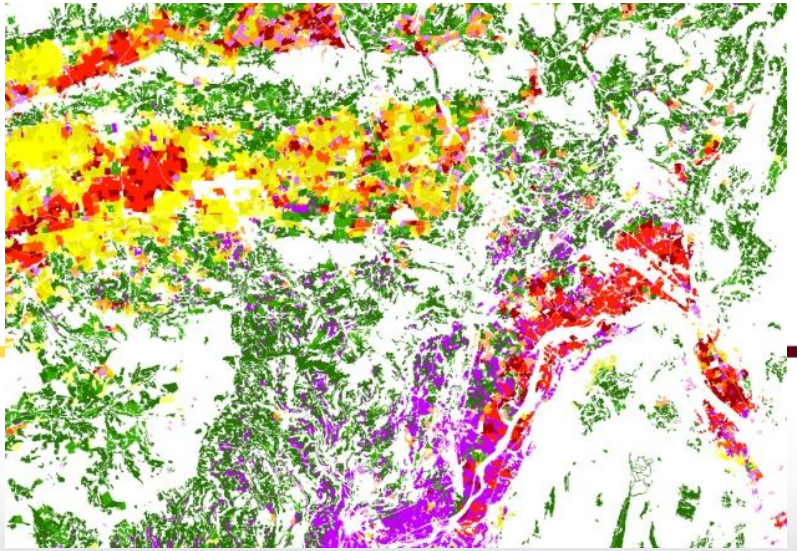


Forage Yields map



At field scale 1:15000

Combination with agricultural statistics



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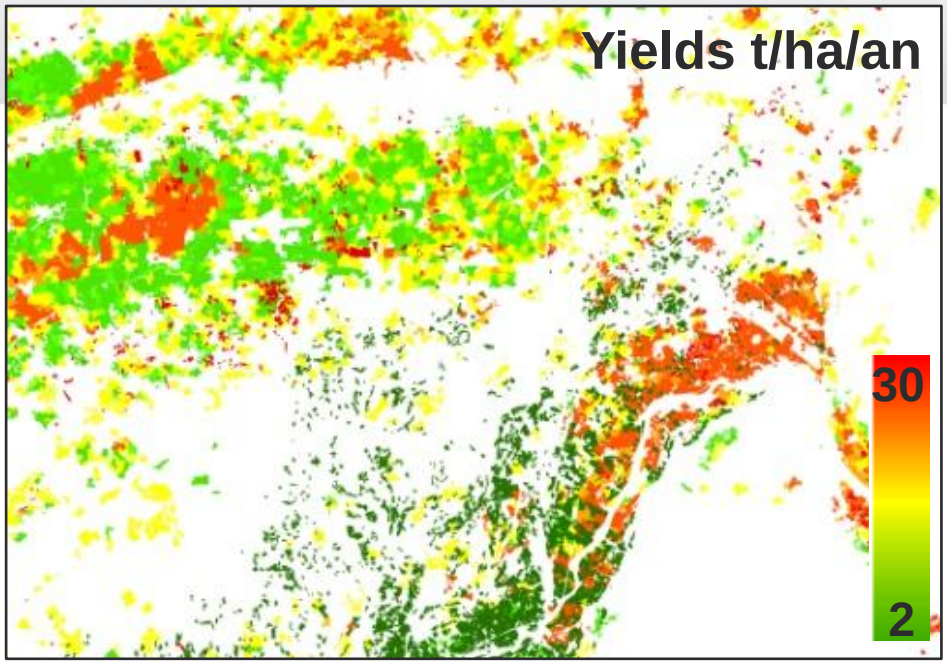
Crop Yields map

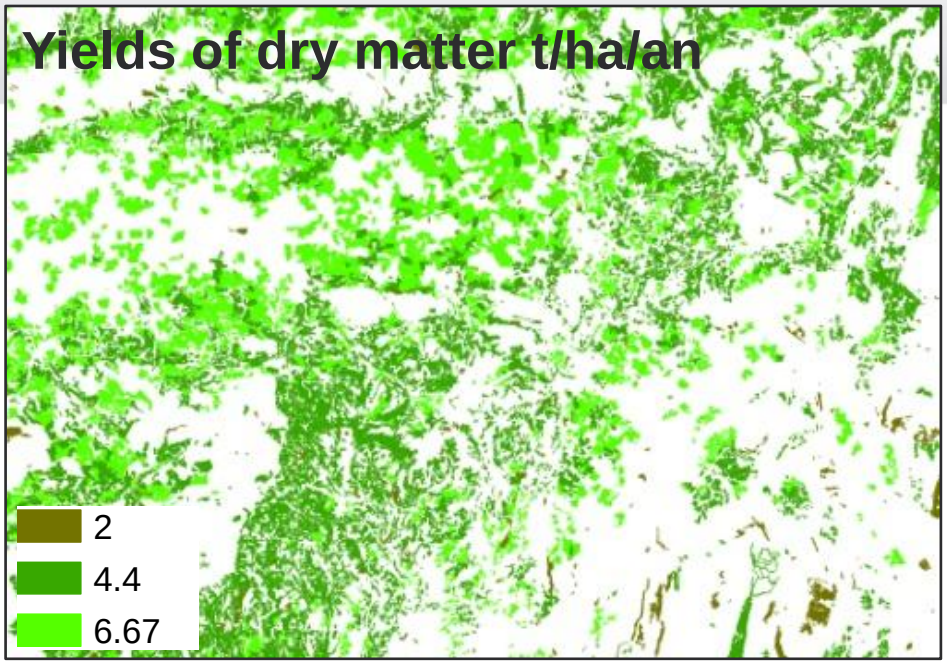


Only 1 statistical data/crop/year

→Using a provision crop model based on Remote Sensing data follow

Ex: SAFY model
M. Claverie *et al.* 2012: Maize and sunflower biomass estimation in southwest France using high spatial and temporal resolution remote sensing data, *Remote Sensing of Environment.*

Forage Yields map

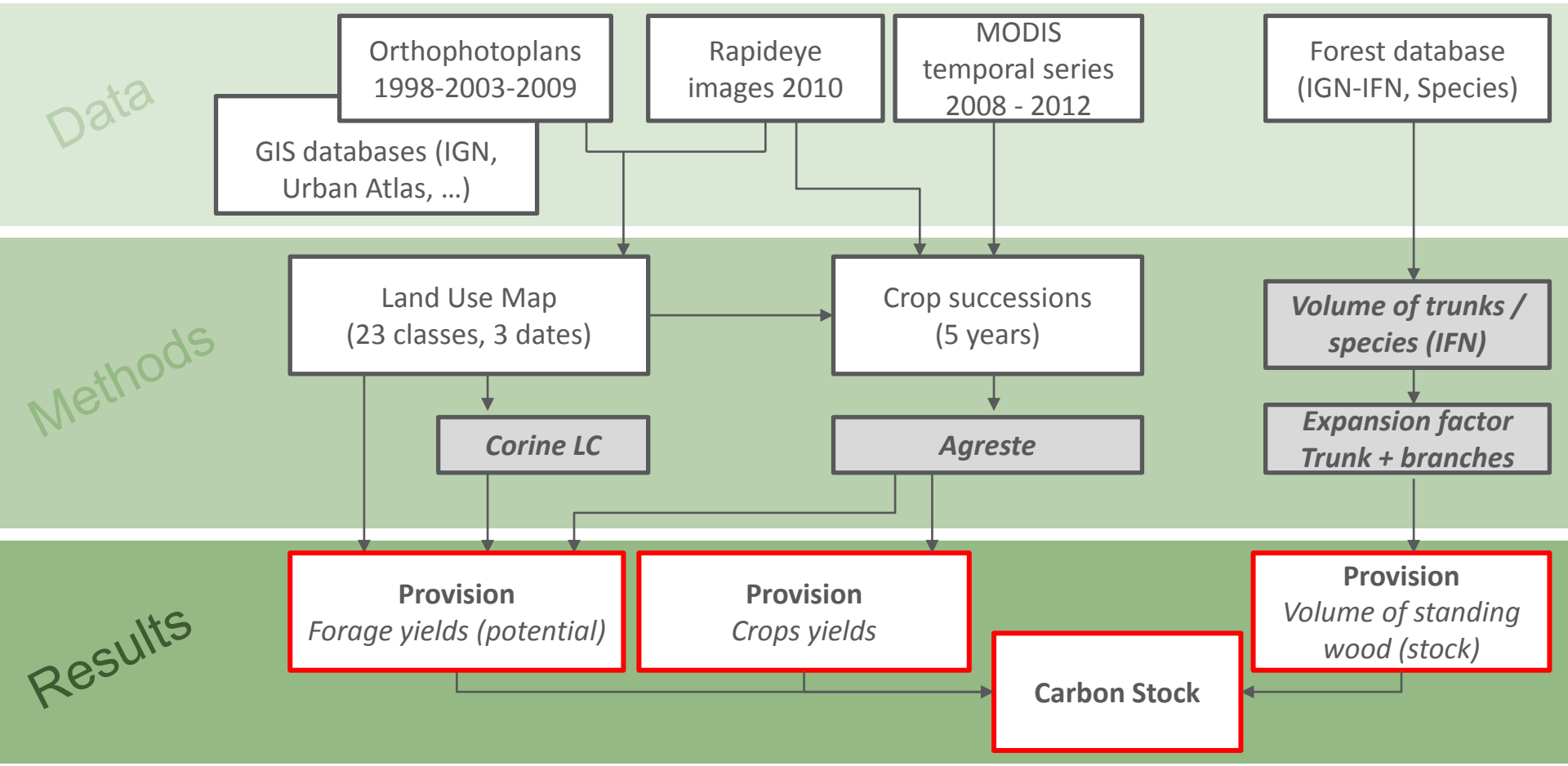


Only 3 types of grassland observable at this scale.

→Using Remote Sensing to define productivity or agricultural practices ?

Ex: CarHab project
Ex: Dusseux P. et al., 2012: Agricultural practices in grasslands detected by spatial remote sensing. *Environmental Monitoring and Assessment,*

Ecosystem Services models and mapping



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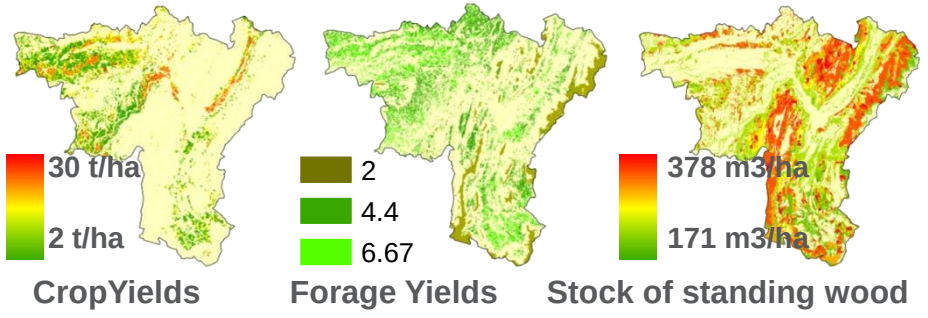
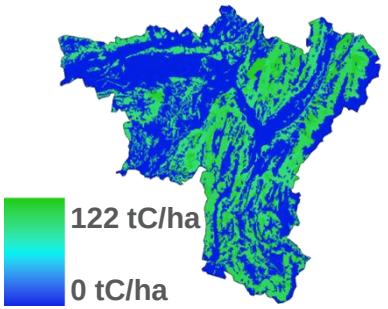
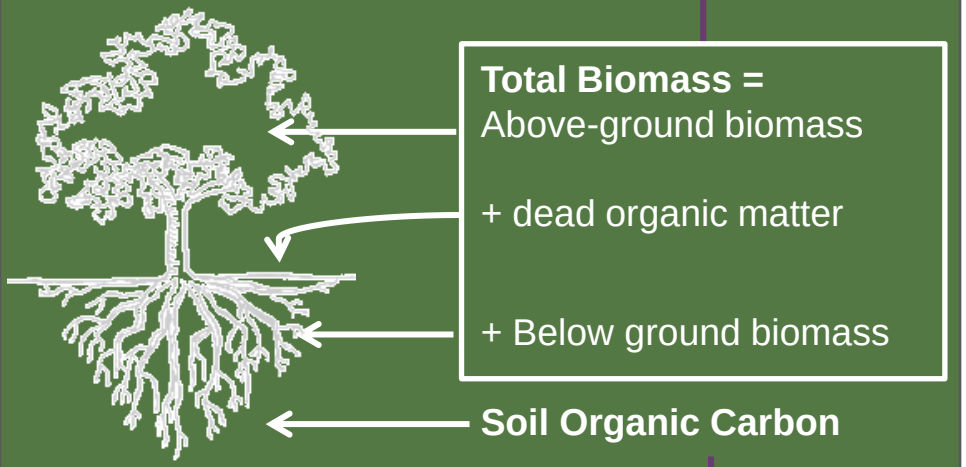
Carbon Stock



Carbon Biomass





Total Biomass =
Above-ground biomass

+ dead organic matter

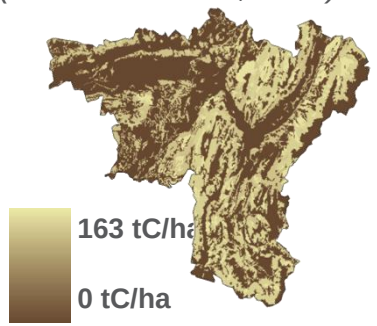
+ Below ground biomass

Soil Organic Carbon

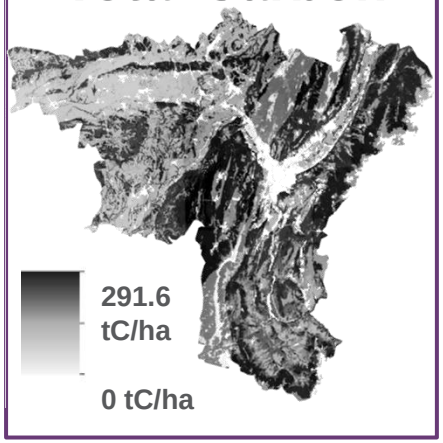
Total Carbon =
Biomass*tx Carbon + Soil Organic Carbon

Soil Organic Carbon

(Meersman et al., 2012)



Total Carbon



Dupouey 1999
Carbofor project

Contributions

- Heterogeneous data fusion
- Improving of existing ES maps: especially from remote sensing datat
- Work on scales/objects/data consistency

Limitations

Study site extent + landscape complexity

→Remote Sensing contributes to LULC and landscape characteristics/structures better description

Perspectives

VHSpatial and Spectral resolution data using for :
- improving forage yields (according to agricultural pressure and practices)
- improving stock of standing wood (species heterogeneity and diversity, forest structures)

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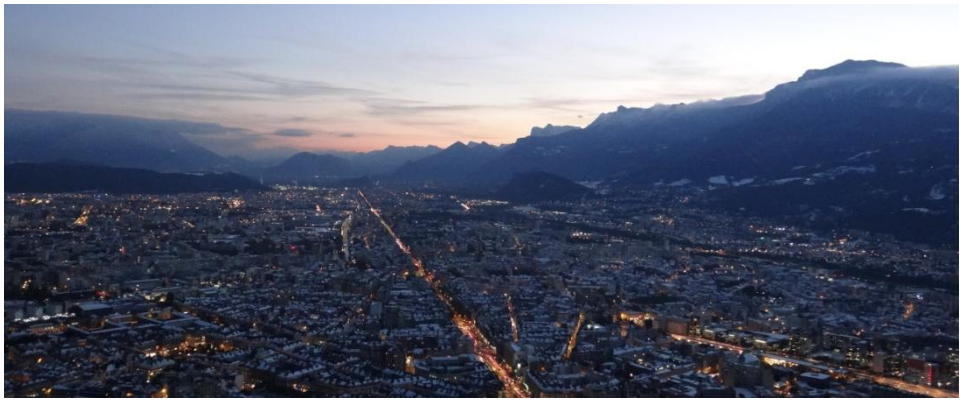
Thank you!



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SEVENTH FRAMEWORK PROGRAMME

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