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CITEPA

USING GEOSPATIAL DATASETS FOR A HIGH RESOLUTION LULUCF INVENTORY

Challenges and lessons learnt in France

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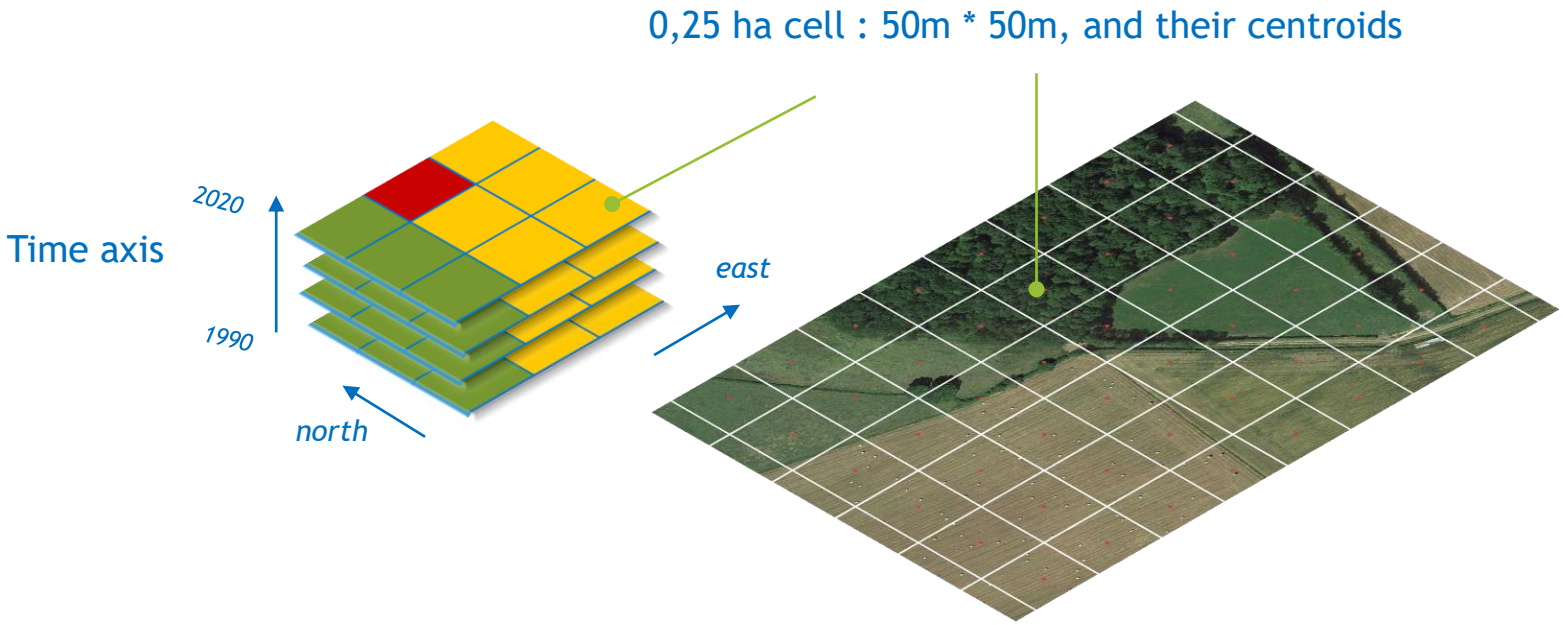
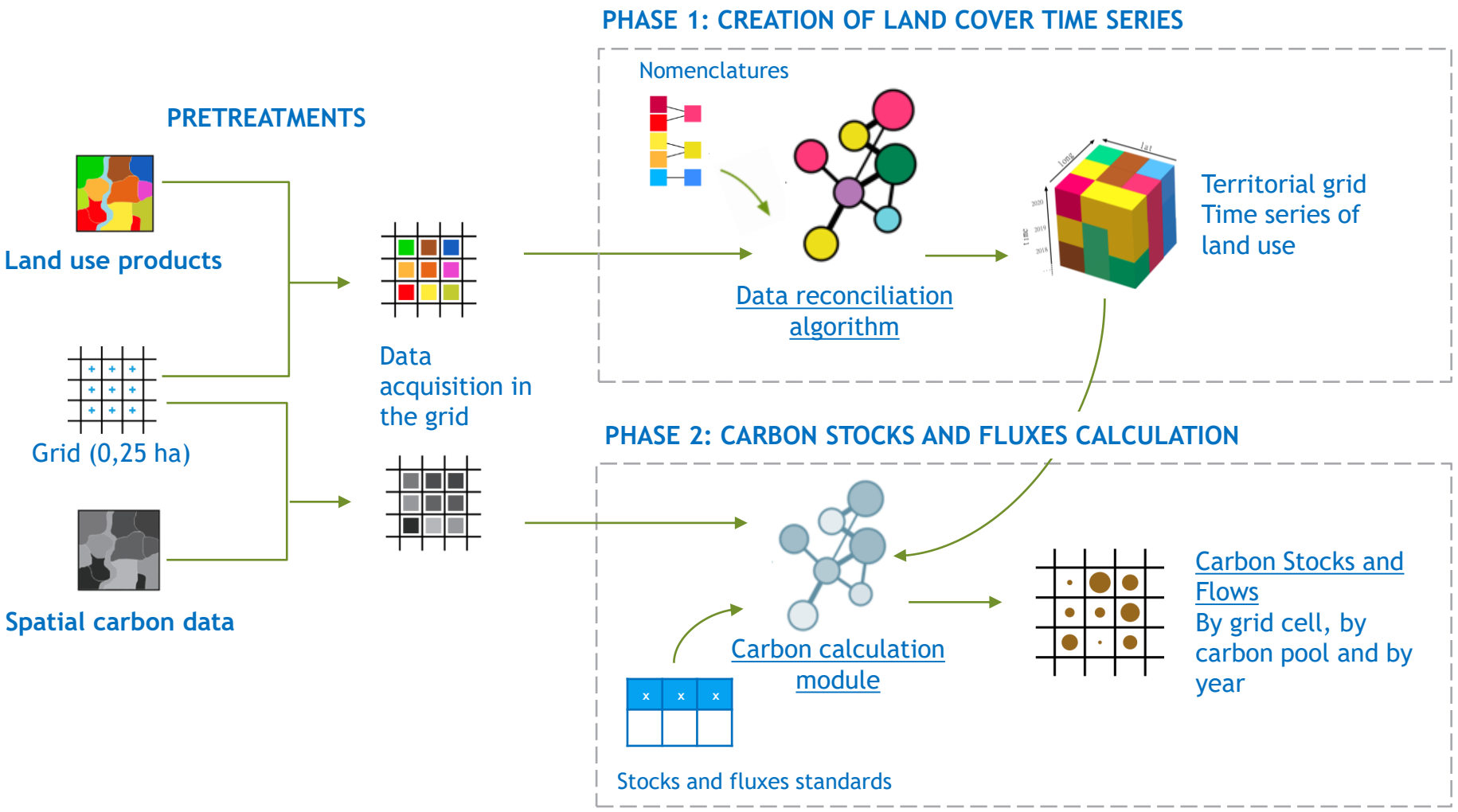
Use of geospatial datasets

1. For the study of **land use changes** and construction of land use matrixes
2. For collecting **reference carbon stocks** for the different pools and build a carbon stock variation model

Basic mapping unit : 0,25 ha grid (220 M° cells)



General concept of the spatially explicit inventory



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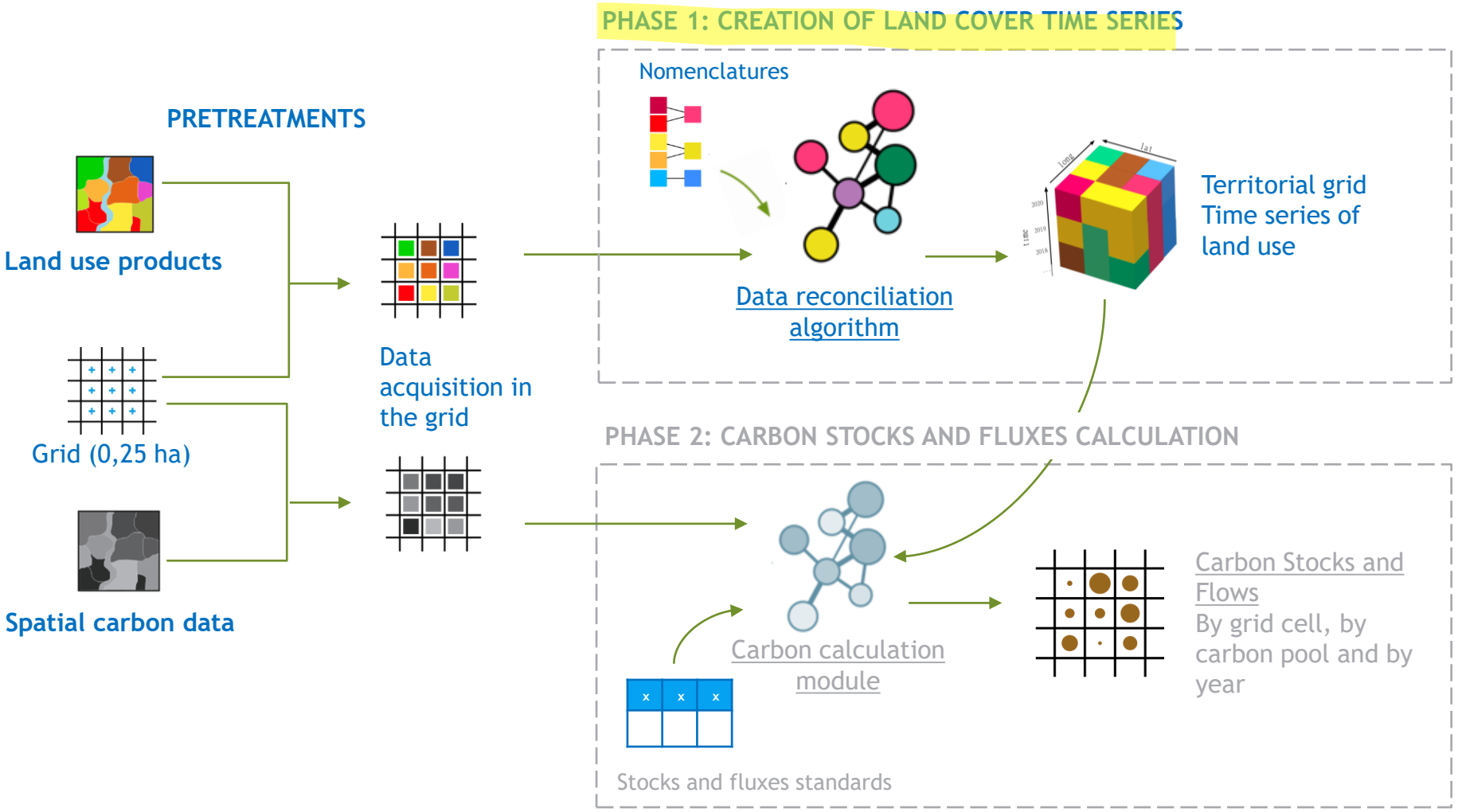


Cartographic products used for land use :
both status maps + change maps

Data	Data producer	Product year	Perimeter	Pertinent use	Continuous or discontinuous	Change product ?
BD Forêt	IGN	*variable*	*National*	*Forests*	*only covers forest lands*	/
RPG (LPIS)	IGN	2010 to 2020	*National*	*Agricultural lands*	*only covers agricultural lands*	/
Urban Atlas	EEA/ Copernicus	2006-2012, 2012-2018 (& annual : 2018)	European	*Settlements*	*Continuous, but only available for urban areas*	Yes
Corine Land Cover	EEA/ Copernicus	1990-2000, 2000-2006, 2006-2012, 2012-2018	European	*all*	*Continuous*	Yes
Natura 2000	EEA/ Copernicus	2006-2012, 2012-2018 (& annual : 2018)	European	*Natural areas*	*Continuous, but only available for specific areas*	Yes
BDcarto	IGN	2018	*National*	*all*	*Continuous*	/
BDtopo : buildings	IGN	2020	*National*	*Settlements*	*Discontinuous*	/

General approach

Step 1 : Intersection of centroids with products to collect land use information

Step 2 : Assignation of a reference use for each centroid, based on available information, and a hierarchy established between products

Step 3 : Land use change application by period for the relevant centroïds thanks to :

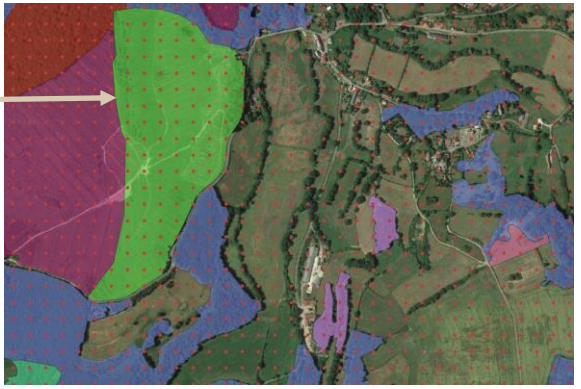
a. Change products (Urban Atlas, Natura2000, CLC)

b. Additional afforestation/deforestation dynamics (NFI maps)

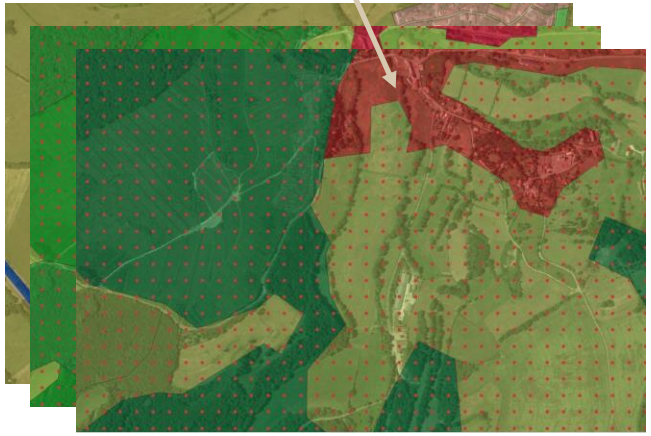
c. Additional module for artificialization dynamics (buildings mapping)

d. Agricultural rotation (LPIS data)

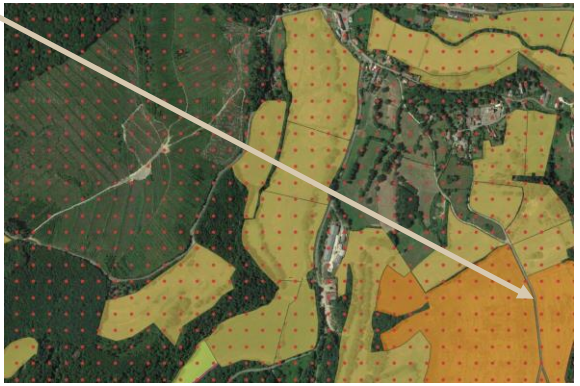
Cartographic products used for land use



Discontinus and highly pertinent product **for forest land use** :
'BD Forest' *(French national forest inventory)*

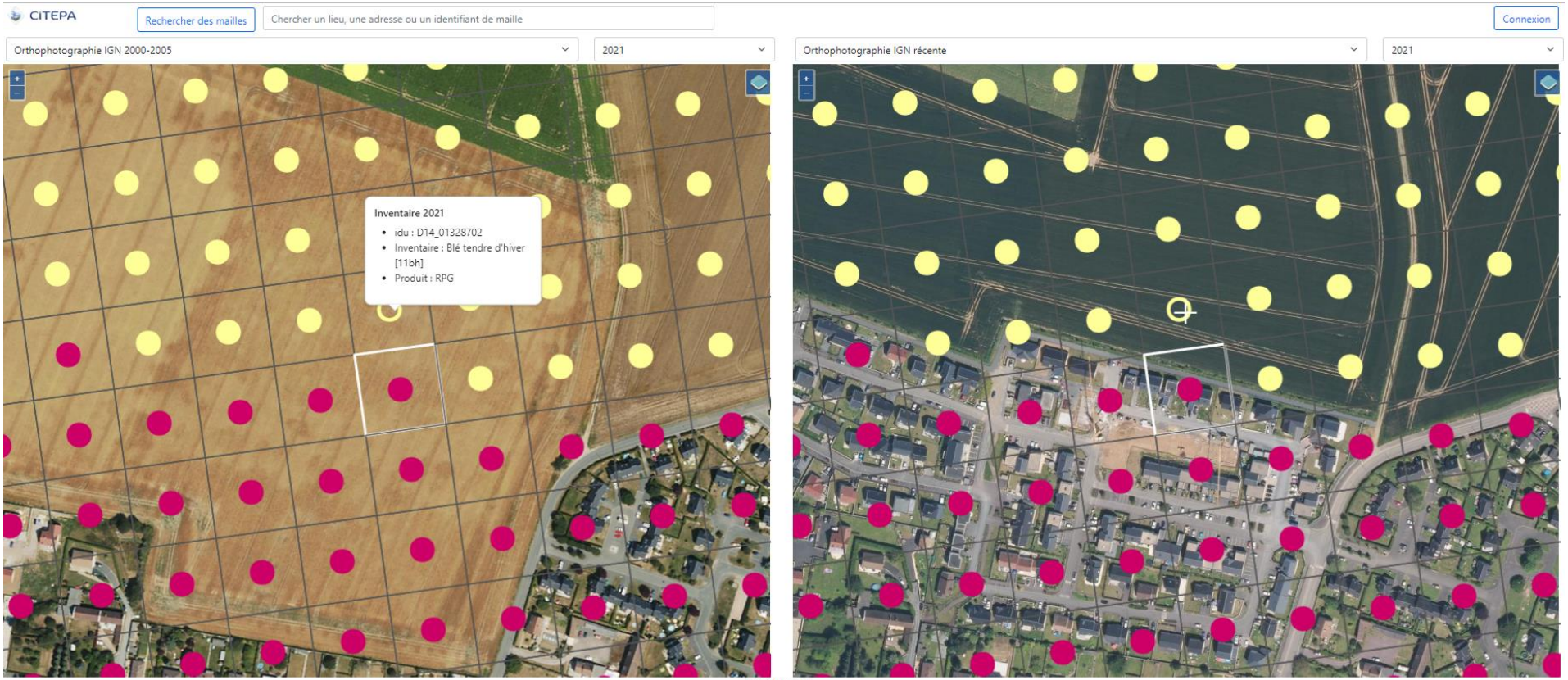


Continus products (Copernicus : Urban Atlas, Natura 2000 -when available on the area-, Corine Land Cover) ; Bdcarto (French generalist product) **for settlements and the remaining unfilled areas**



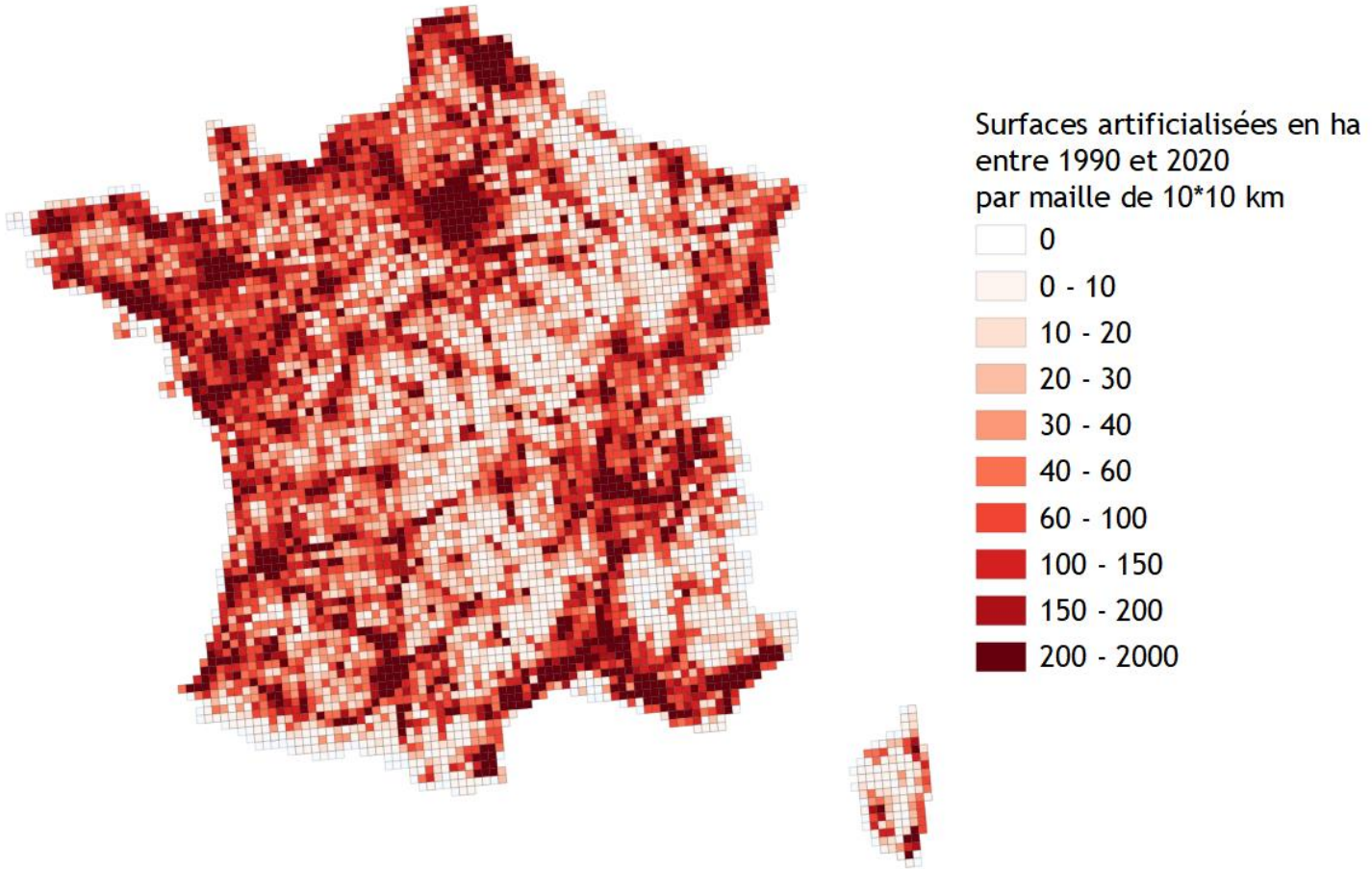
Discontinus and highly relevant **for agricultural land use** :
'RPG' *(used for CAP declarations)*

Visualization tool



Cartographic analysis

Example of dynamics that can be illustrated through information aggregation in larger grids.



Soil sealing between 1990 and 2020

Lessons learned (areas)

Improvement of **transparency** (visualization tool) + **precision**

Direct link between land use and carbon calculation model – mapping of stocks and fluxes

High impact of :

1. Choice of the products + hierarchy between the products
2. Nomenclatures
3. Size of the grid
4. Treatment (e.g. buffers) for wall-to-wall modules parameters
5. Difficulty to anticipate the final impacts (recalculation of areas, CO2)

Lack of data for the period 1990-2000 and post 2018.

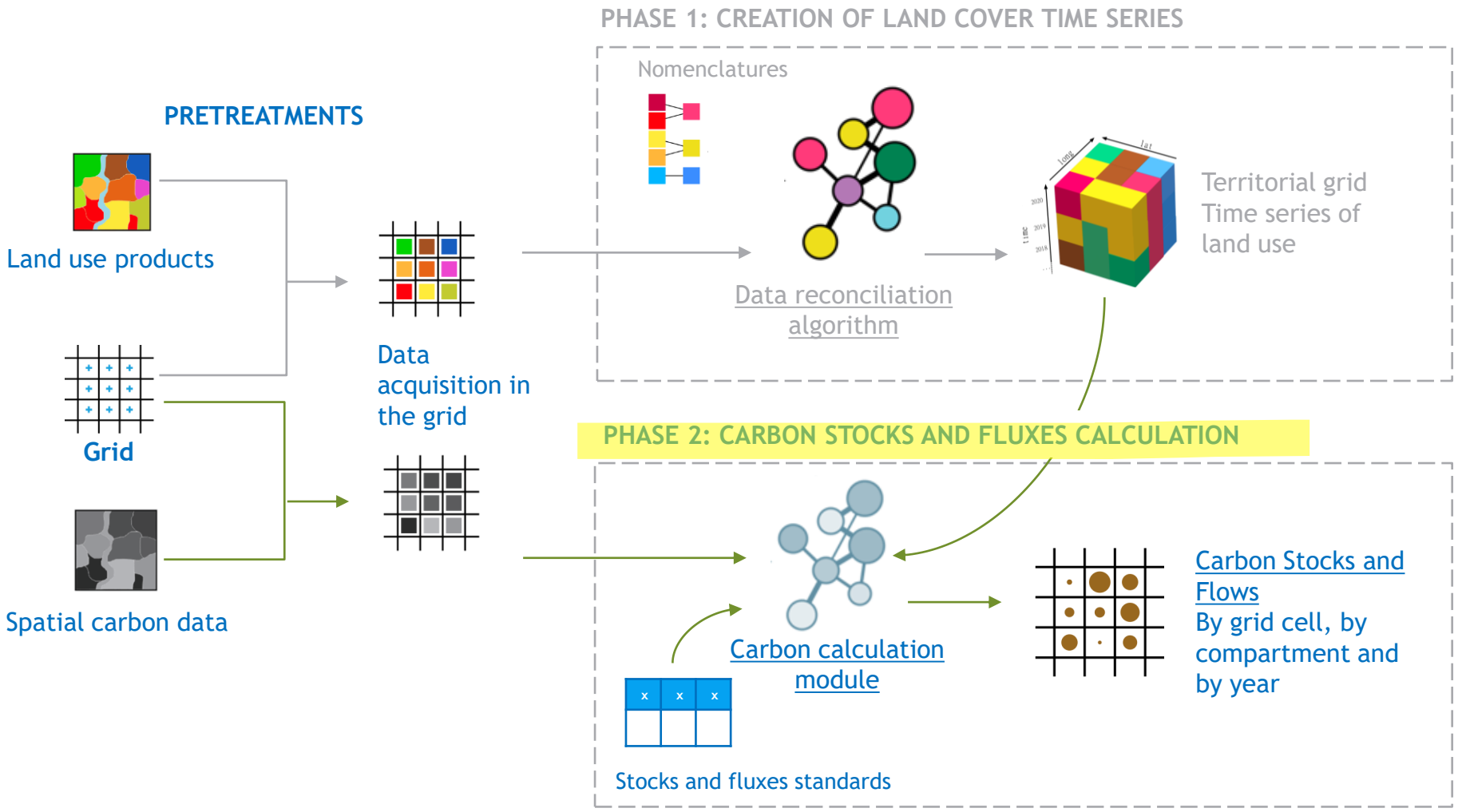
1. Necessity to add some non cartographic adjustments – end result is not totally spatially explicit
2. Temporal and spatial consistency can be discussed

Increase of complexity compared to the old method :

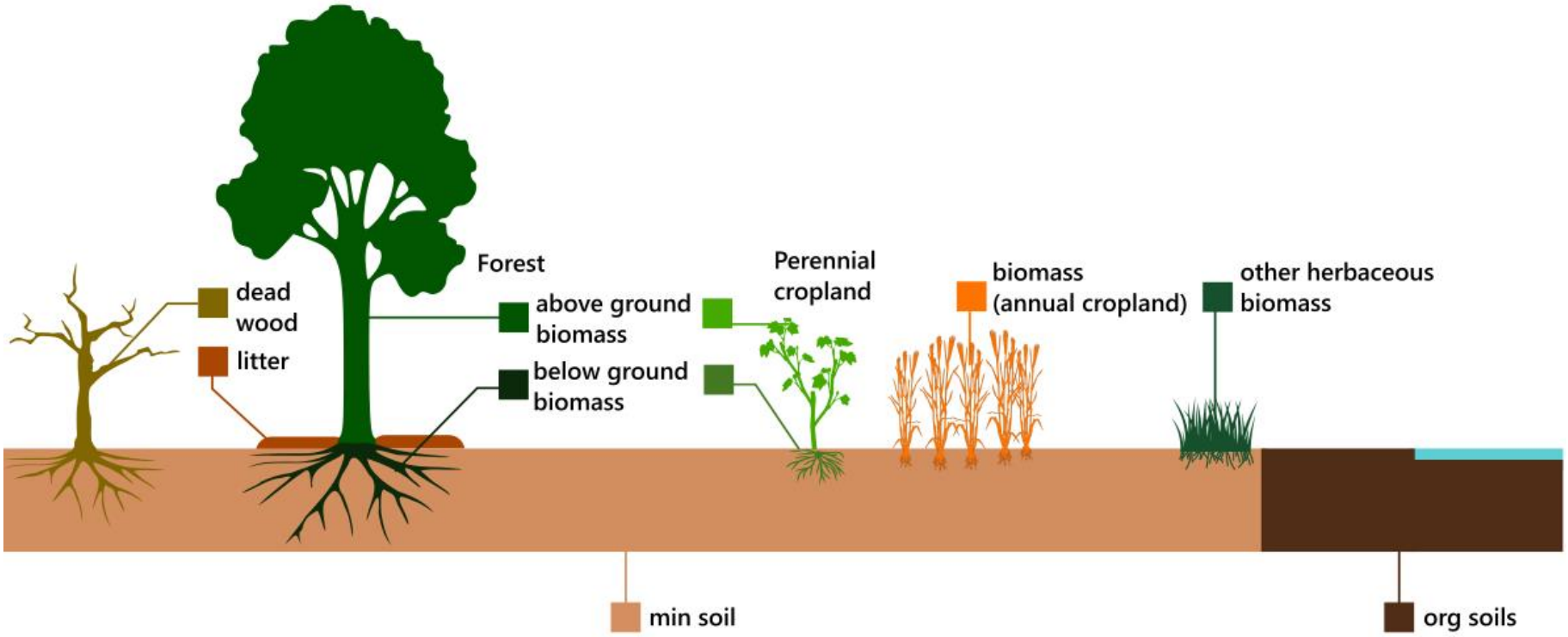
1. a lot of pre-processing, long analysis and calculation times, a lot of data storage
2. need to master programming languages and maintain a remote server

- Next steps : improve wetlands data, propose an analysis for hedges dynamics
- Comparison with CLC+ ?

Carbon Calculations



10 Carbon pools studied

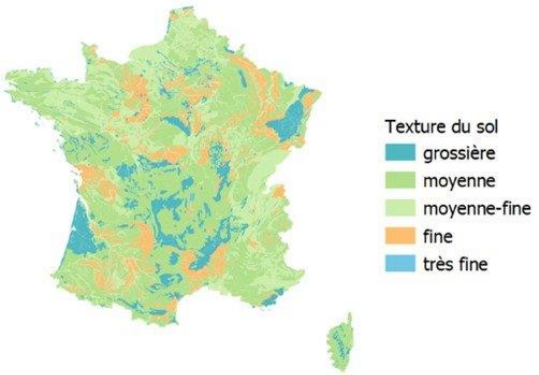


Initialization of stocks : use of cartographic data

1) **Initialization of stocks in 1990:** Allocation of carbon stocks, by carbon pool according to:
   - land use; different zoning; cultural practices

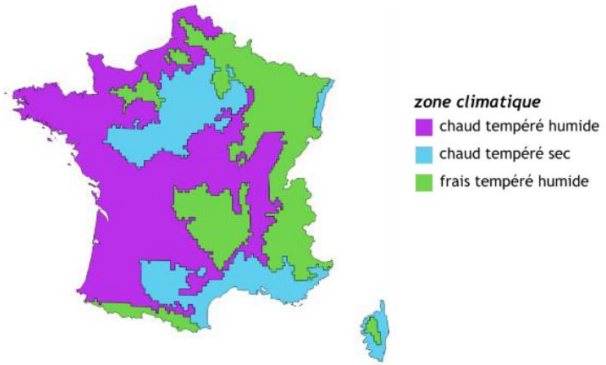
Different zoning used for the spatialization of carbon stocks

Mapping of sylvo-ecoregions (IGN)
▫ For forest biomass and deadwood



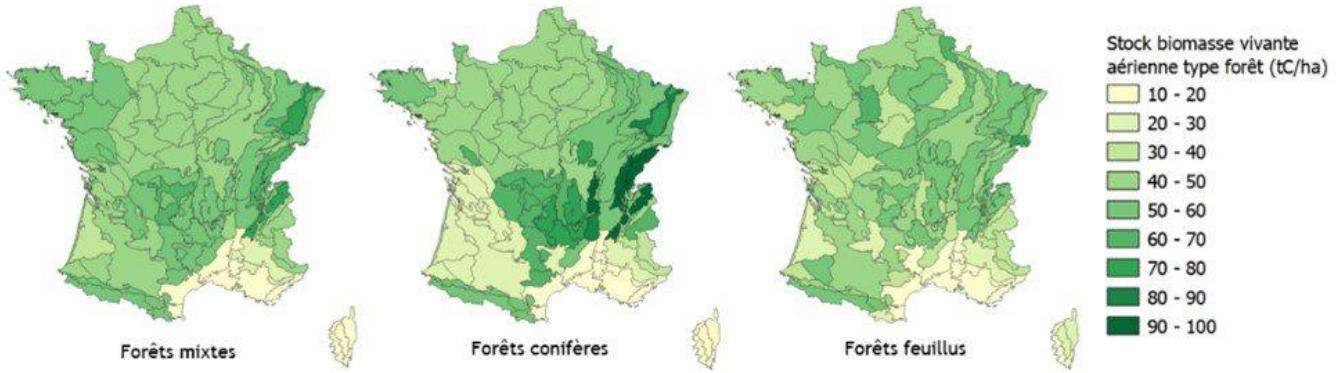
Mapping of soil areas [BDGSF - Citepa]

→ *For soil carbon*



Mapping of climate zones [JRC according to IPCC 2006]

Ex: Spatialization of carbon stock in forest biomass by forest type



Gridded stock variation model

2) **For each year, for each centroid, comparison of the inherited stock with the new stock** (related to the new land use, or different management practices in the area)

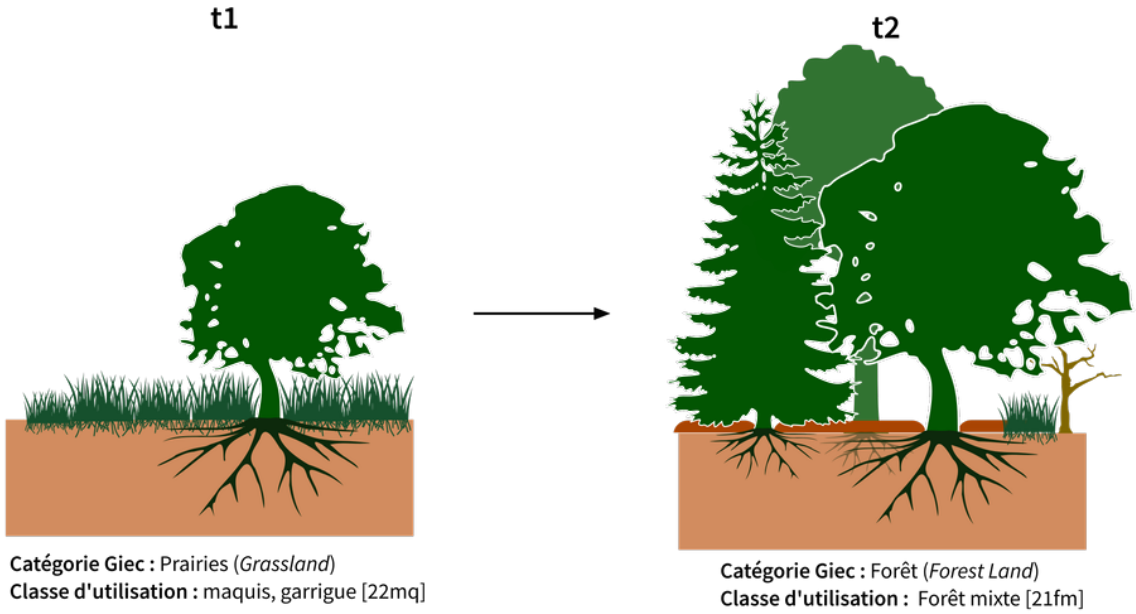
→ The difference in stock between years creates carbon emissions or removals.

→ Carbon fluxes are bounded by maximum flows per type of use, to calibrate to speed of the stock variation.

→ The stock variation can be interrupted by another land use change.

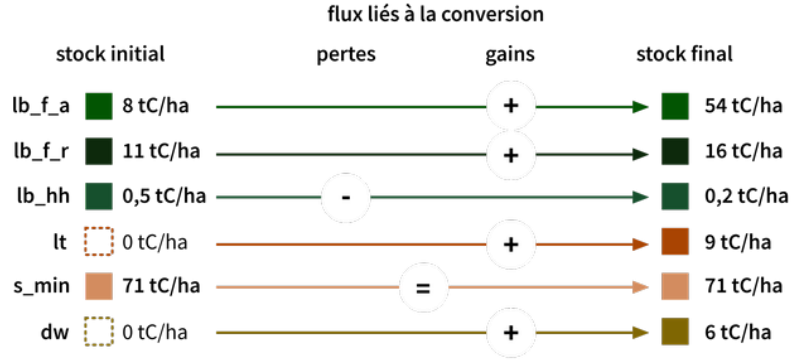
These flows from the model are combined with other flows to obtain the complete LULUCF inventory: NFI forest flows, N20 emissions, etc.

Carbon fluxes calculation per cell - land use changes



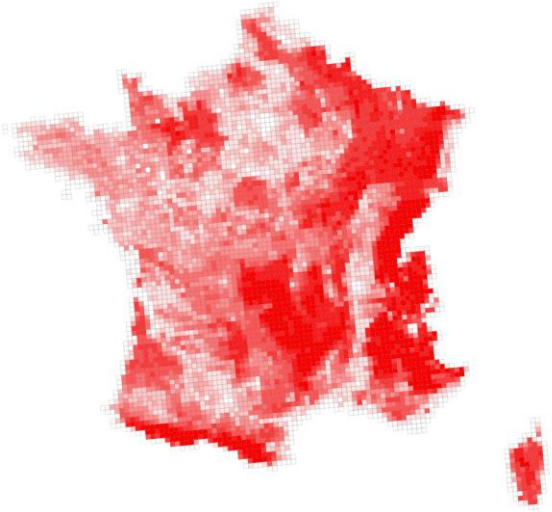
Zone pédoclimatique 1_1
texture pédologique grossière
climat chaud tempéré humide

Sylvoécorégion
Cévennes

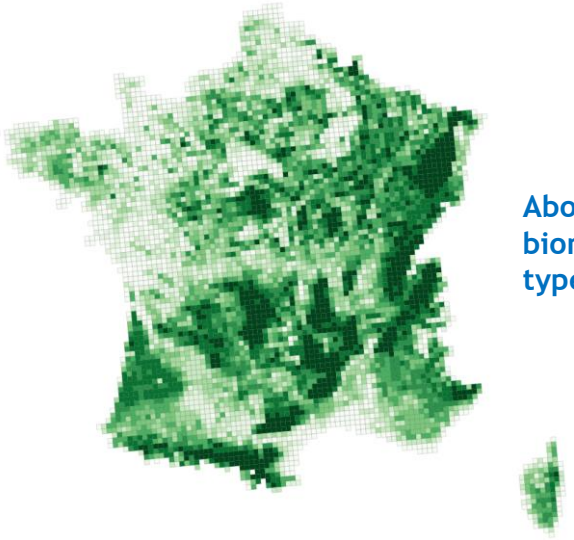


Stock mapping : exemple of 4 carbon pools, all land use type

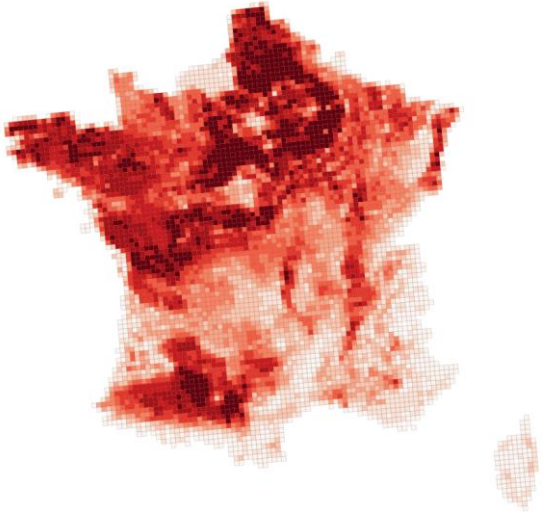
Min soils



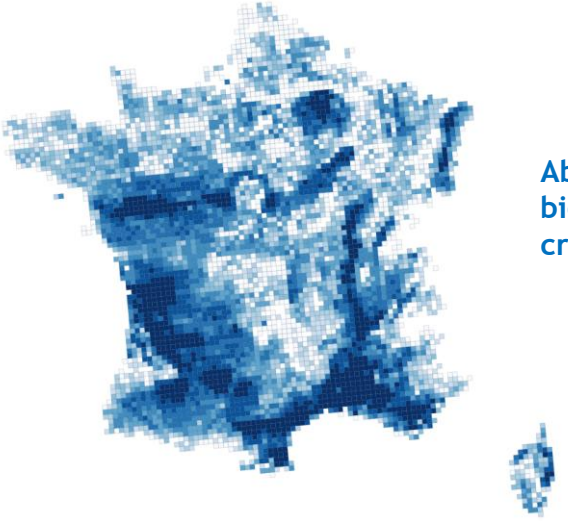
Above ground biomass (forest type)



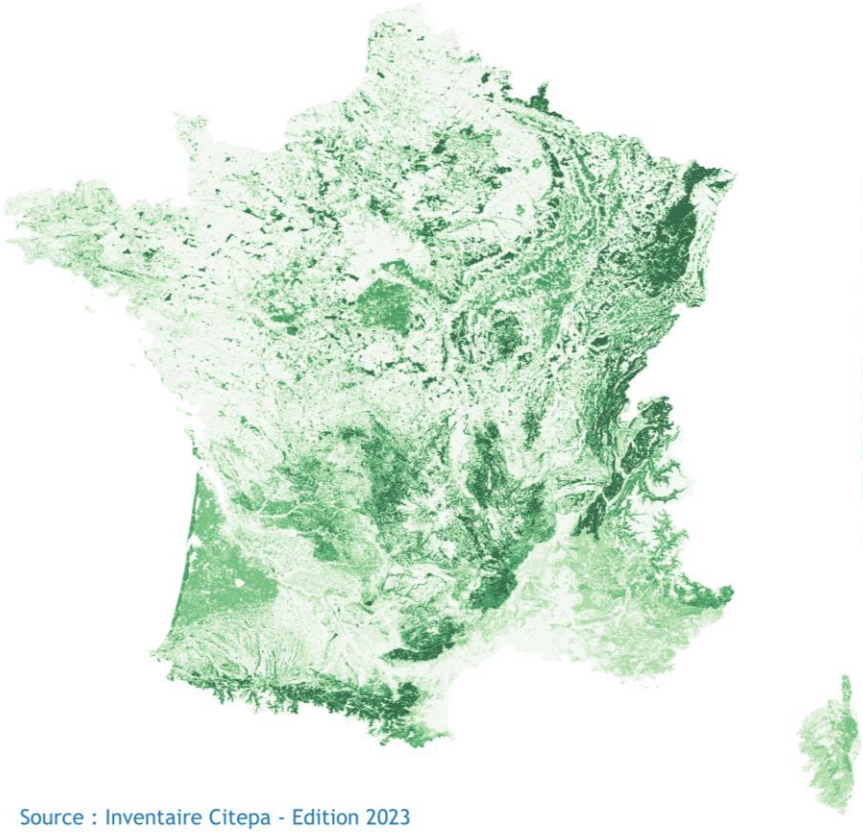
Biomass (annual cropland)



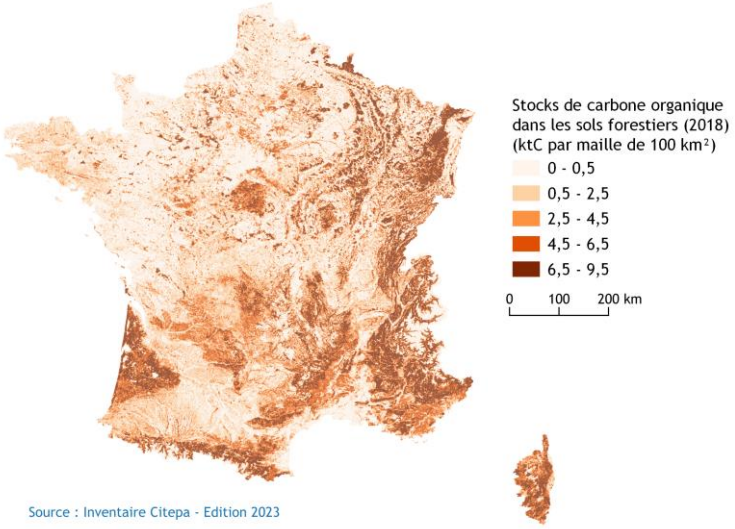
Above ground biomass (perennial cropland type)



Stock mapping – biomass and soil organic carbon – forest land

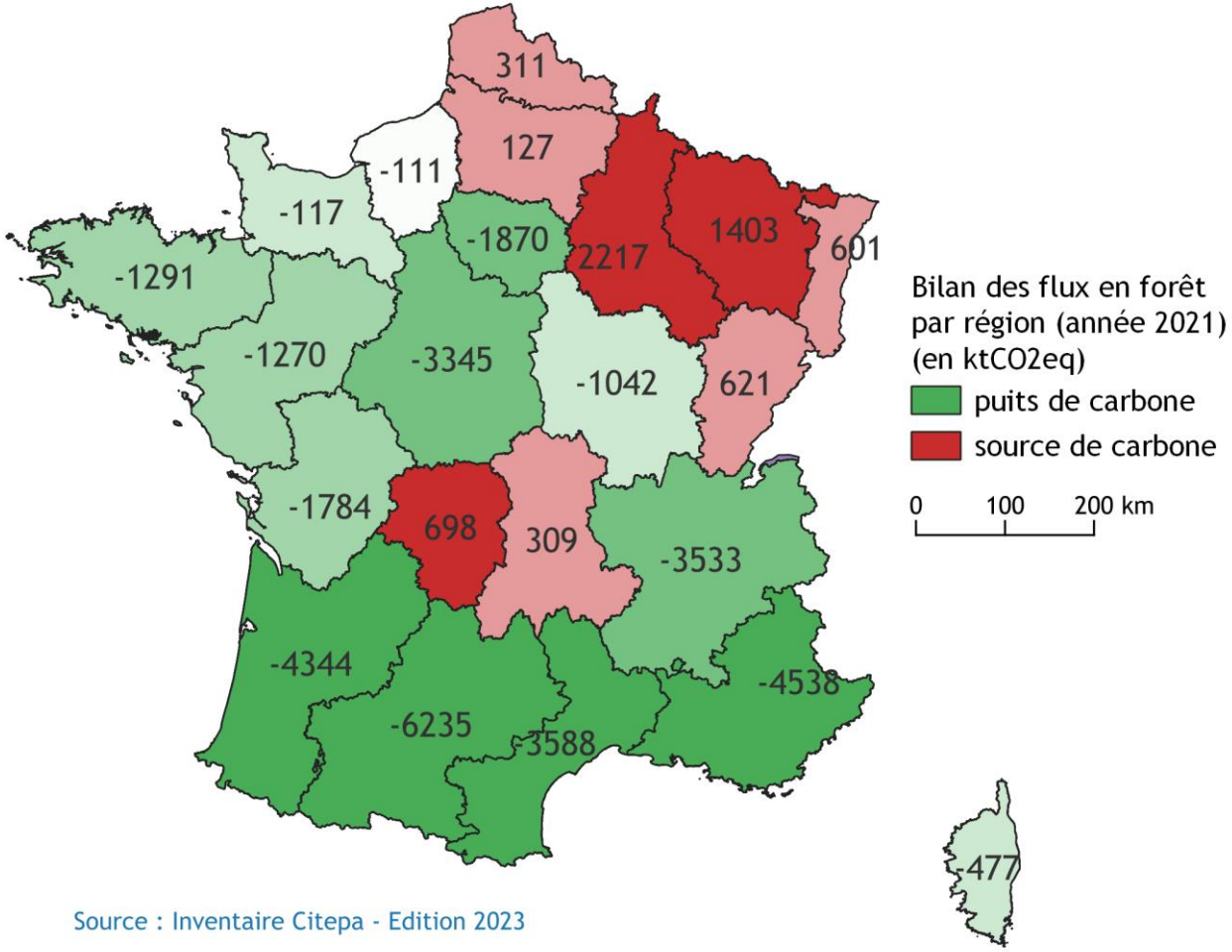


Source : Inventaire Citepa - Edition 2023



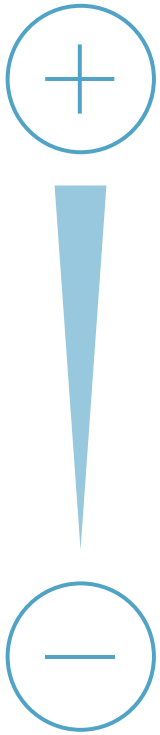
Source : Inventaire Citepa - Edition 2023

Flow mapping : balance of forest flows by region



Source : Inventaire Citepa - Edition 2023

Lessons learned (carbon)



Improvement of transparency, flexibility of the method to be combined with spatialized stocks, management practices…

Distinction of biomass types (correct gains and losses methods)

Harmonization of the calculation for all land use changes, all pools, and changes in management for agricultural soils.

Increase of complexity compared to the old method :

1. a lot of pre-processing, long analysis and calculation times, demanding data storage
2. need to master programming languages and maintain a remote server

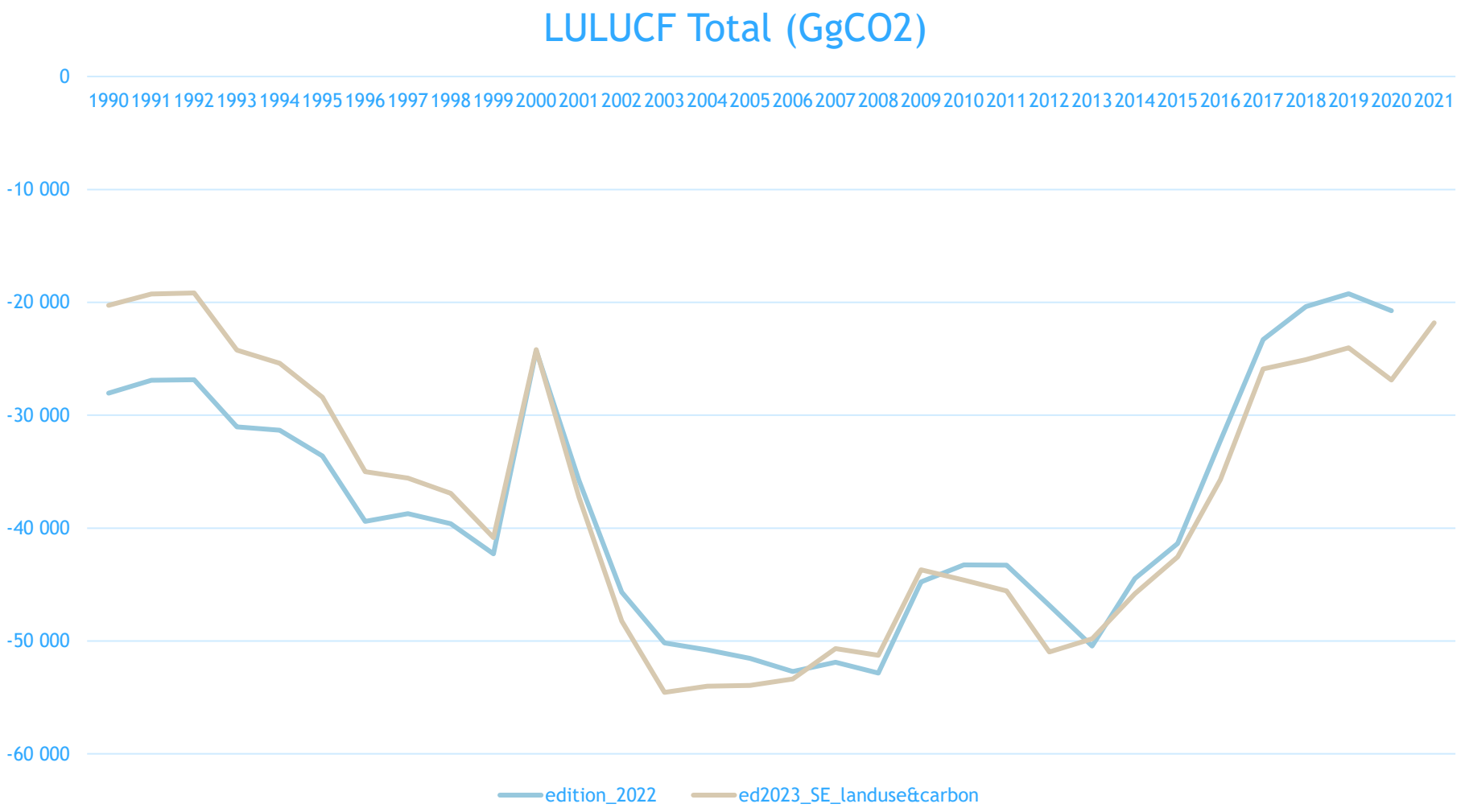
Need to add calculations that are not spatially explicit (e.g. NFI fluxes in FL remaining FL)

High impact of :

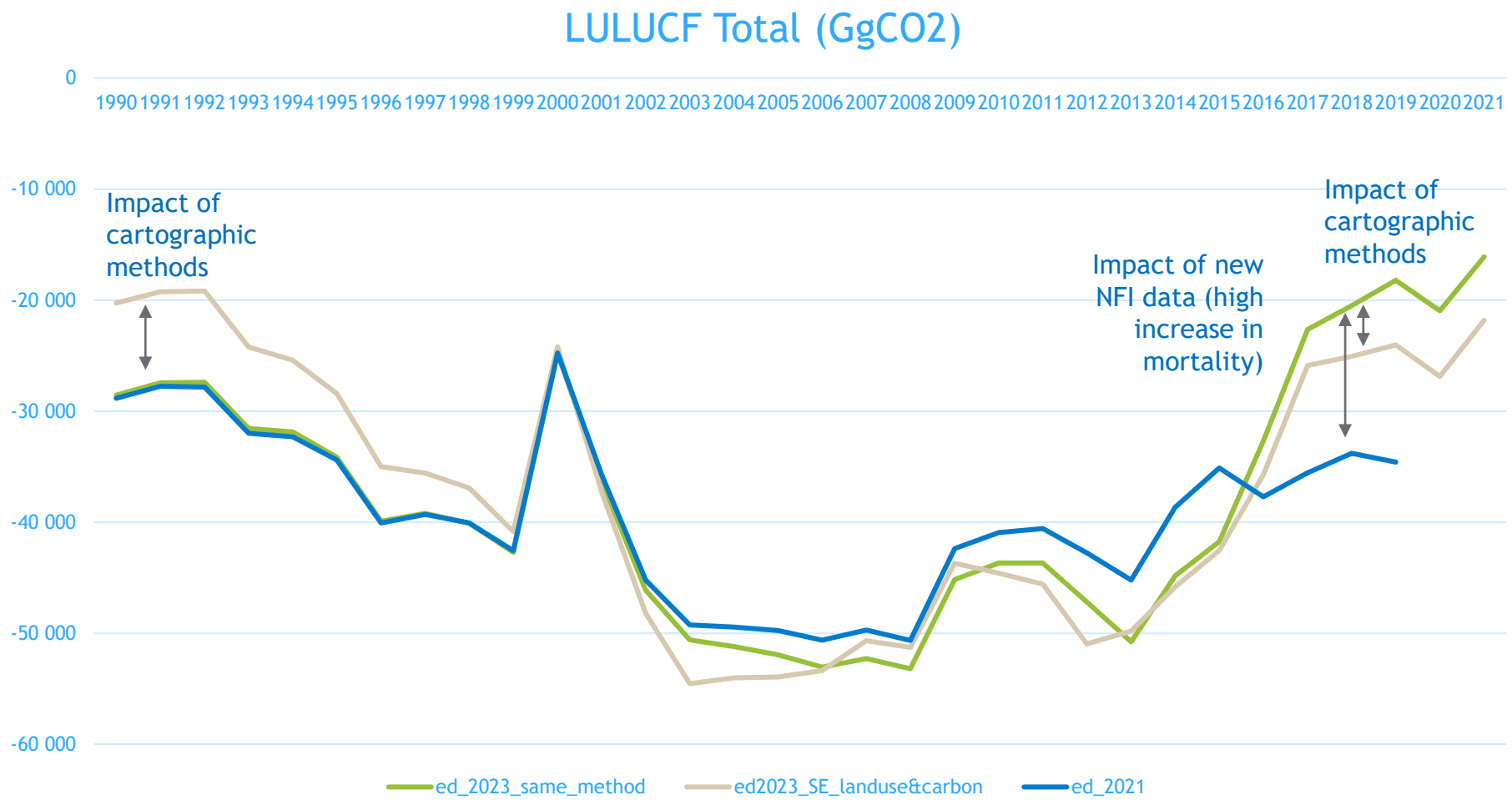
1. The choice of the speed of conversion to the new carbon reference stock
2. The decision whether to differentiate stocks between categories where a lot of land use changes occur (e.g. herbaceous stocks among cropland types)

Improvements needed: organic soils, wetlands, forest soils, hedges…

Recalculations



Recalculations



Thank you for your attention !
Merci !