



# Towards a methodology for the harmonization of soil maps assisted by digital mapping

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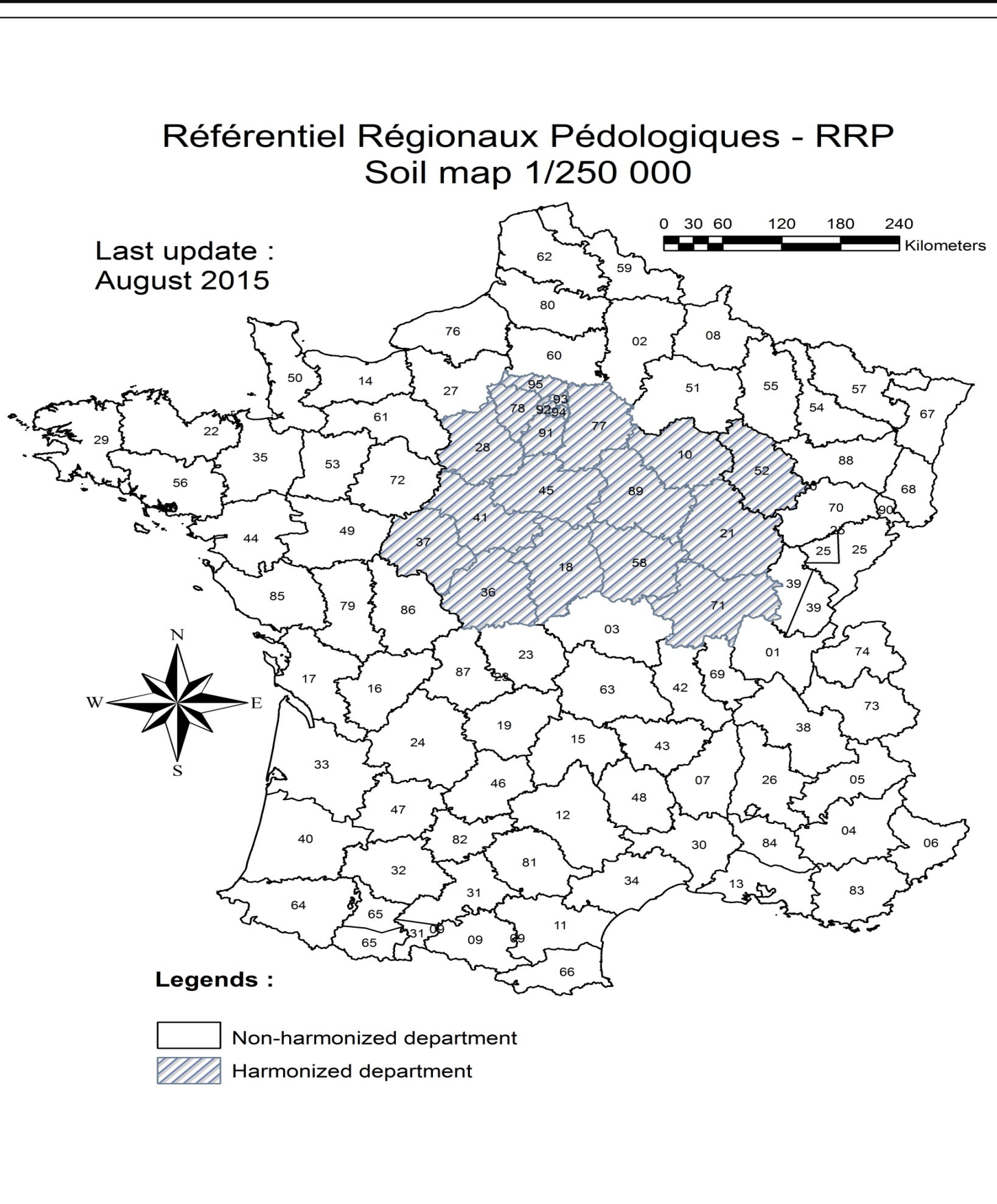
## Background & objectives

Soils are central to several global challenges such as ecosystem services delivery, food security, climate change mitigation or biodiversity protection. Though soils are threatened by many human activities such as intensive agriculture or urbanization. So it is indispensable to protect soil and manage this resource as well as possible.

To manage soil resource on an area, it is firstly necessary to gather spatial information about soil types and soil properties. Today, the only exhaustive soil map available for France is the 1/ 1.000.000 soil map published in 1998 and available on this website : <http://www.gissol.fr/donnees/cartes/les-sols-dominants-de-france-metropolitaine-1491>

In 1991, to respond to the needs of planners and managers of Departments and Regions, France launched a 1/250.000 soil mapping program. To develop this national program, each department was responsible for the production of a soil map on its own area. In 2001, a new program was launch to establish common rules and a shared database for mapping. Despite of these specifications, there are consistently several **inconstancies between adjacent department soil maps**. These inconstancies can be graphic problems or semantic problems or both. So our objective is to **harmonize** these maps to create a coherent 1/250.000 soil map on the whole country.

To use a **reproducible method** which can be applied to maps of the entire country. The harmonization method has also to be objective to erase the inconstancies between the adjacent maps due to the interpretations of each soil surveyor during the mapping process and the drawing of the **Soil Map Units (SMUs)**. As testing area, INRA started with 3 central regions in France which are Région Centre (where INRA is located), Ile de France (Paris...) and Région Bourgogne. It was easier to start with these department since map author where geographically close.



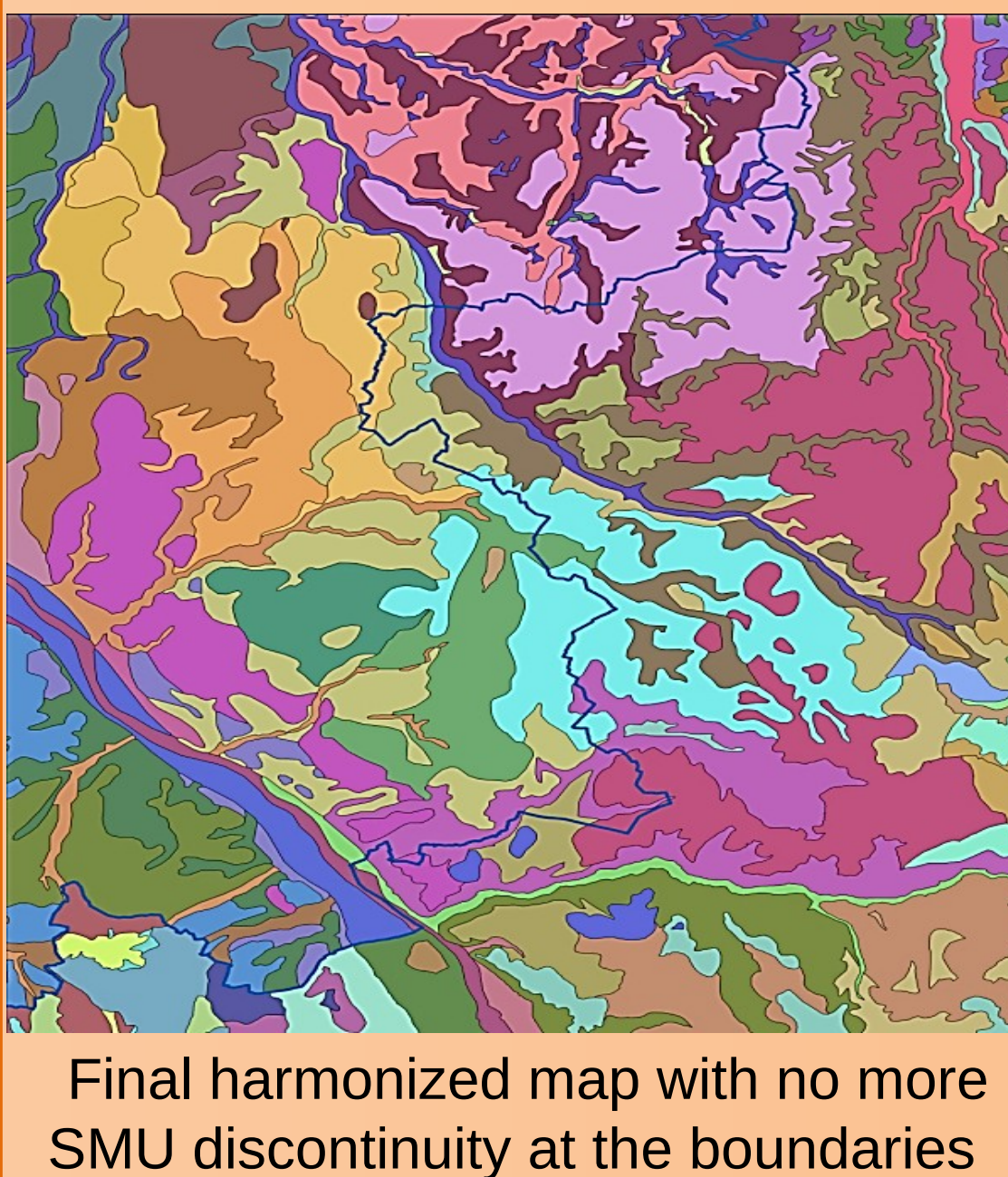
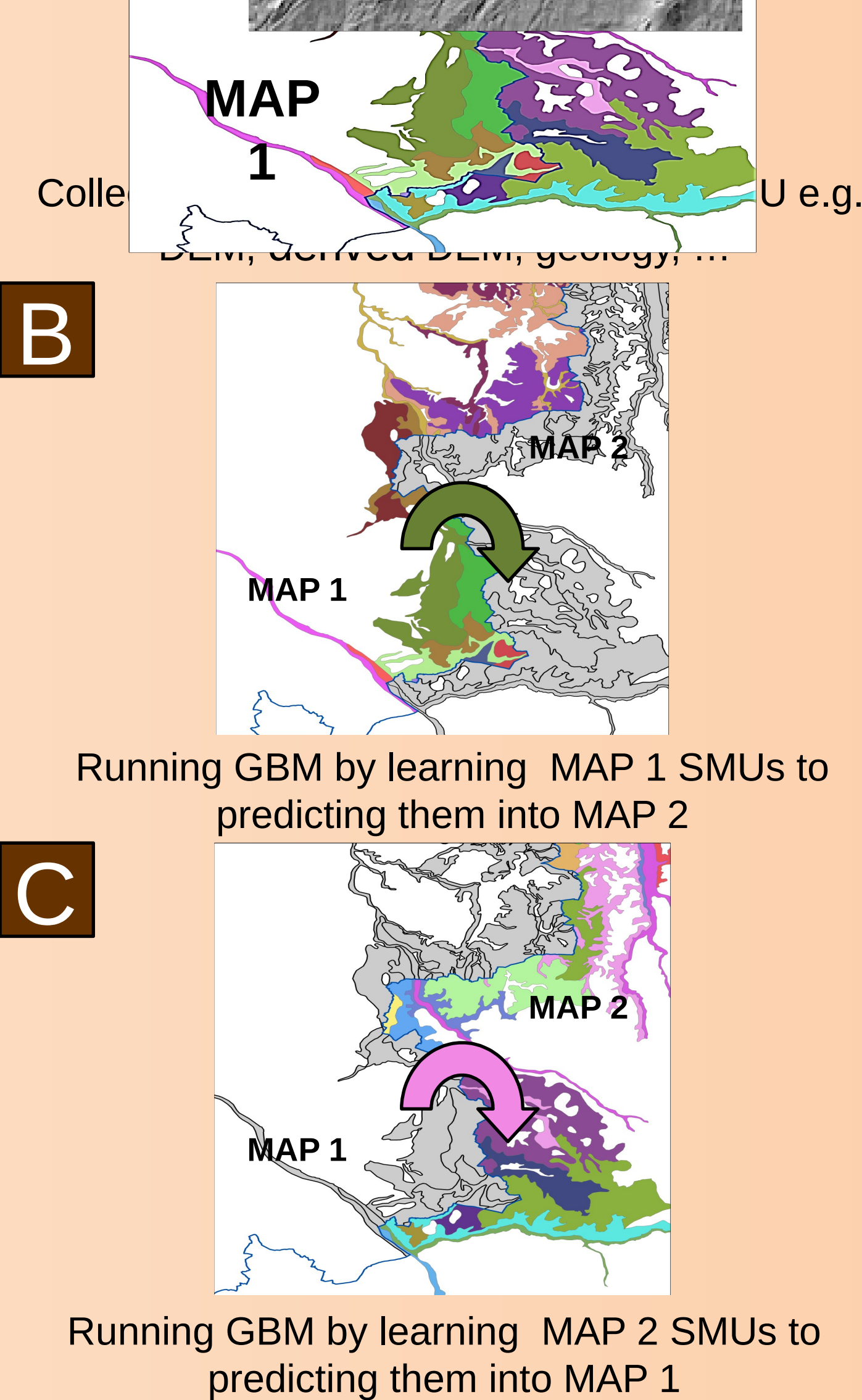
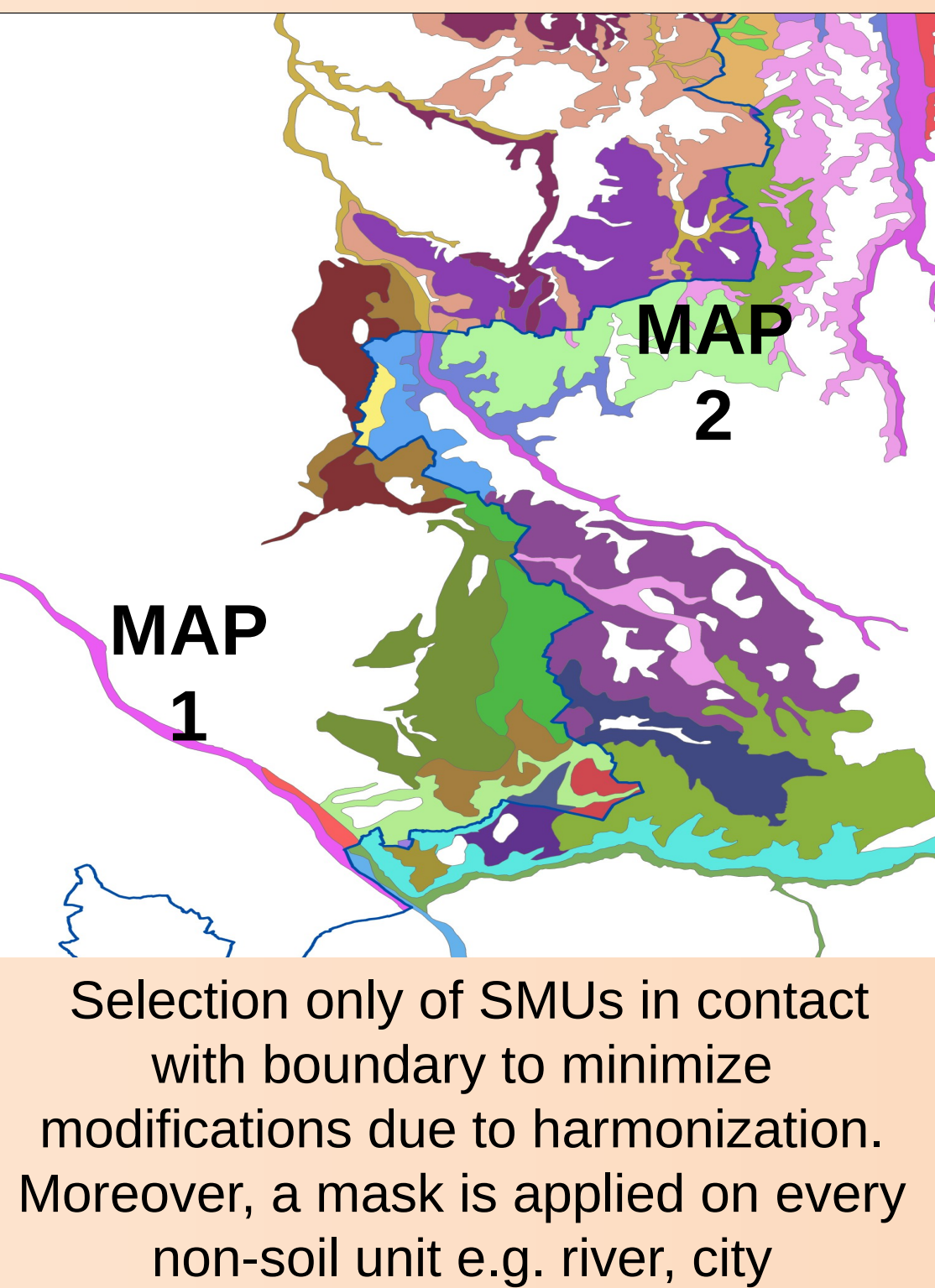
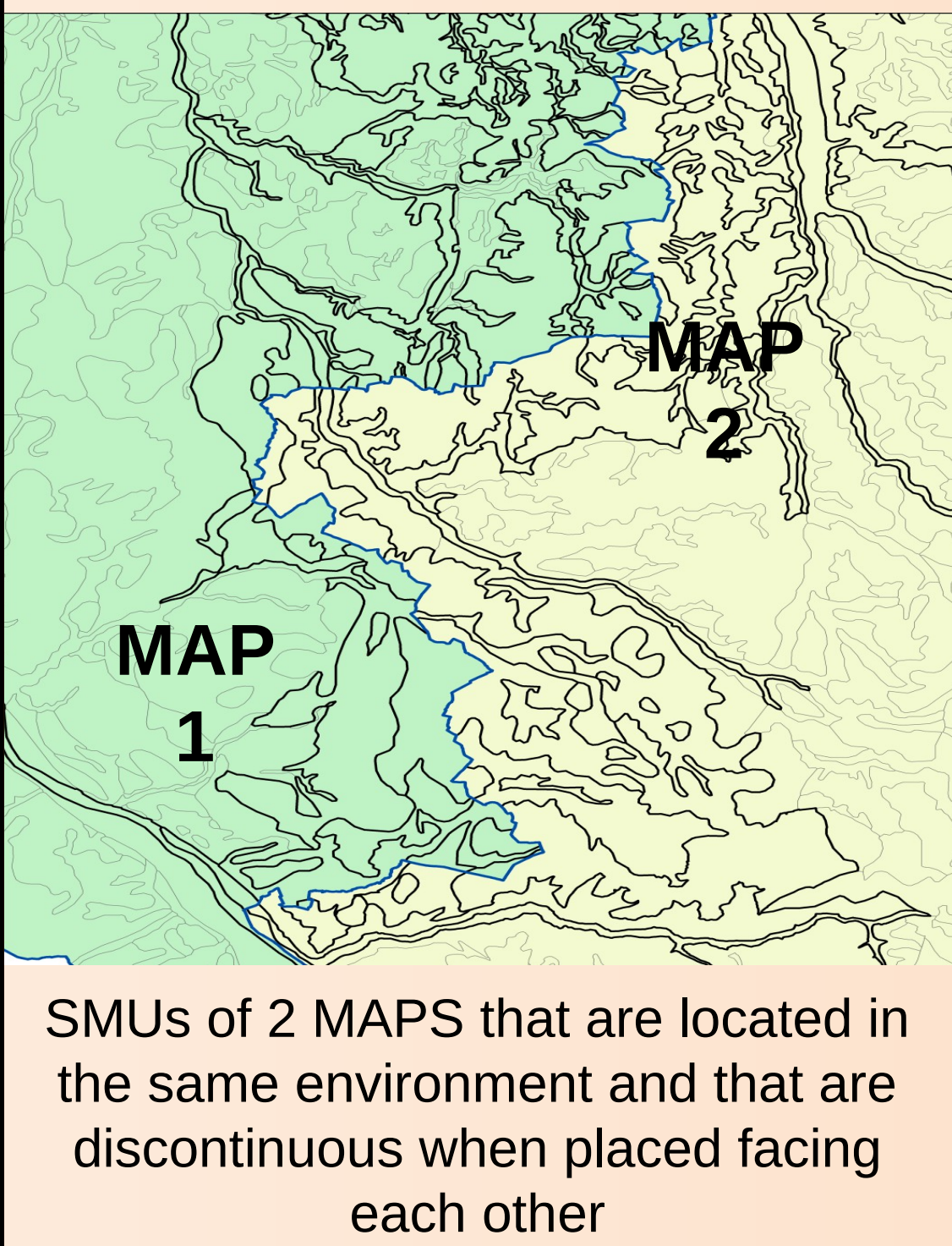
## Material & Methods

1  
Identify **similar environment** area to work on SMUs modifications

2  
Select SMU from either side in **contact with the boundaries**

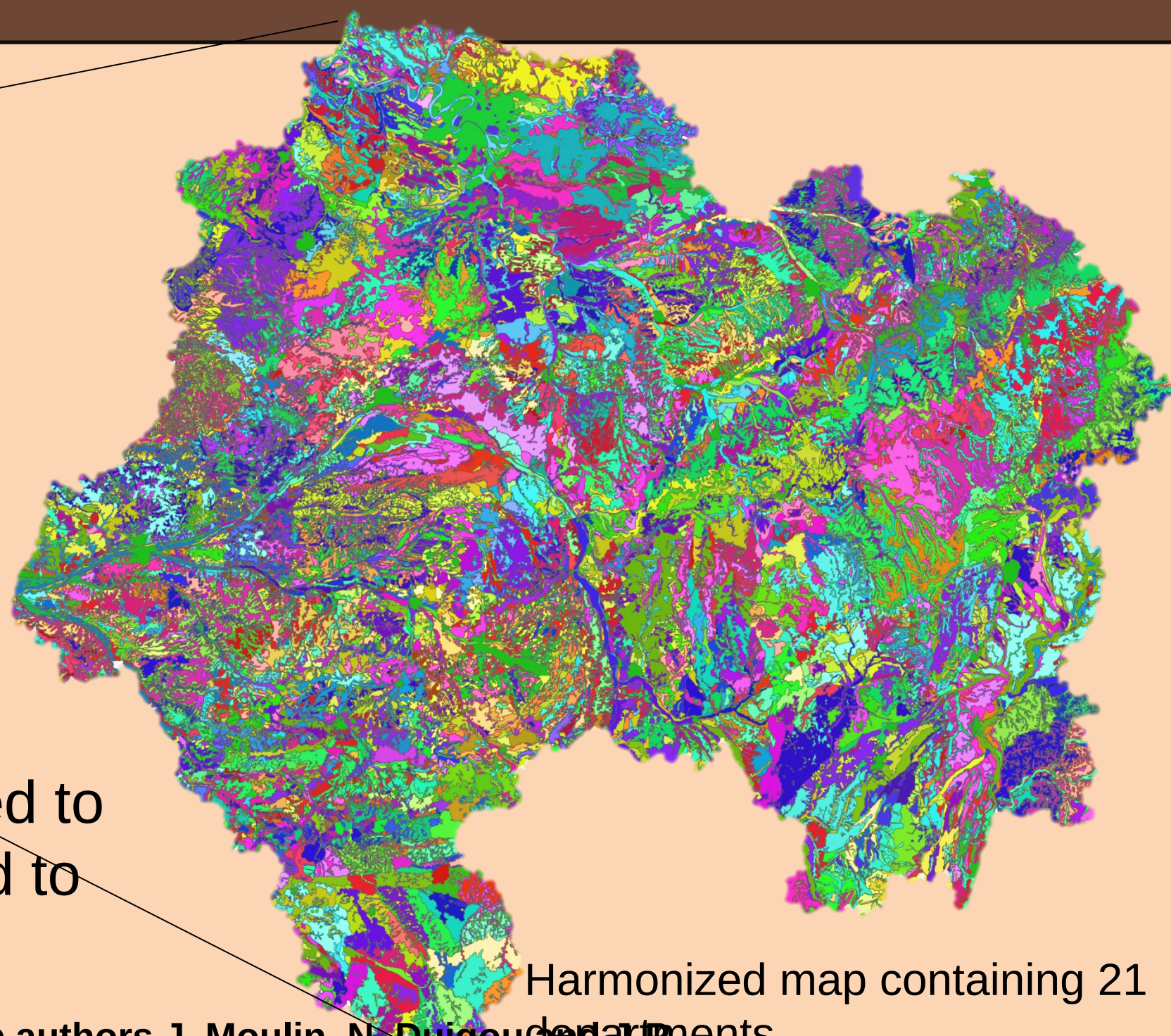
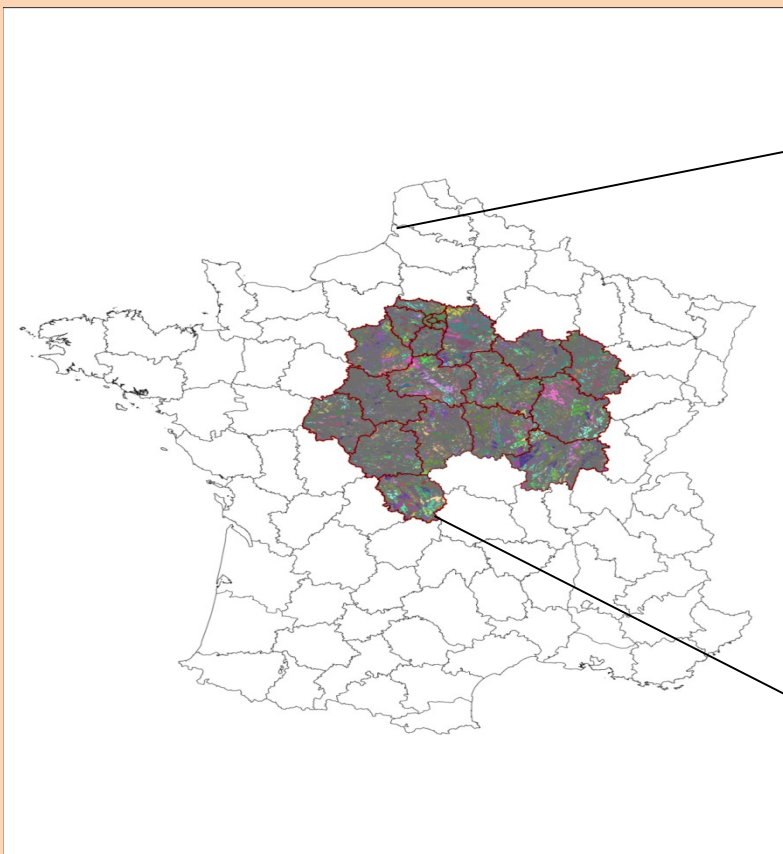
3  
Apply SCORPAN **prediction model** (Gradient Boosting Machine - GBM)

4  
Graphic and semantic harmonization of SMUs and their attributes using authors decision and digital mapping predictions



## Results

Harmonization steps	Time spent *
Data preparation	1 day
Running prediction model	2 days
Preparation and holding of mapping expert meeting	2 days
Digitalization and modification of graphic units	1 week
*Without taking account of time spent for R script programming	
Soil units	Count
Number of SMUs in initial maps	32 979
Number of SMUs in harmonized map	32 232
Total deleted or merged SMUs	747



Harmonized map containing 21 departments

This project is under the framework of the network « RMT Sols et Territoires » <http://www.sols-et-territoires.org>  
Harmonization is achieved on 22% of the metropolitan French territory. Methods works well and will now be applied to the rest of the country. A way to improve prediction models could be to gather additional covariates if available, and to run new validation fields sampling.

**SCORPAN** \* McBratney, A.B.; M.L. Mendonça Santos, B. Minasny (1 November 2003), "On digital soil mapping", *Geoderma* (Elsevier B.V., Amsterdam) **117** (1–2): 3–52 / **Acknowledgment** : **Special thanks to map authors J. Moulin, N. Duigou, J. L. L...**