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# Contextualized phosphorus recycling: potential diminution of phosphorus criticality at territory scale - Application to agricultural LCA

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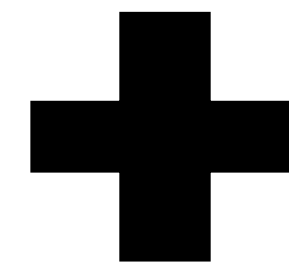
## Why phosphorus recycling?

Phosphorus (P) is an **essential element for crop nutrition**. It plays a crucial role in global food security.



### Phosphate rock: main source of phosphorus

- ▶ Critical raw material for European Union's (EU) economy
- ▶ Non renewable and exhaustible resource
- ▶ Long time scale for the exploration of new deposits
- ▶ Uneven distribution of global reserves



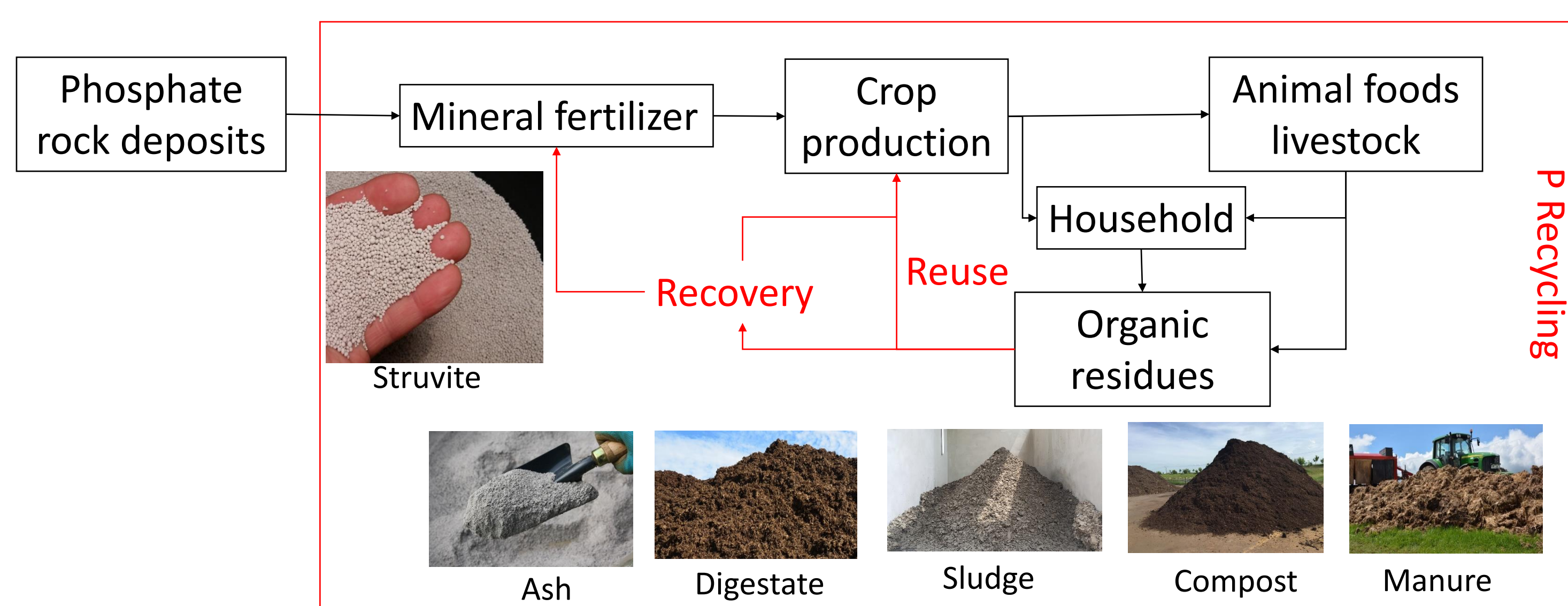
- ▶ Mostly used for phosphate mineral fertilizer manufacturing (86% in EU)
- ▶ P as element cannot be substituted in crop fertilizing
- ▶ Finland is the only European country producer of phosphate rock (16% of EU supplier)
- ▶ High EU dependency on third party countries



➔ In the agricultural sector, providing P from recycling sources is currently the only way to mitigate phosphate rock criticality

## Main issues for phosphorus recycling

**Phosphorus recycling** refers to the reuse in agriculture of collected (i.e. organic effluent) or **recovered** phosphorus (i.e. struvite) which is contained in organic residues (OR) as digestate, manure, sludge...



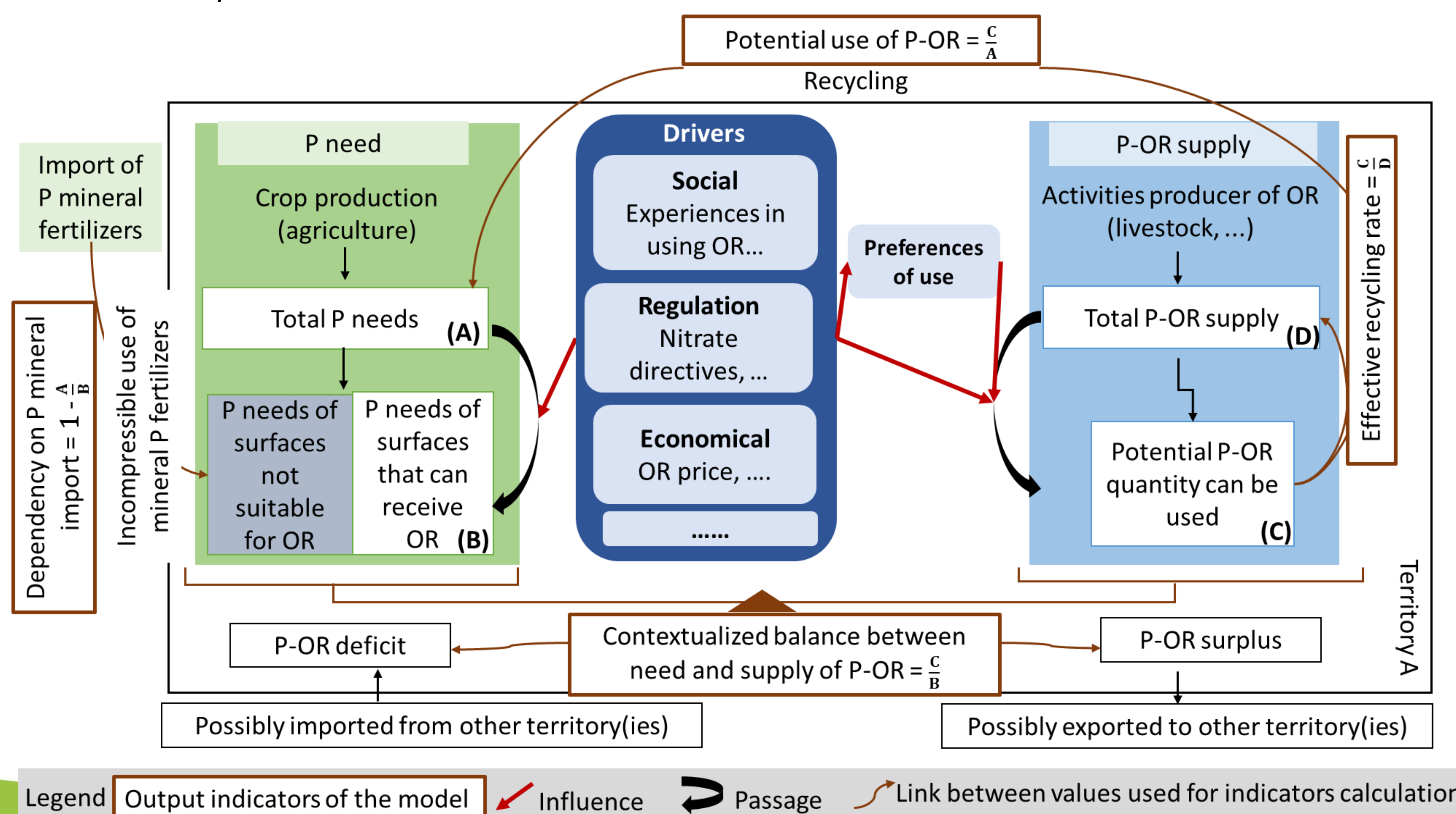
- ▶ P content varies according to OR types, treatment processes
  - ▶ OR diversity is a function of the economic activities present at the spatial scale
  - ▶ OR reuse in agriculture is presided over by regulations
  - ▶ Farmers may not use P recycled depending the characteristics of OR (price, agronomic value, location,...)
- => P recycling depends on the **geographical scale studied** and its **context** (regulatory, social, economic, agronomic,...).

The context and geographical scale are not taken into account in the evaluation of the recycling rate indicators used in the raw material criticality assessment (as EOL-RR, EOL-RIR,...)

➔ There is a need to **contextualize P recycling at the local scale**

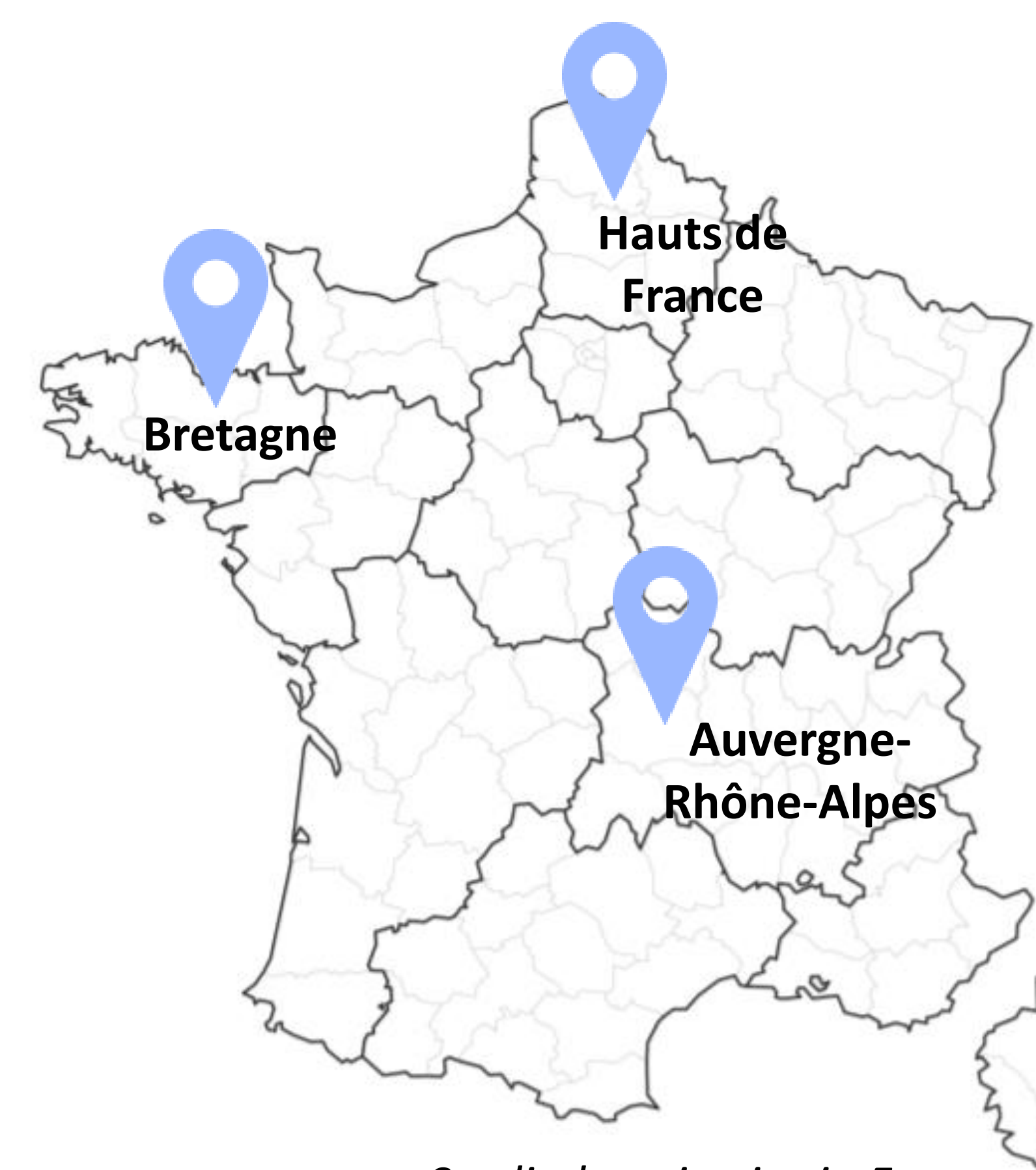
## Conceptual model for contextualized phosphorus recycling

The conceptual model aims to put P recycling back into its context to assess the **maximum recoverable and recyclable potential** of phosphorus from organic residues deposits in the studied territory.



To build the model, four set of parameters are identified

- ▶ P-OR supply
- ▶ P needs
- ▶ Drivers, i.e. any factors that can influence the use of P from OR by farmers
- ▶ Preferences of use by farmers



Studied territories in France

## Conclusion

The proposed model will help to provide an **effective recycling rate consistent with local context** (fertilizer regulation, water framework directive, farmers preferences, agronomy context...). This promotes a **better integration of the characteristics of phosphorus recycling into criticality assessment**. The model gives a methodology advancement, which **would improve or be a complement of the LCA tool to assess territorialized phosphorus recycling scenarii**.