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Copper contamination in vineyard soils of Bordeaux : spatial risk assessment for the replanting of vines and crops

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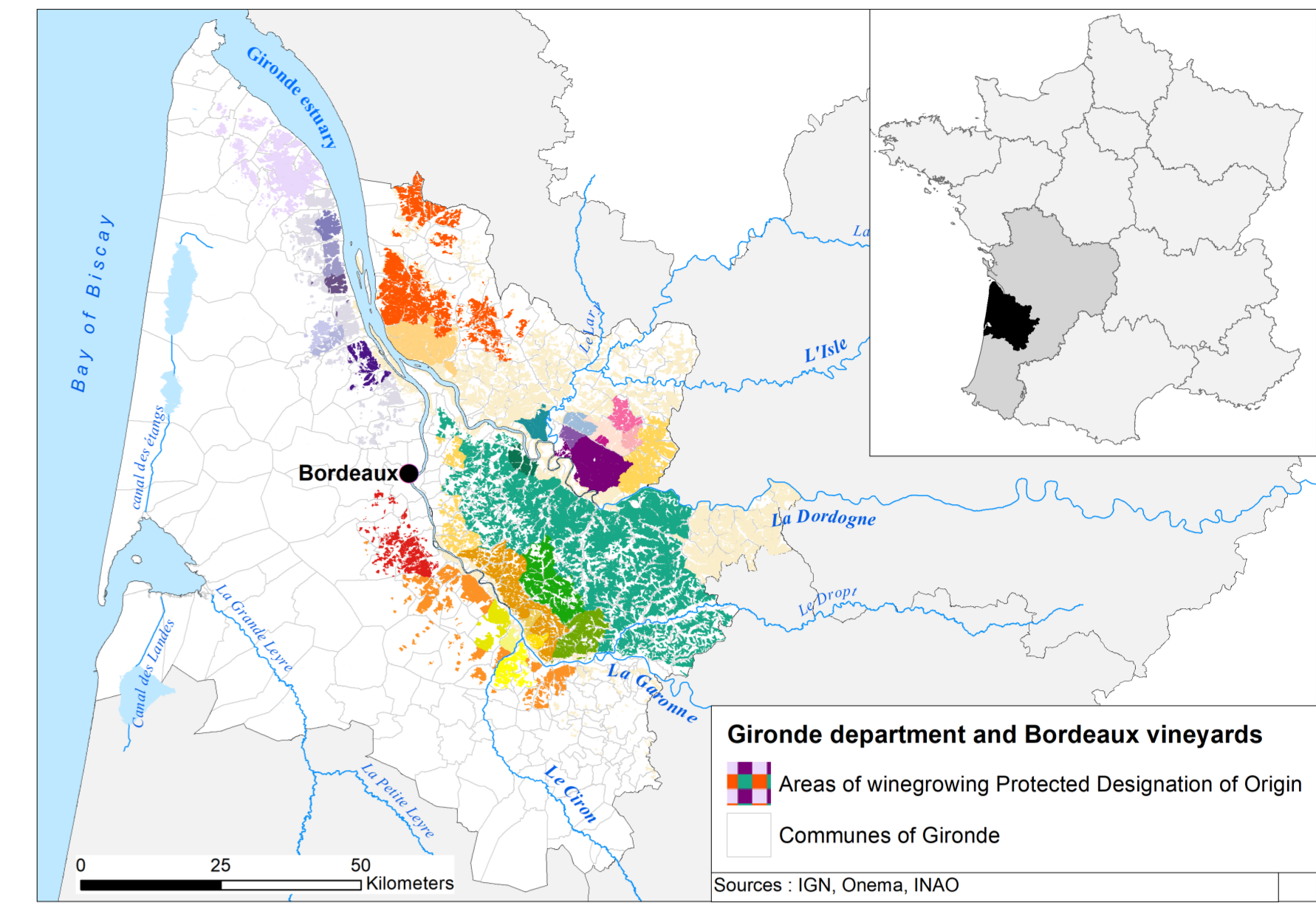
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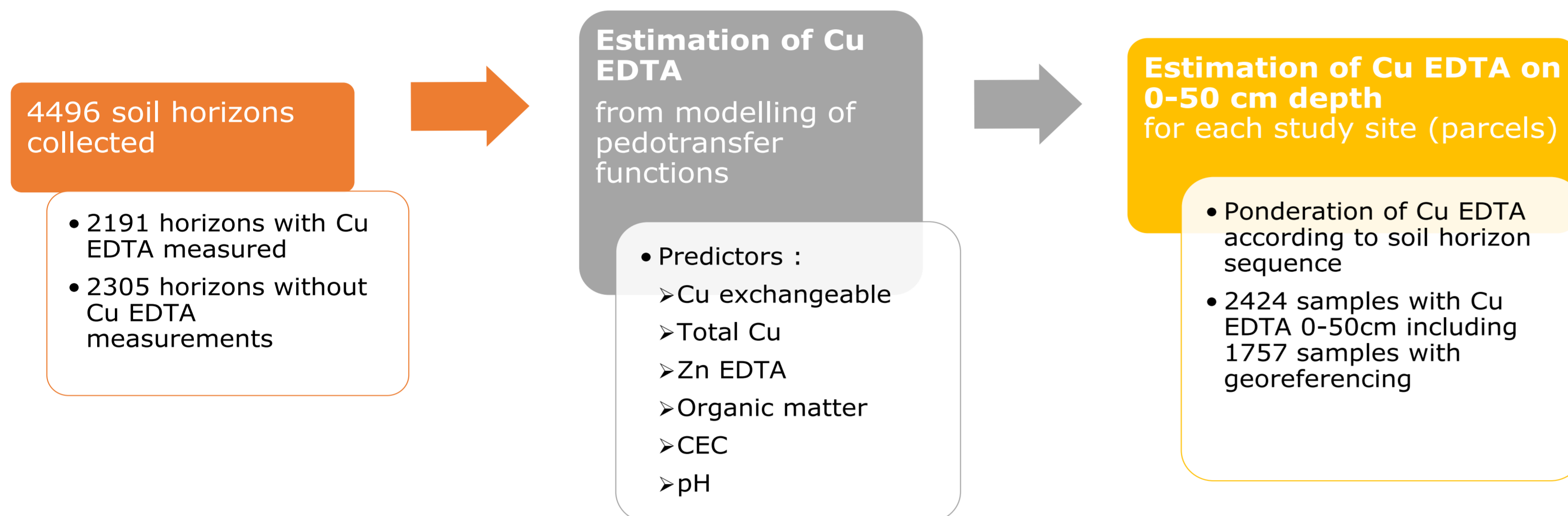


Introduction

Copper (Cu) is widely and historically used in viticulture as a fungicide against mildew. Cu has a strong affinity for soil organic matter and greatly accumulates in topsoil horizons of vineyards¹. Excess of Cu in soils negatively affects soil organisms and young plants, consequently reducing soil fertility and productivity^{2,3}. The Bordeaux vineyards have the largest vineyard surfaces (26%) within French protected designation of origin and a great proportion of French wine production (around 5 million hectolitres per year). The Bordeaux vineyards are also under heavy fungal pressure due to local climate. Considering the local context of vineyard surfaces decreasing (vine uprooting) and the possible new crop plantation, the issue of Cu potential toxicity rises. Therefore, our aims are to evaluate the Cu contamination in vineyard soils of Bordeaux, then to produce a risk assessment map for new vine or crop plantation.

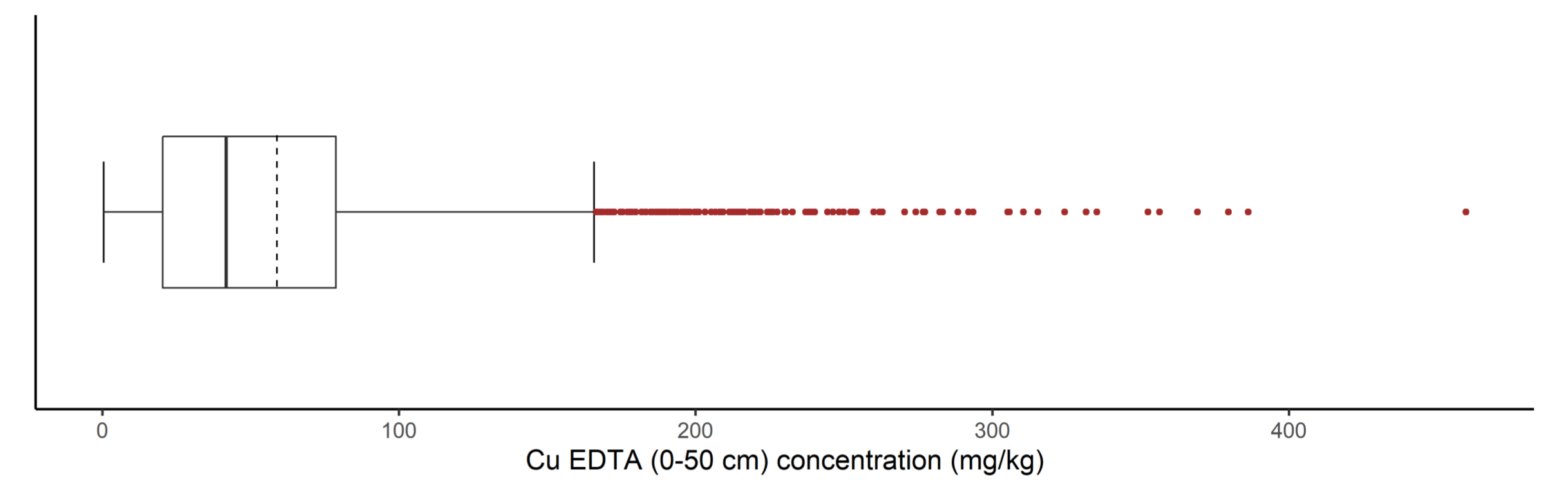
Database of Cu contamination in vineyard soils

- 4496 soil horizons over 2424 study sites (soil pits), including 1757 georeferenced sites
- Data collected from various soil studies within the Gironde area (1984 - 2020)
- Analysis of Cu : total, EDTA, exchangeable (ammonium acetate)



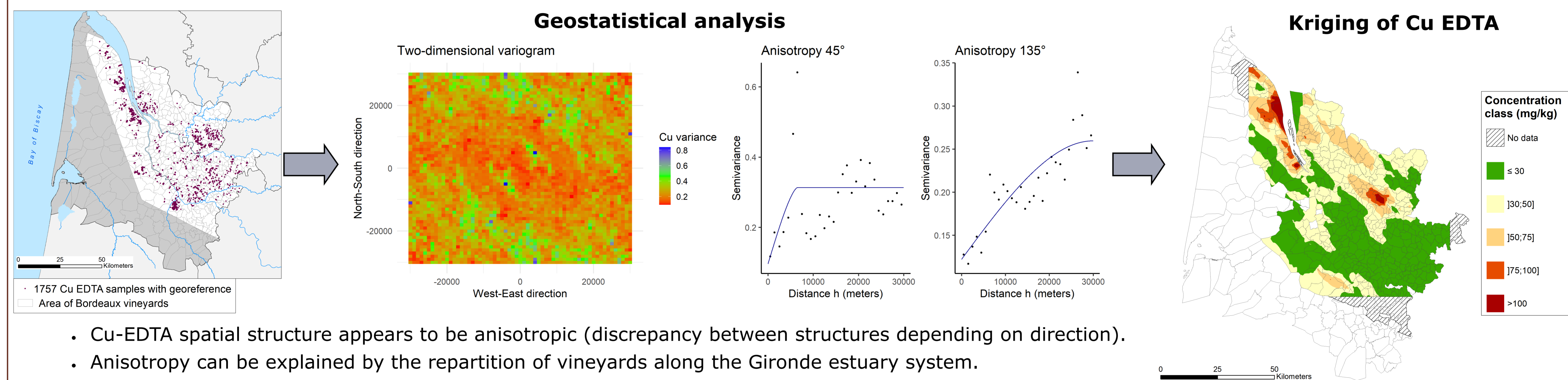
- Statistical summary of Cu-EDTA 0-50 cm (mg/kg)

Minimum	1st quartile	Median	Mean	3rd quartile	Upper whisker	Maximum
0.5	20.3	41.8	58.8	78.8	166.5	459.7



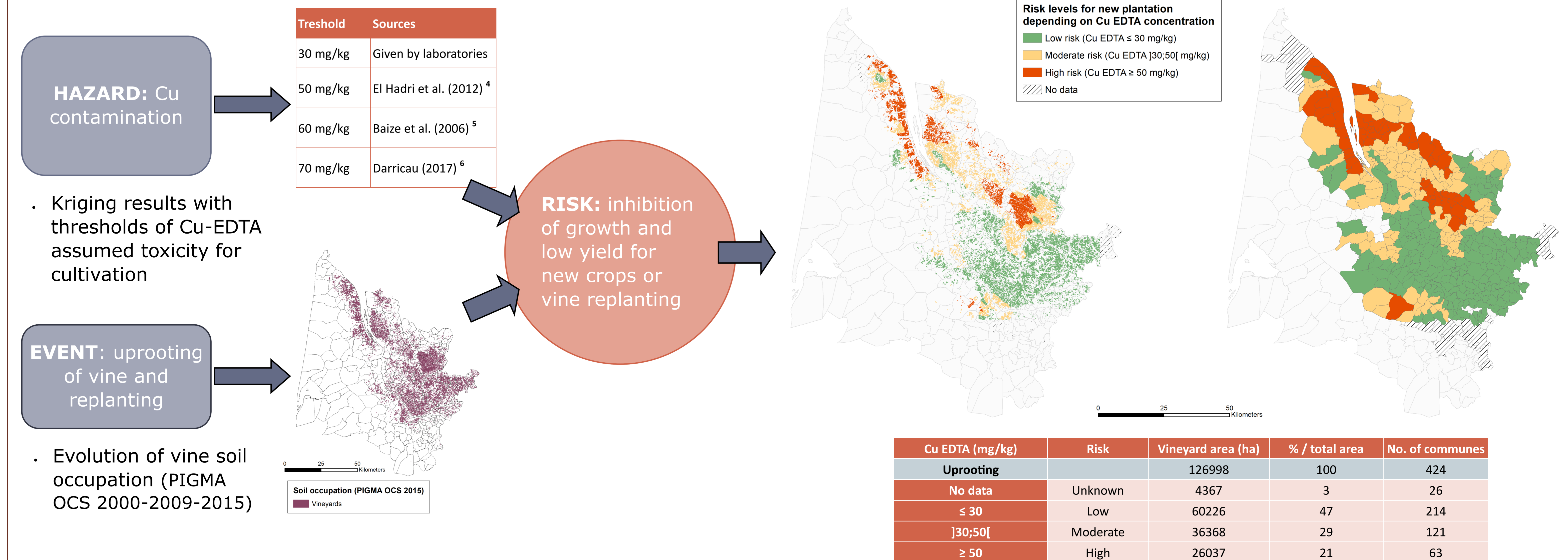
- French reference for soil pollution (Afnor) : 100 mg/kg total Cu

Spatial distribution of Cu contamination in vineyard soils and risk assessment



- Cu-EDTA spatial structure appears to be anisotropic (discrepancy between structures depending on direction).
- Anisotropy can be explained by the repartition of vineyards along the Gironde estuary system.

Spatial risk considering vine soil use, uprooting and replanting



Highlights

- Moderate or high risk for new plantation is estimated for 50% of Bordeaux vineyard soils (Cu-EDTA concentration superior to 30 mg/kg).
- Highest Cu contamination is found in the oldest and most prestigious appellations (Médoc, Saint-Emilion) which early used Cu as a fungicide.
- Results must be interpreted cautiously as they have limitations such as modelling errors, old data (in relation to Cu accumulation) and spatial missing data that may underestimate Cu-EDTA concentrations in vineyard soils.

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