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Toward an ecological agriculture on well catchment areas: what impacts in terms of nitric pollution at the scale of the Seine Basin, France?

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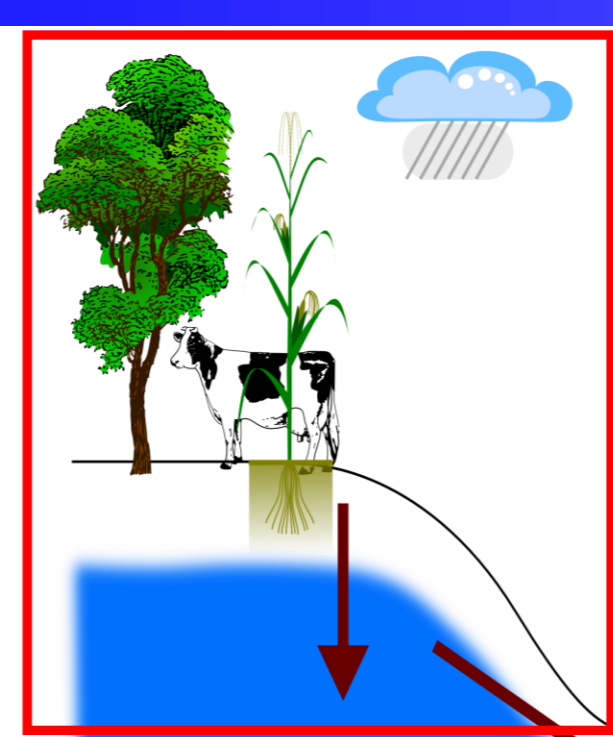
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TOWARD AN ECOLOGICAL AGRICULTURE ON WELL CATCHMENT AREAS: WHAT IMPACTS IN TERMS OF NITRIC POLLUTION AT THE SCALE OF THE SEINE BASIN, FRANCE ?

1 – Introduction, the nitrogen cascade

Nitrogen (N) comes for a large part from **agricultural diffuse sources**. This Nitrogen, in excess compared to the Plants requirements, is **leached** to the aquifers and to the rivers. This is a threat for producing drinking water and causes **eutrophication** of rivers and coastal zones.



Diffuse N from agriculture is leached to aquifers and to rivers

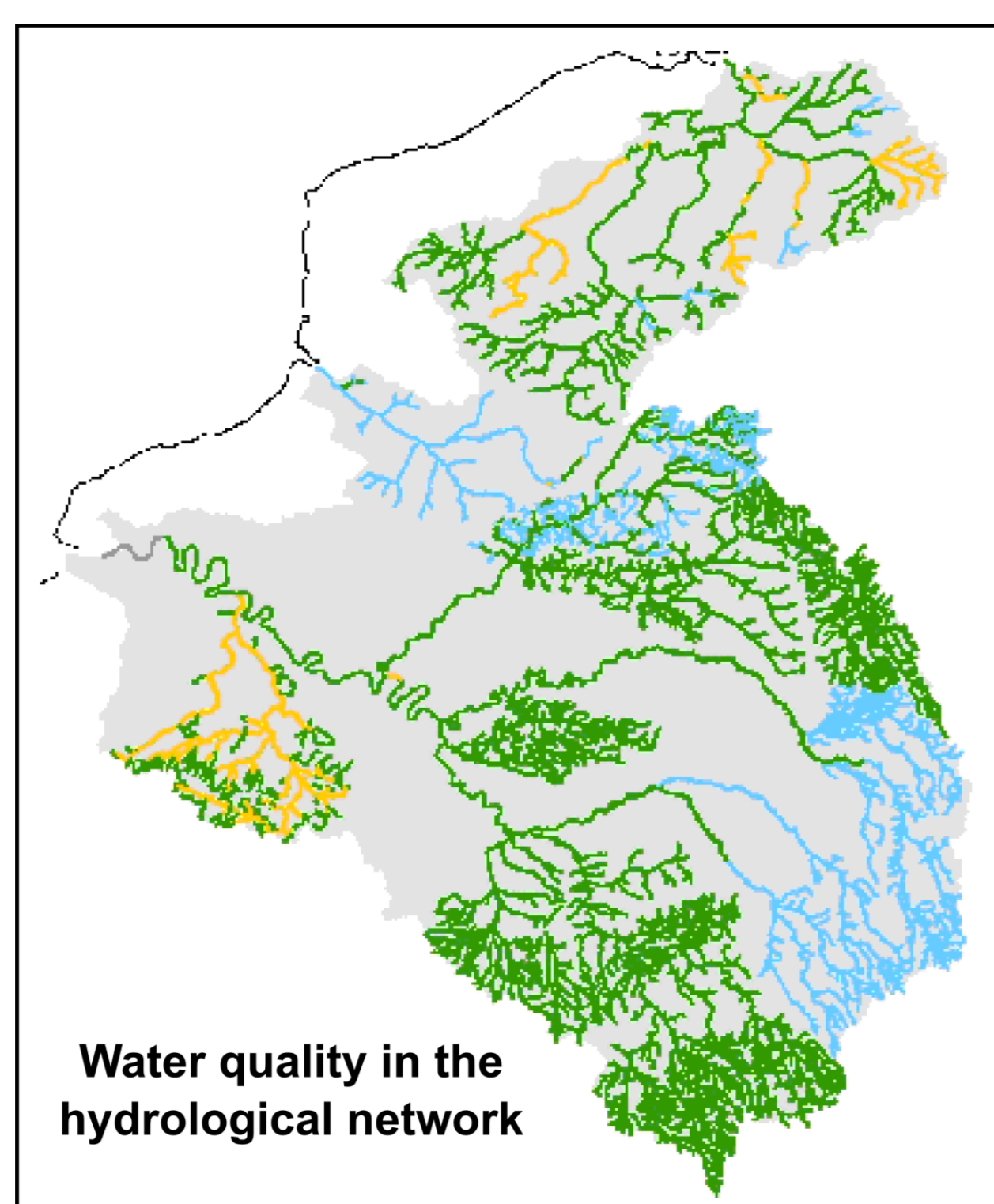
In 2007, in France, the « Grenelle de l'Environment » (a corpus of laws) was adopted. It prescribes to decrease N excess on arable lands within well catchment areas (WCA) in order to decrease N leaching to the hydrological network and coastal zones.

Riparian zones and stagnant water bodies can decrease N concentration within rivers by denitrification.

Point sources from cities and industries (WWTP), provide essentially phosphorus (P) and are nowadays well managed

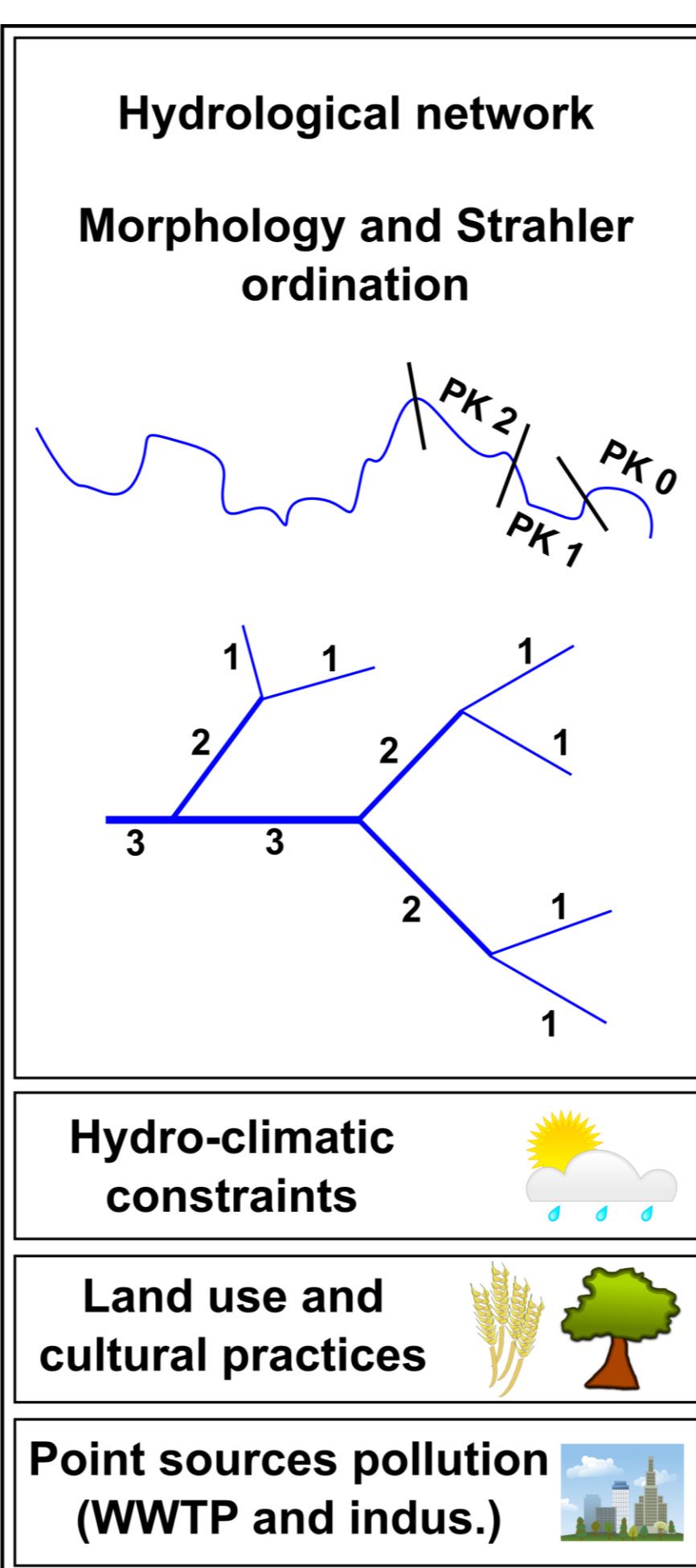
N excess over P and Si leads to **eutrophication** of coastal zones. **Hypoxic and anoxic** conditions can occur, threatening environment and economy.

2 – Modelling tool Seneque/Riverstrahler



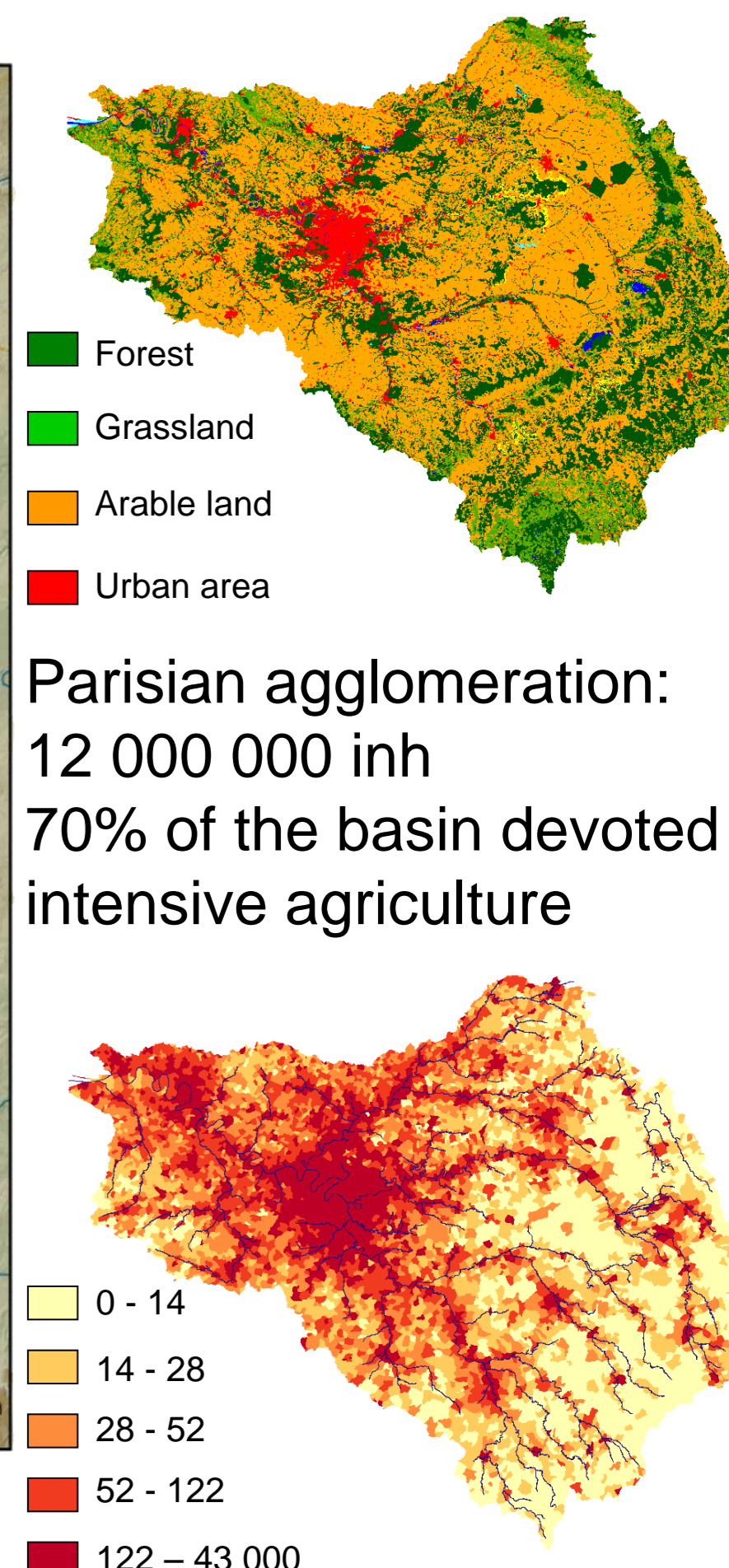
N, P, Si delivered to the sea

Seneque/Rivsetrahler model
RIVE



The Seneque/Riverstrahler model is a **mechanistic** model, depicting biogeochemical processes occurring within the water column → **Water quality within rivers**

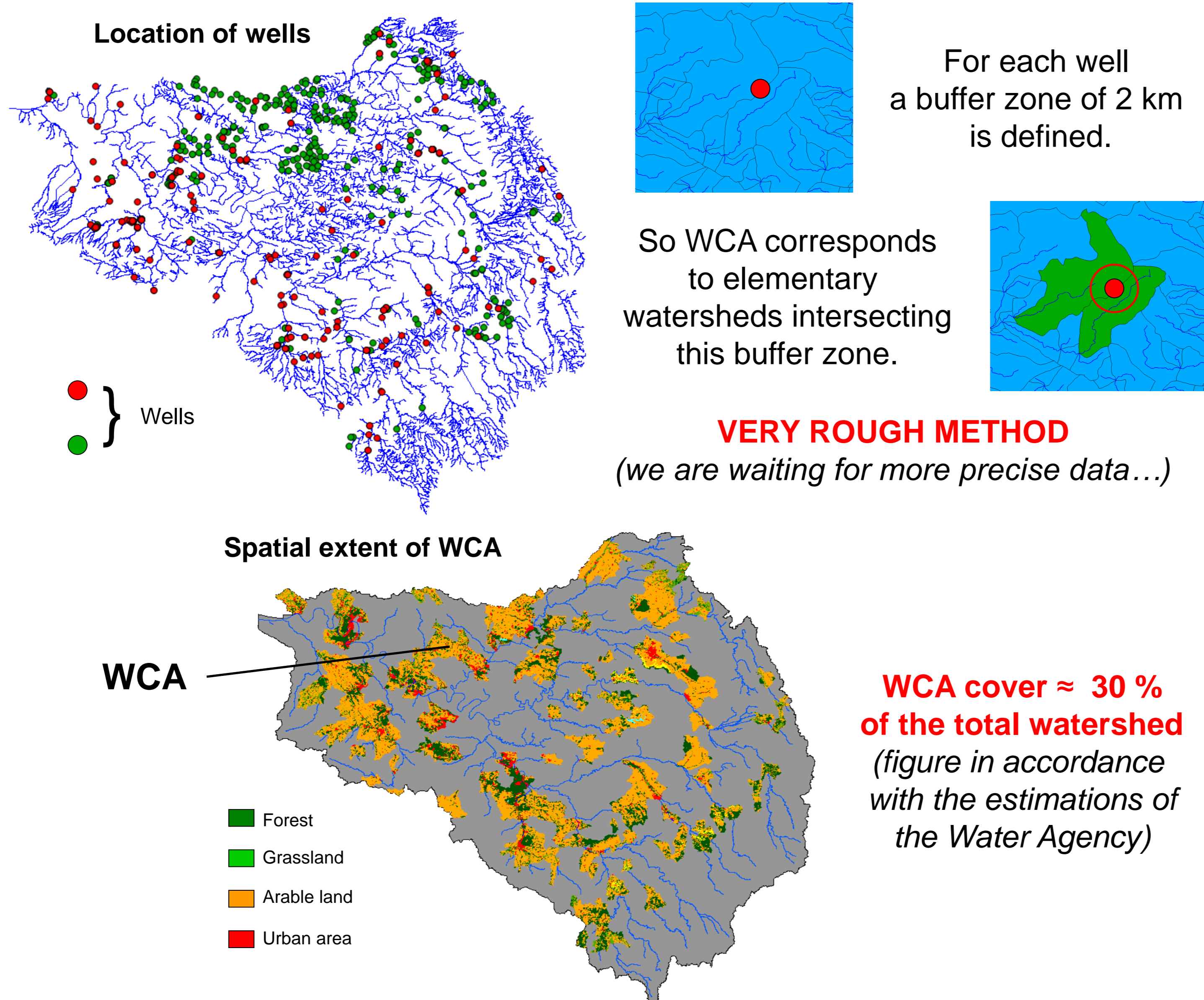
3 – Study site



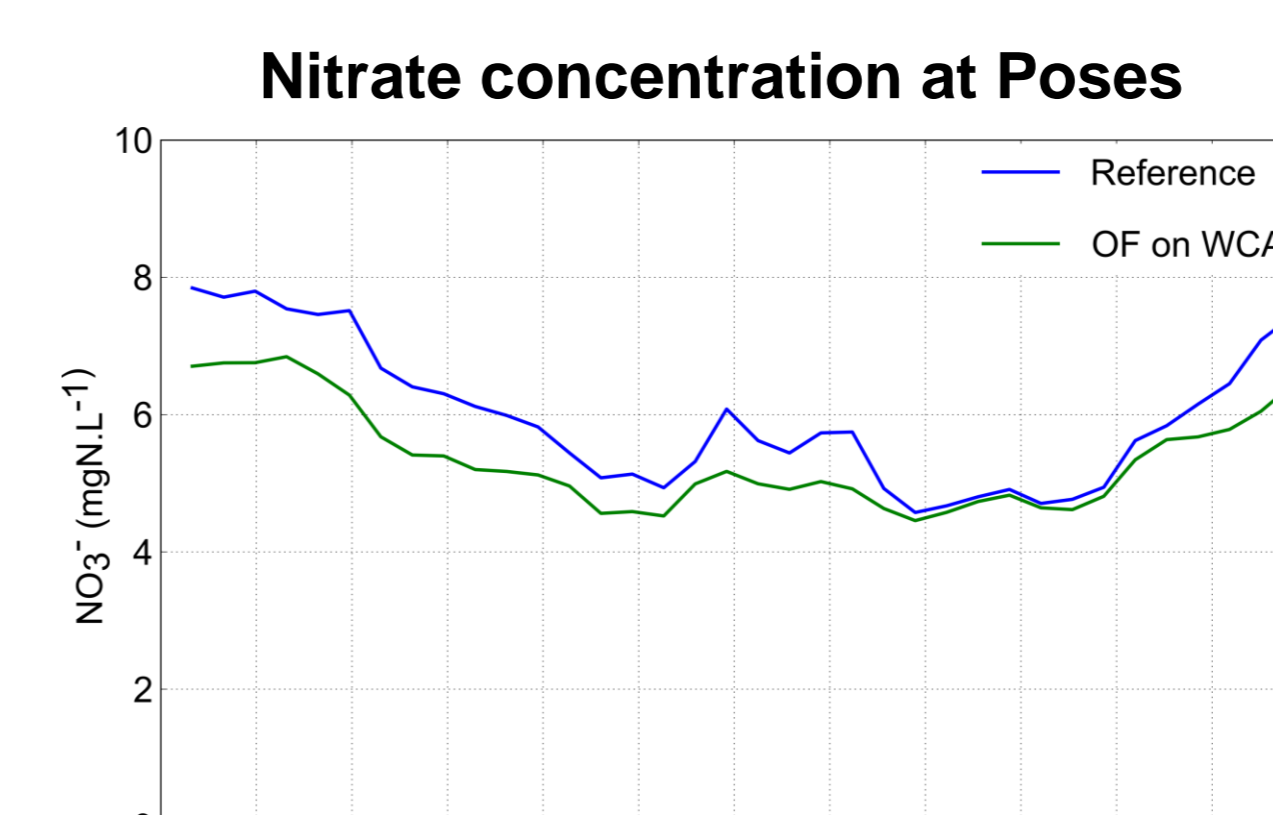
Seine watershed: 76 270 km²
Population: 16 000 000 inh.
Density: 215 inh.km⁻²
Intensive cerealiculture

High density in the central and downstream parts of the basin.

4 – Delineation of WCA

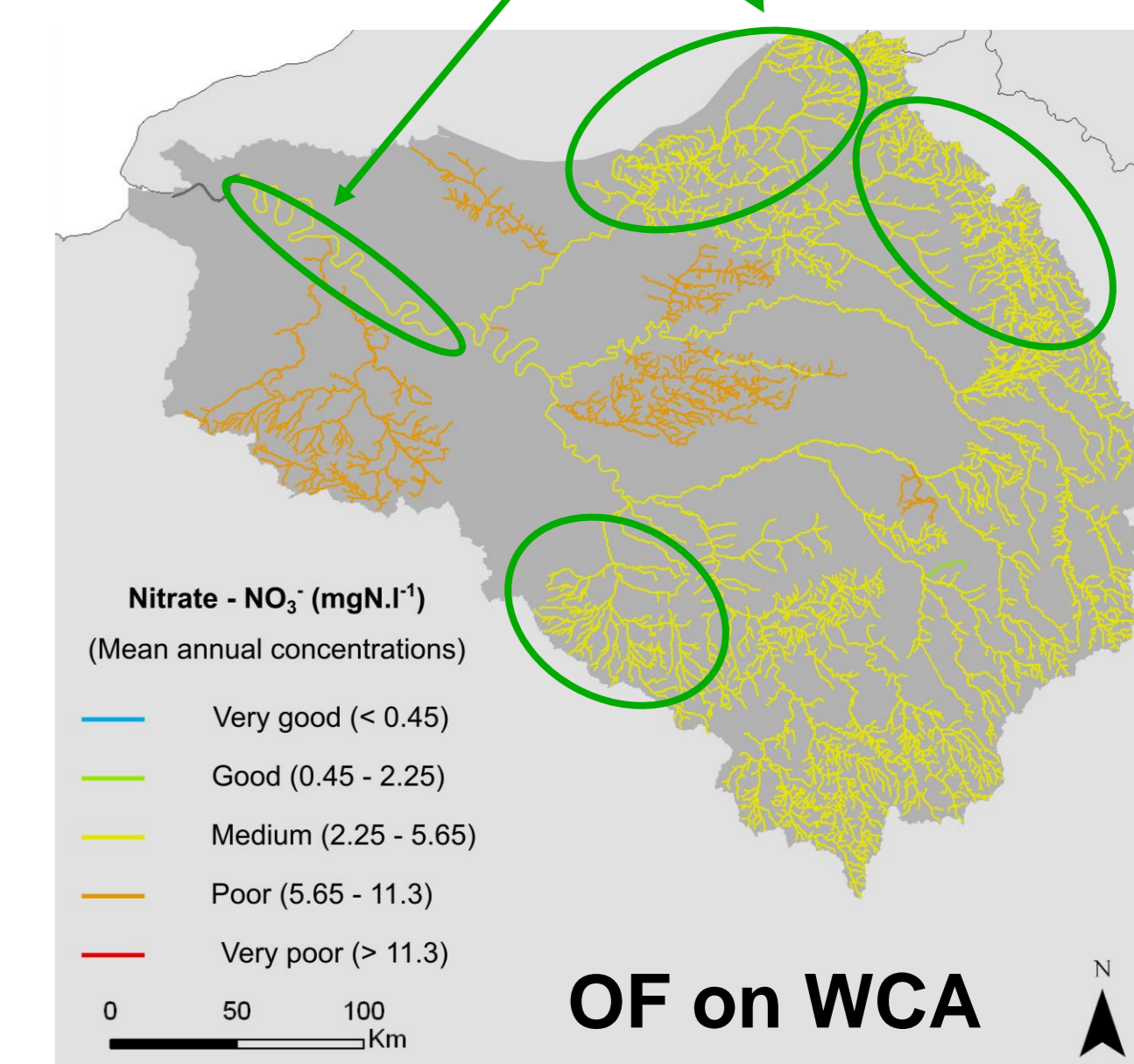
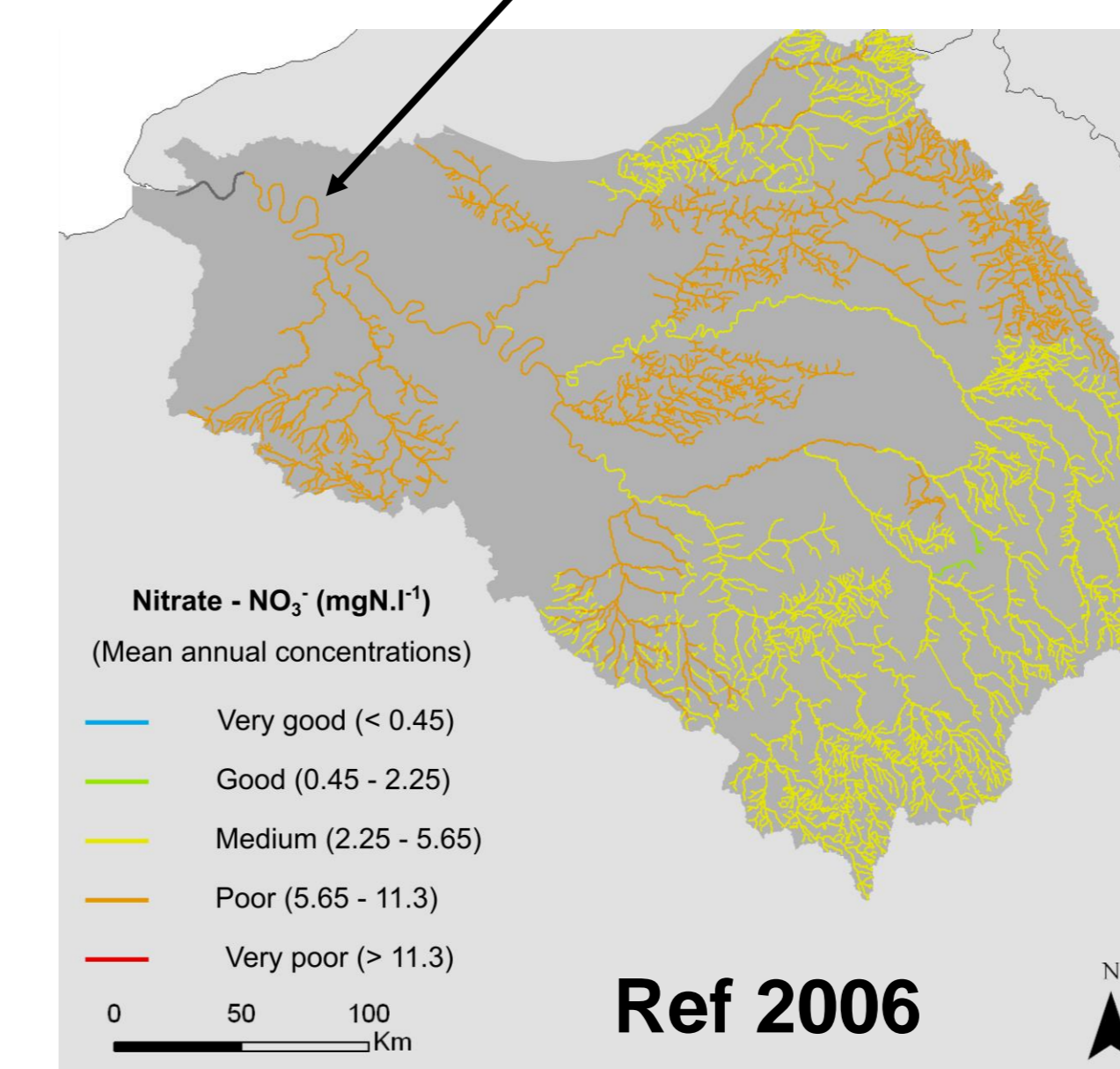


5 – Results



A (minor) slight decrease of NO₃⁻ concentrations at the Seine outlet

Some improvements in sub-basins and the downstream part of the Seine



4 – Conclusions and perspectives

Encouraging results concerning the hydrological network

Only a NO₃⁻ decrease by less than 5% at the outlet of the Seine

Few impacts on the coastal zone in terms of algal blooms

Some improvements within sub-basins (from poor to medium)

A better situation for the production of drinking water

To go further ...

Manage a **more retentive landscape** by reintroducing wetlands or ponds.

Generalize an agriculture using **less mineral fertilizers** to the whole basin (organic farming, precision farming ...)

What is the theoretical best achievable ?

