



WATERSCAPE MANAGEMENT, PONDS IMPLEMENTATION AND NUTRIENT TRANSFERS THROUGH A WATERSHED.

How to decrease nitric pollution in the intensive agricultural basin of the Seine (France)?



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EPCN 2012 Little things mean a lot: understanding the role of ponds in a changing world
Luxembourg City, 4th – 8th June 2012

What is the problem?

Point sources pollution



Ammonium and phosphorus



Improve the treatment of urban and industrial waste waters

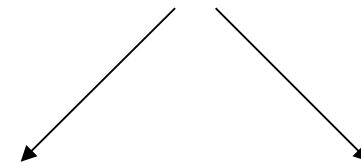
GOAL (almost) ACHIEVED

Diffuse sources pollution



Nitrate

Rivers and coastal waters eutrophication

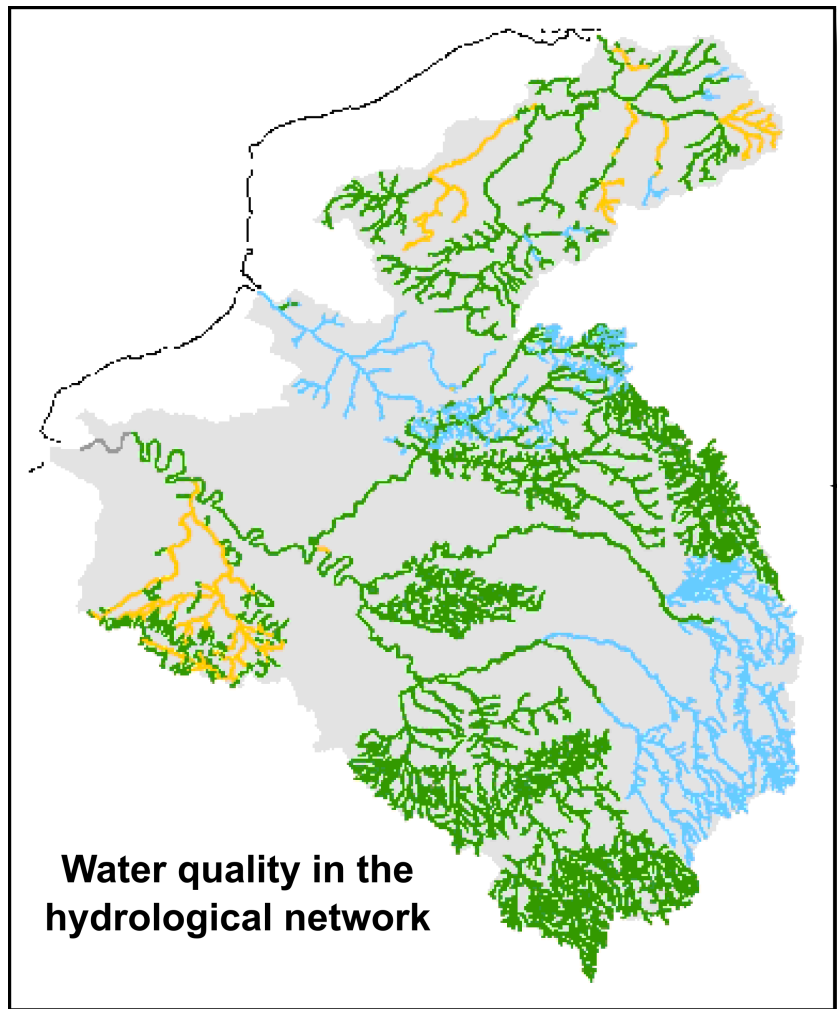


Changes in agricultural practices

Landscape management (like reintroducing wetlands or ponds)

GOAL NOT (yet) ACHIEVED

What are we able to simulate?



Water quality in the hydrological network

N, P, Si delivered to the sea

Seneque/Rivsetrahler model

RIVE

Hydrological network

Morphology and Strahler ordination

A diagram illustrating a river network. The top part shows a blue line representing a river with three points marked: PK 2, PK 1, and PK 0. Below this is a schematic diagram of a branching network with numbers indicating Strahler order: 3, 2, 1, 1, 1, 2, 1, 1, 1, 1, 1.

Hydro-climatic constraints

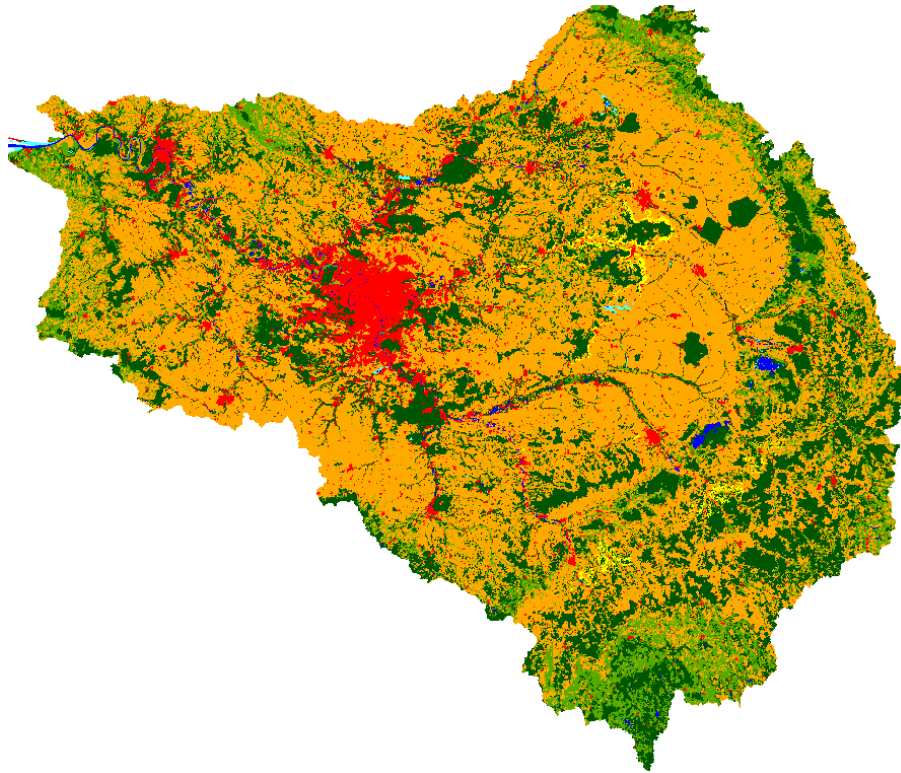
Land use and cultural practices







Point sources pollution (WWTP and indus.)

Validation with the period 2003 - 2006

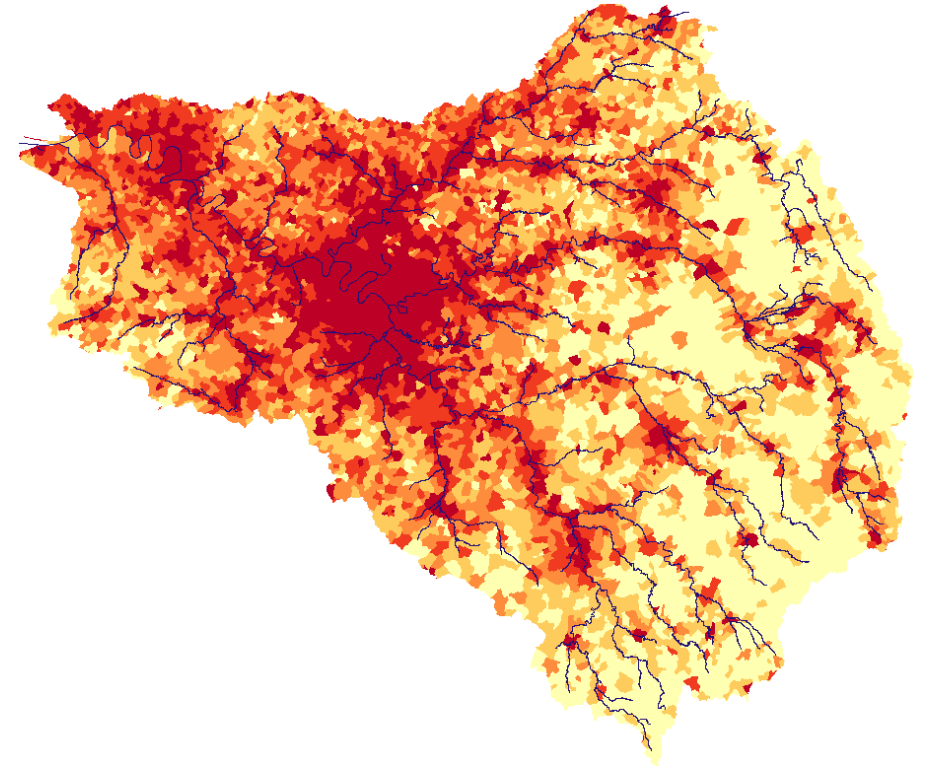
Study site – the Seine River basin, land use and population






Land use (CLC 2006)



-  Urban area
-  Arable land
-  Permanent crops
-  Grassland
-  Forest
-  Water bodies

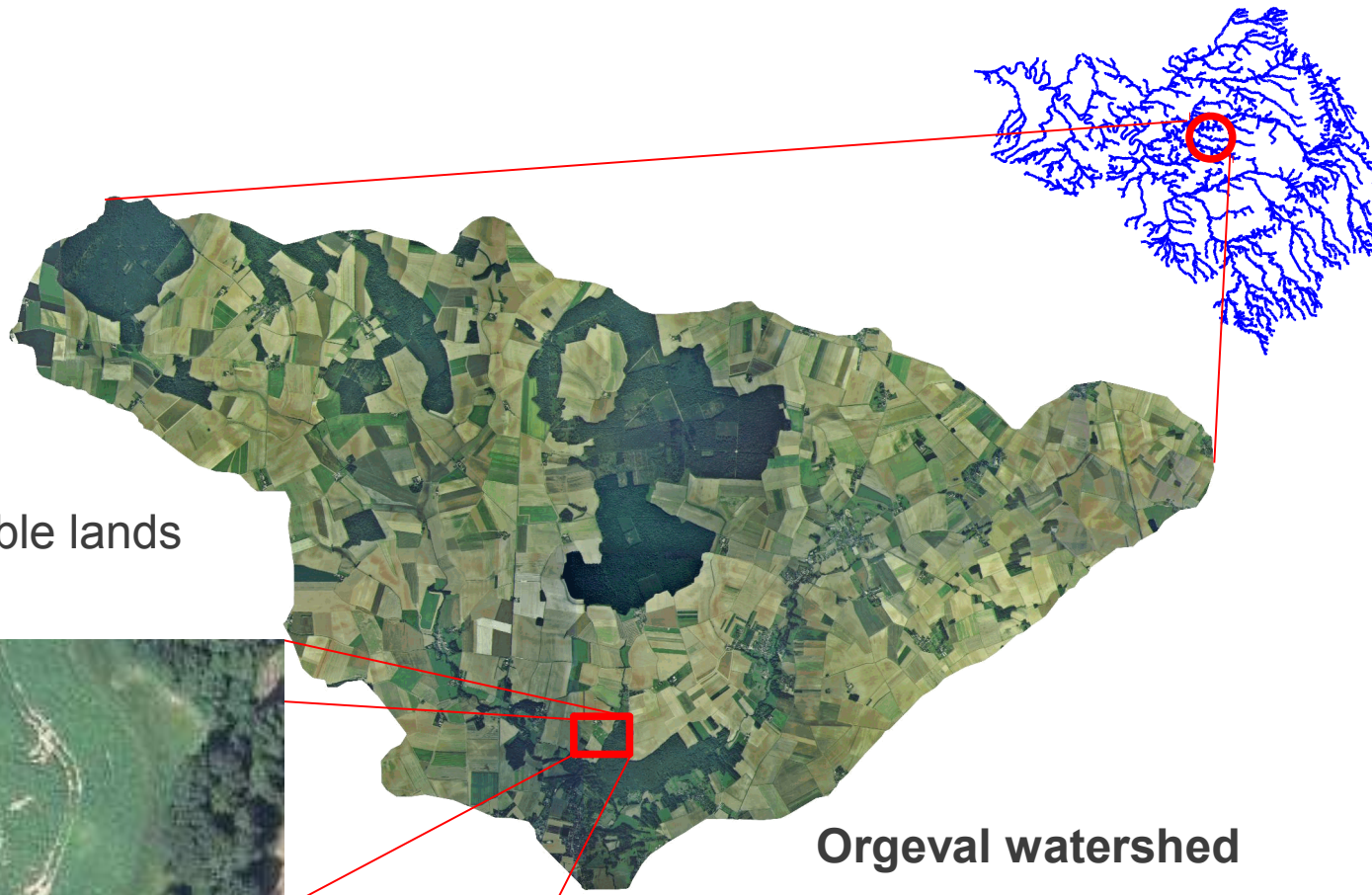
Population density (2006) (inh.km⁻²)



-  0 - 14
-  14 - 28
-  28 - 52
-  52 - 122
-  122 - 42573

Why thinking to the ponds?

The "Mare à Gobard"



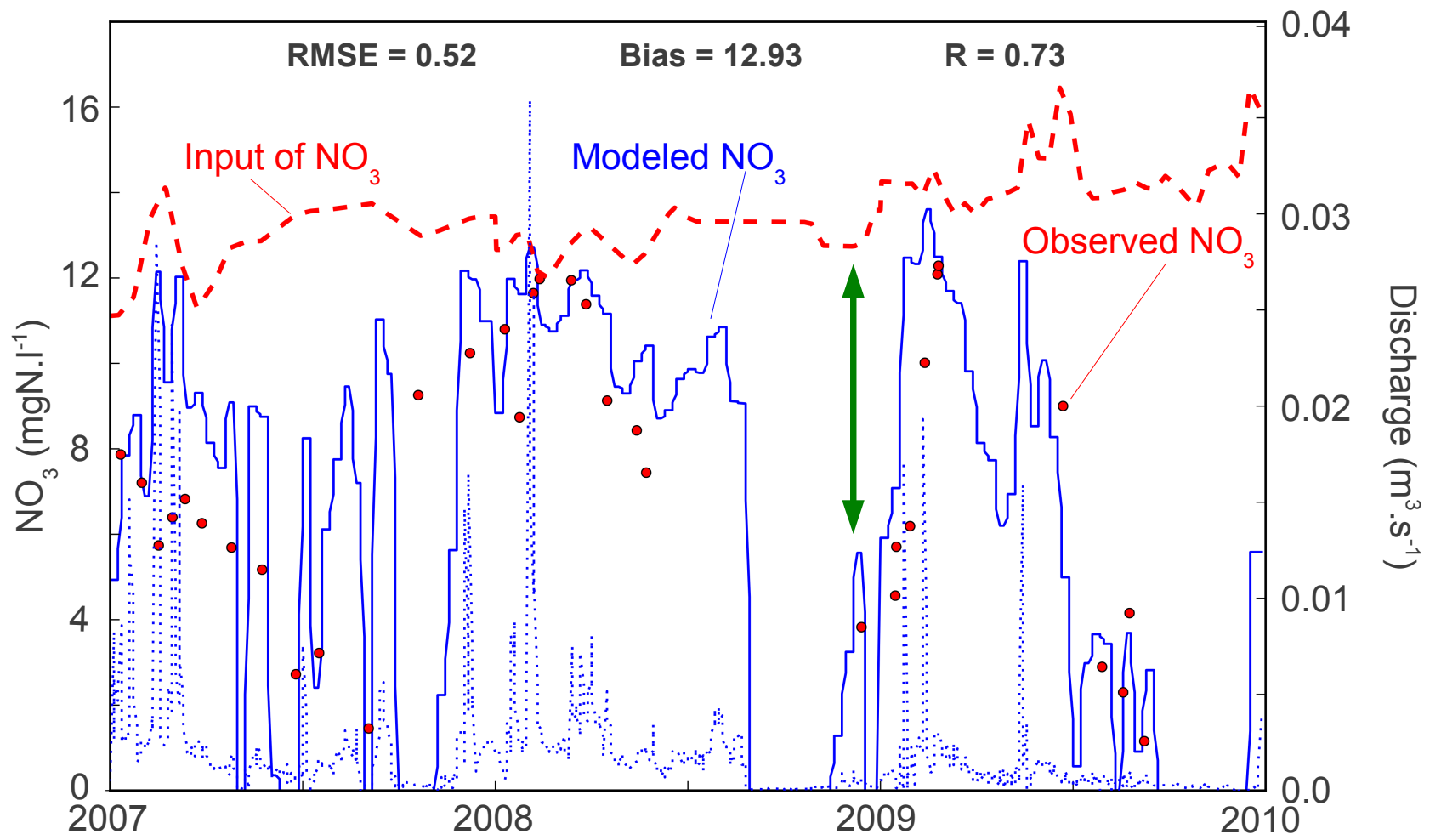
Watershed: 35 ha of arable lands

Orgeval watershed



Pond: 3 700 m² – 8 000 m³

Why thinking to the ponds?



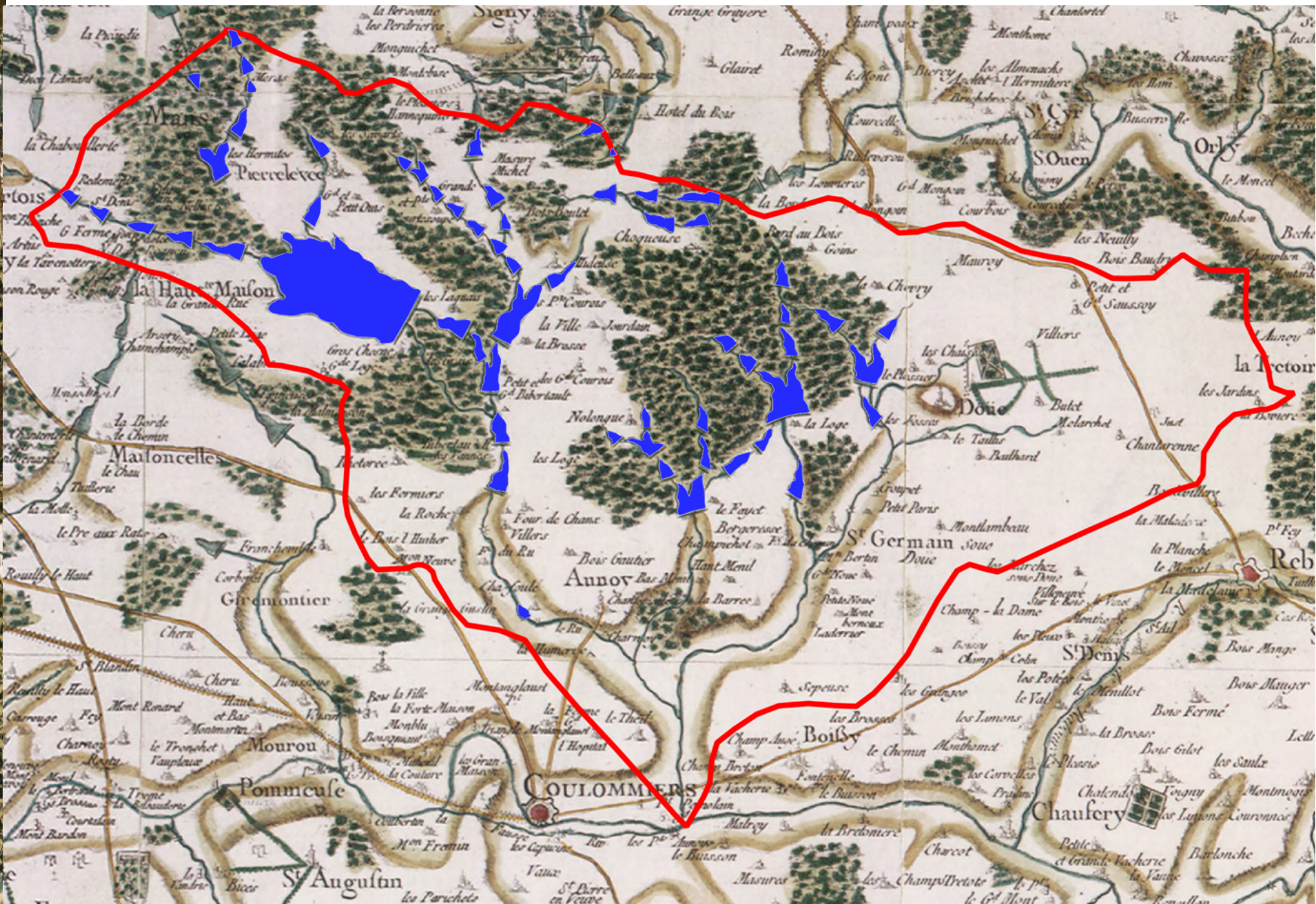
DECREASE OF NO_3 CAN REACH 60 % AT THE END OF SUMMER

Which location of historical ponds?



Cassini Map of the Orgeval watershed (end of 18th century)

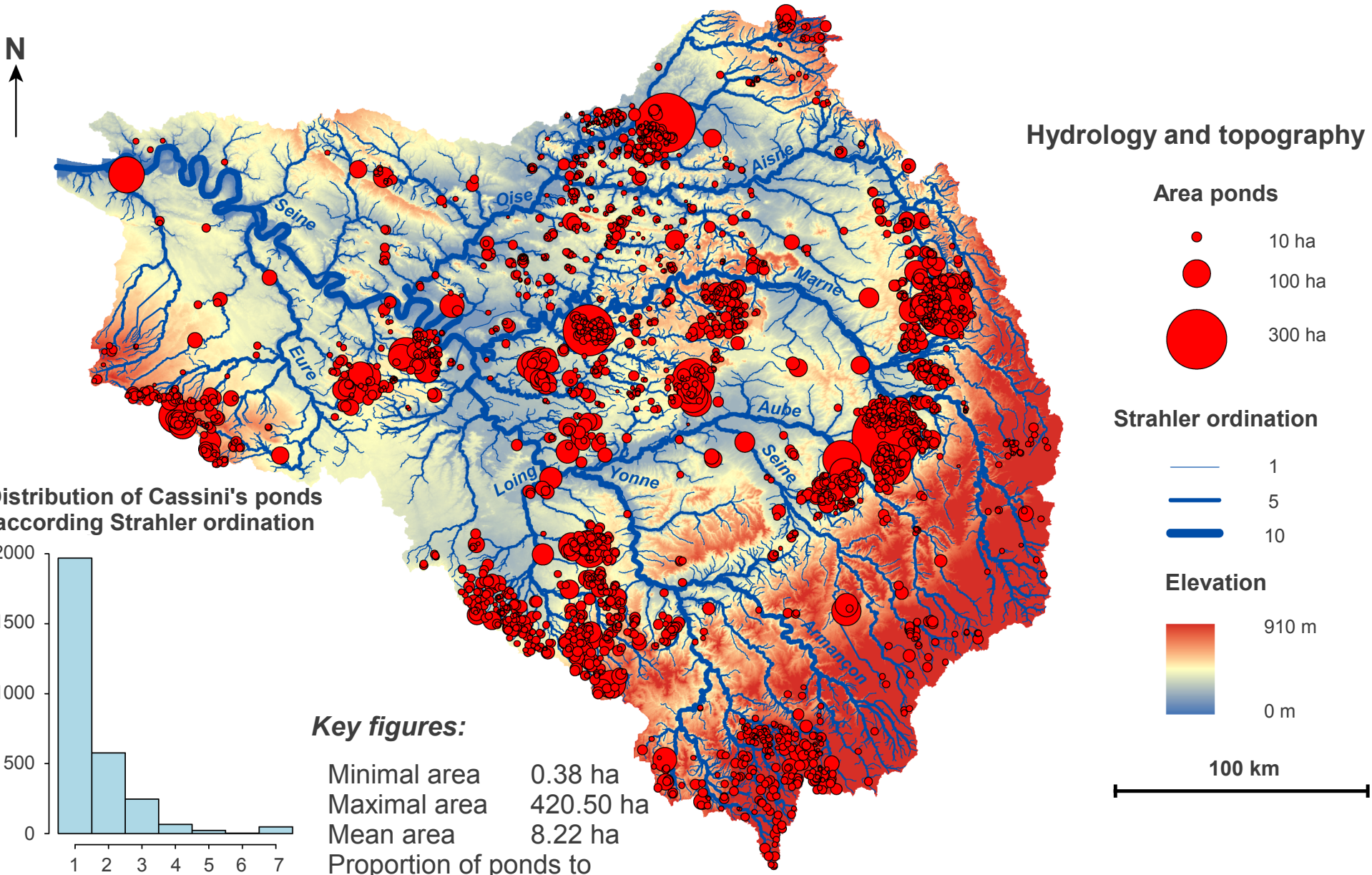
What were historical ponds for?



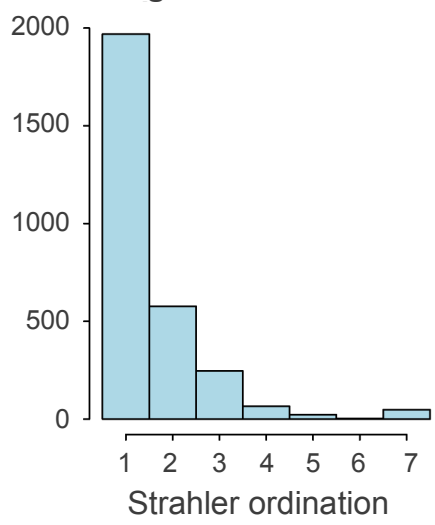
Many ponds (fishing, mills, timber rafting ...)

How many historical ponds within the Seine River basin?

DISTRIBUTION OF CASSINI'S PONDS ON THE SEINE WATERSHED



Distribution of Cassini's ponds according Strahler ordination



Key figures:

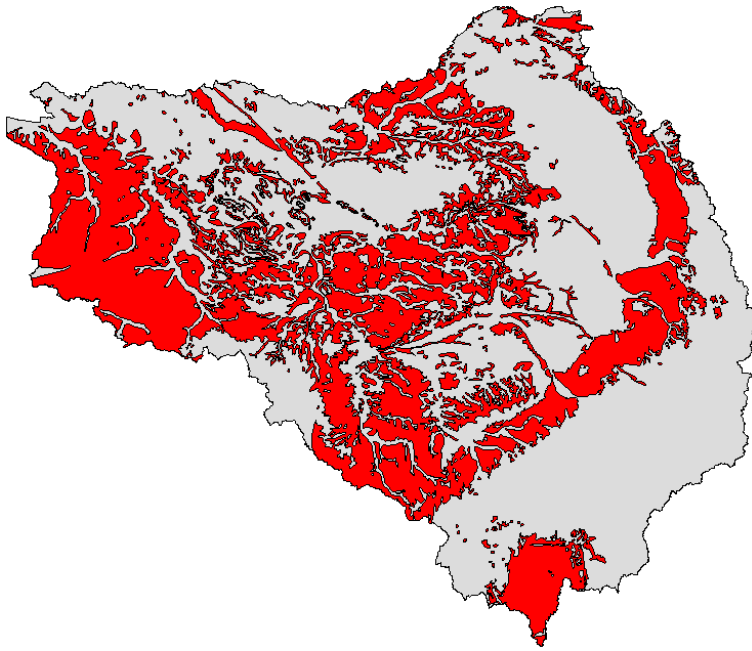
Minimal area	0.38 ha
Maximal area	420.50 ha
Mean area	8.22 ha
Proportion of ponds to the area of the Seine basin	0.24 %

Topography SRTM DEM 90 m

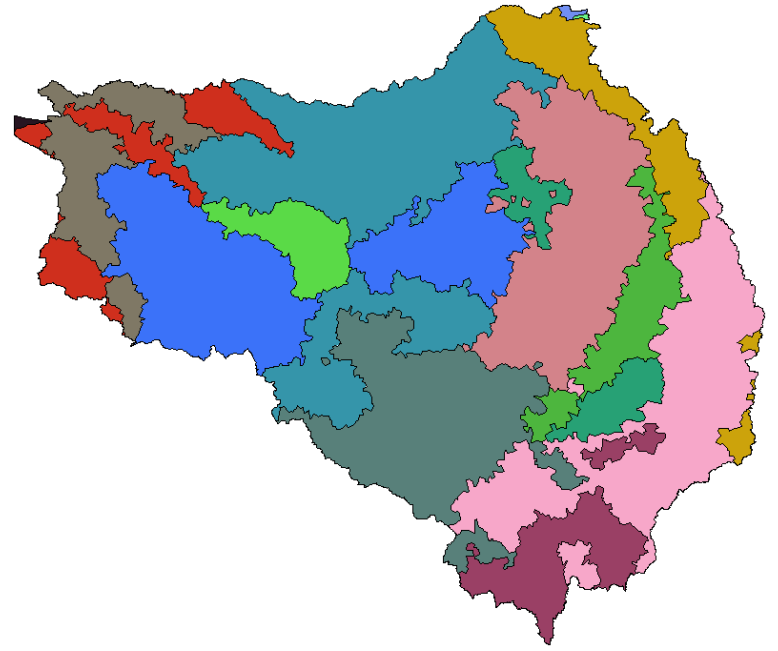
Ponds digitized from the map of Cassini georeferenced by EHESS

What pondscape for the future?

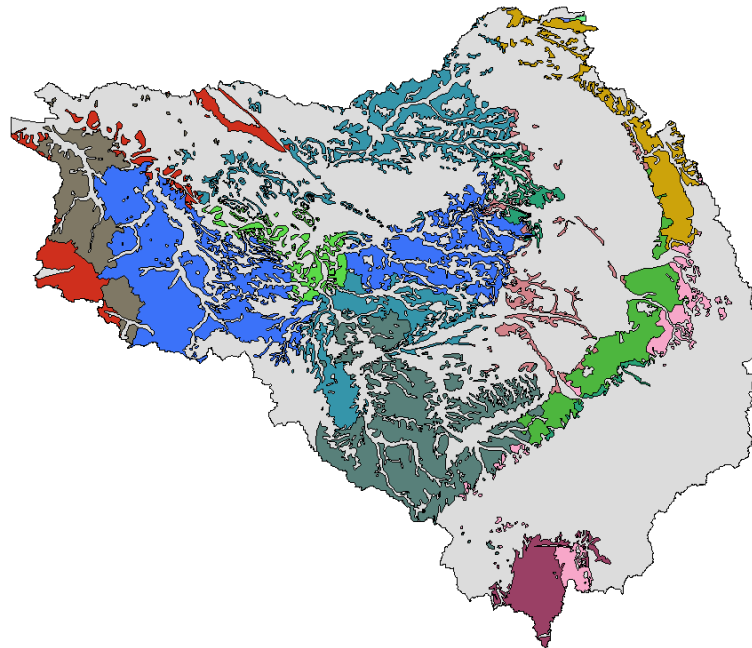
Impermeable substrate



Homogeneous agricultural areas



+
=

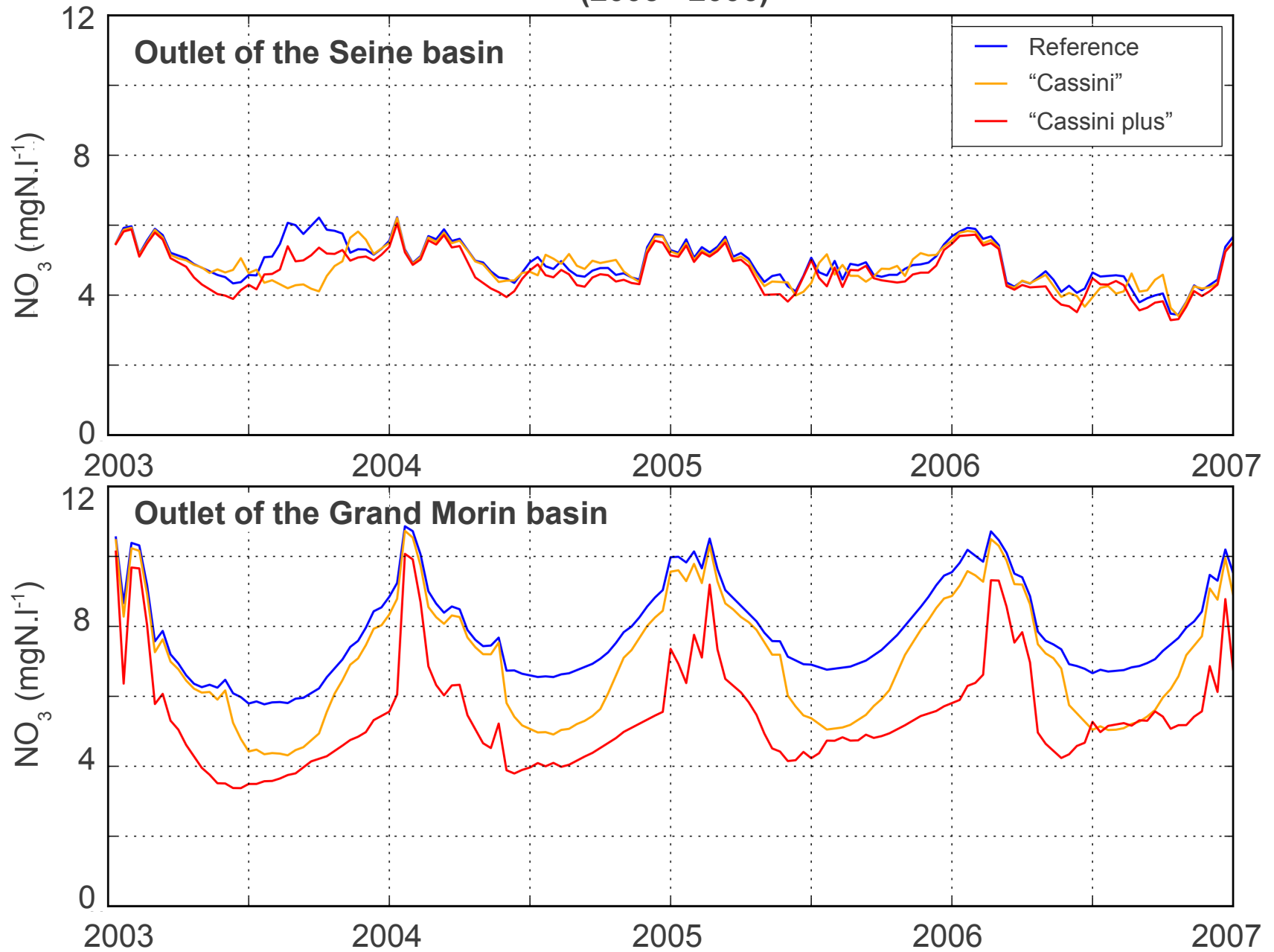


Homogeneous areas
to manage
ponds implementation



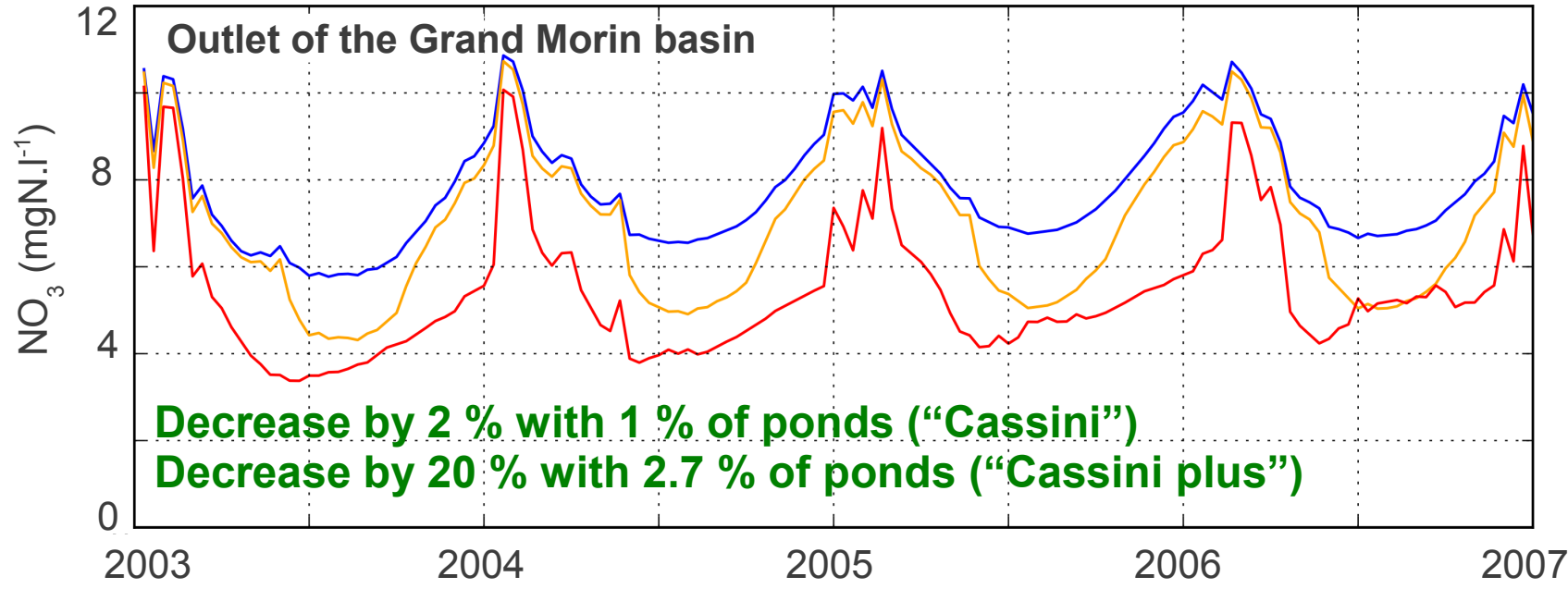
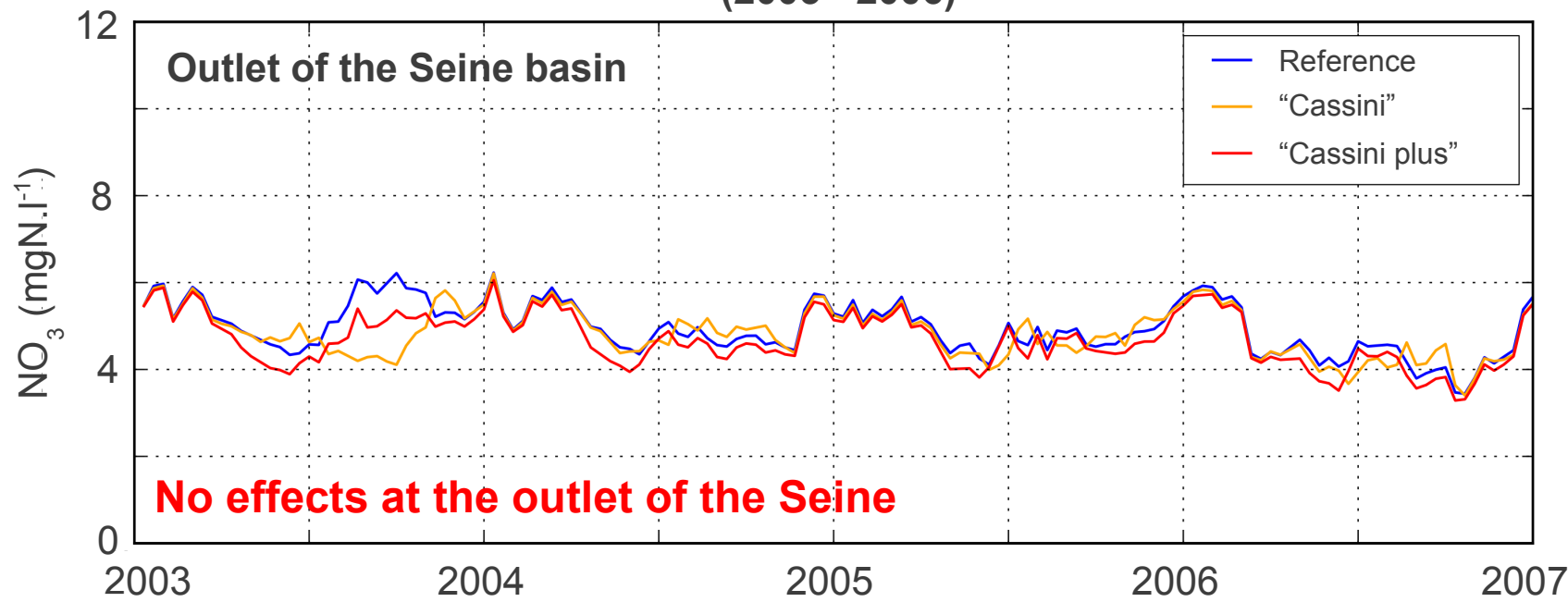
What are the effects of these ponds?

Seasonal variations of NO_3 concentrations
at the outlets of the Seine and the Grand Morin basins
(2003 - 2006)



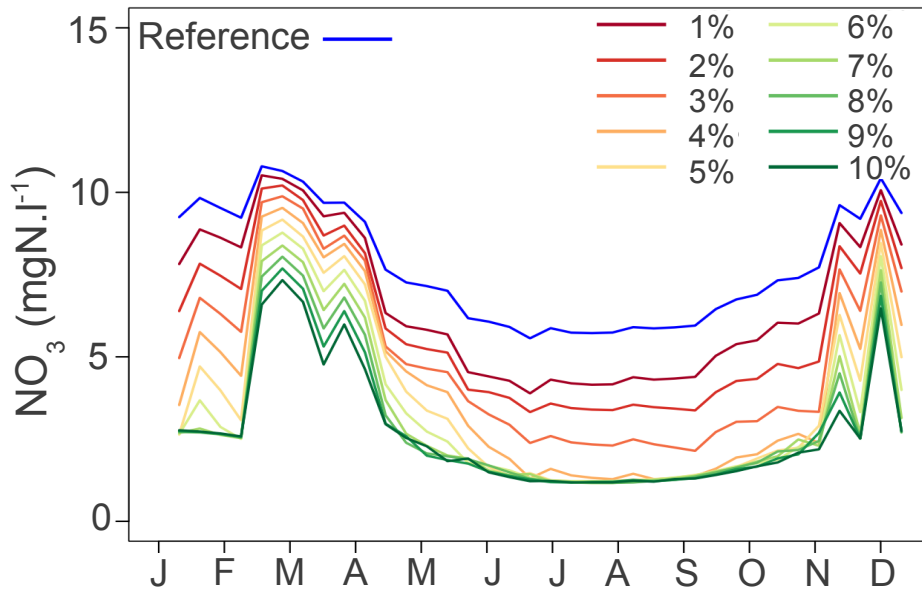
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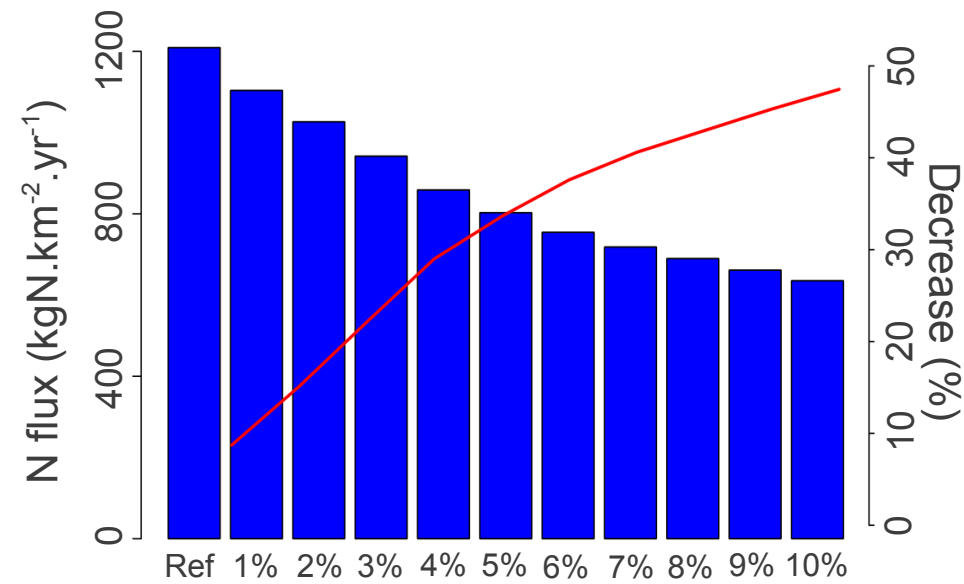


What optimal ponds density?

Seasonal variations of NO₃ concentrations at the outlet of the Orgeval basin



Evolution of NO₃ fluxes at the outlet of the Orgeval basin



5 % of the area of the watershed devoted to ponds permits to decrease by 50 % the NO₃ summer concentration

Main conclusions

- Ponds were ubiquitous features of the traditional rural waterscape: more than 2500 ponds were present at the end of the 18th century, representing 0.24 % of the basin.
- Ponds can reduce NO_3 concentration by 20 % at the outlet of a basin covered by 2.7 % of ponds, but have no effects at the outlet of the Seine River.
- A pond density of 5 % could reduce NO_3 concentration by 50 %.

Managing pondscape could be a solution to locally reduce NO_3 concentrations within the river network, but best results would be achieved by changing agricultural practices.

Thanks for your attention / Merci fir Är Opmierksamkeet

Some questions? / Etlech Froen ?

