Identifying ecological thresholds for lake physico-chemical parameters influenced by land use

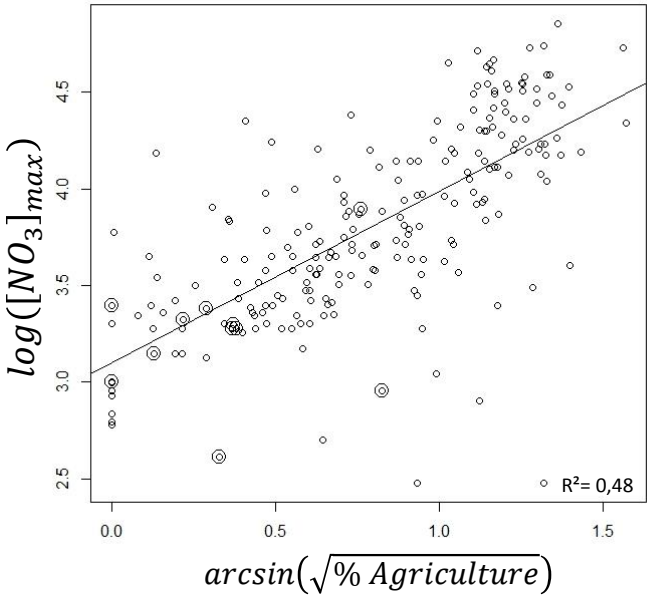
Vincent Roubeix, Pierre-Alain Danis

Onema-Irstea consortium for Lake Hydroecology, Aix en Provence, France

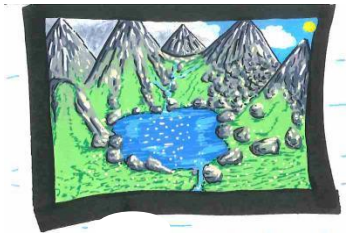
Land Use and Water Quality Conference, Vienna, 21-24 sept 2015

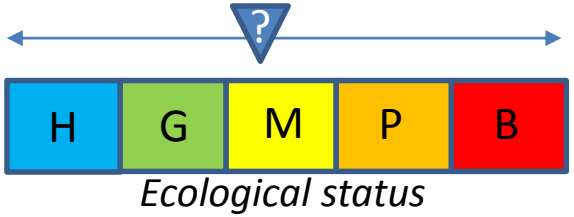
Context

- Lake water pollution by agriculture in France



- European **W**ater **F**ramework **D**irective -> Lake ecological assessment





➢ **Environmental standards** for lakes -> nutrients (phosphorus, nitrates)

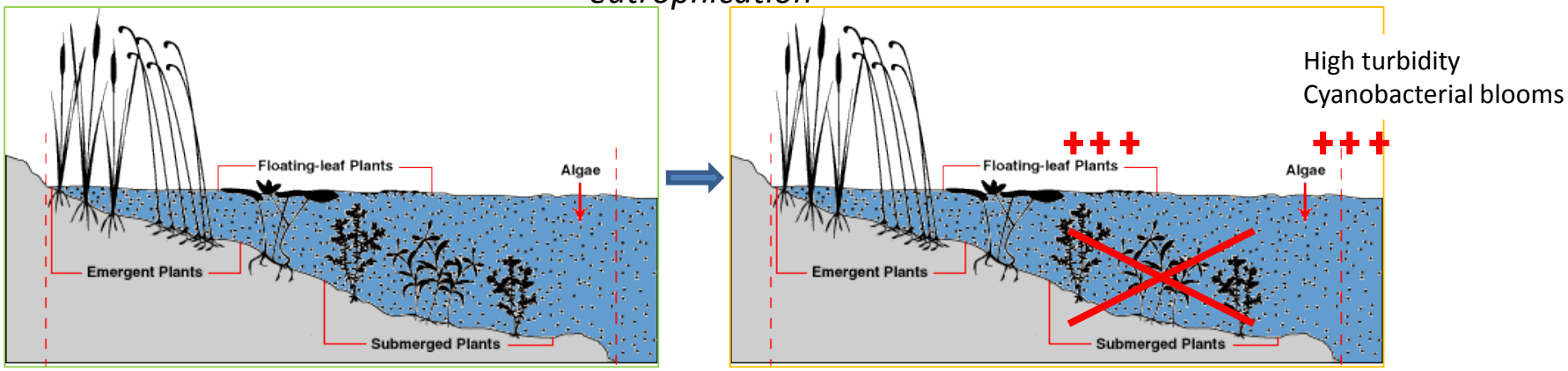
Objectives

Good ecological status → Degraded ecological status

Which limits ?

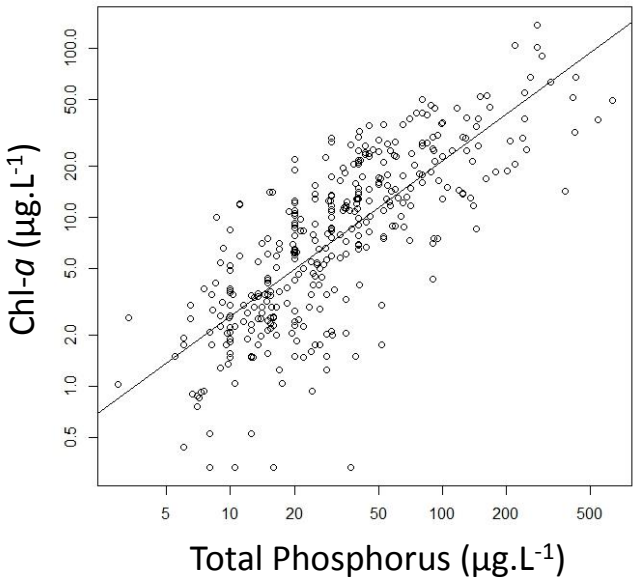
Nutrient concentrations

eutrophication

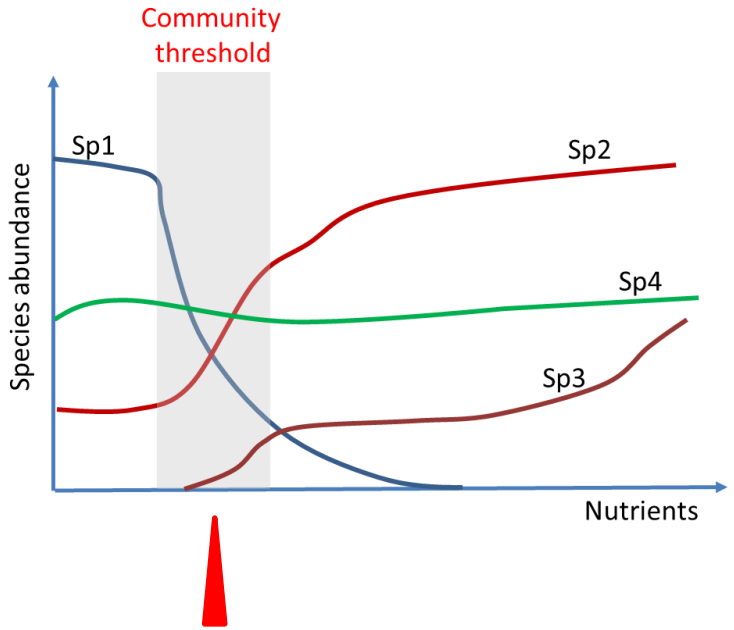


Approach

- Examining community response to **spatial nutrient gradients** (among lakes)



- Searching **at species level** for **community thresholds**

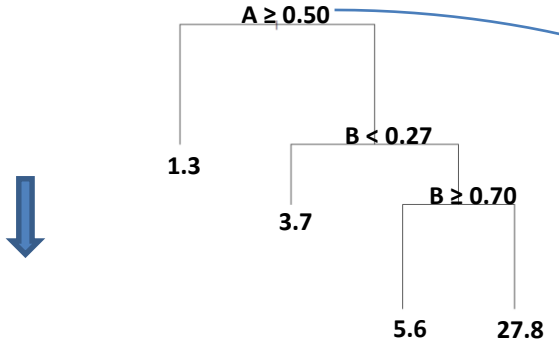


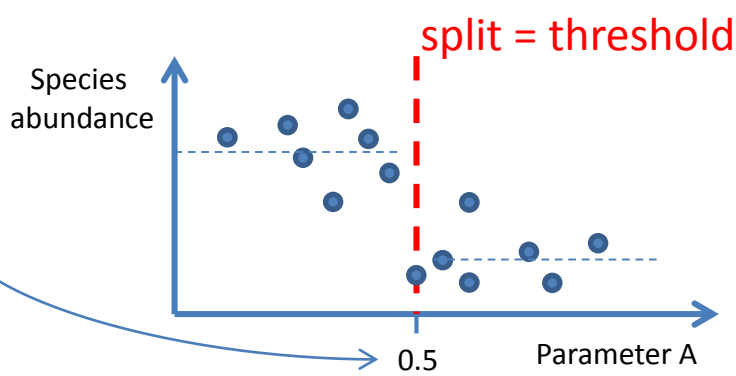
High compositional **turnover**

How to detect community thresholds?
1. Regression trees

- <u>For each species</u> -> **Regression trees** : Abundance = f (nutrients, other variables)

Regression tree

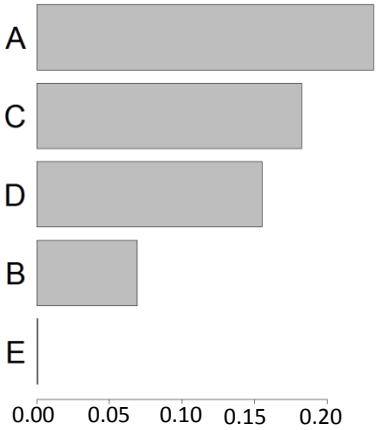




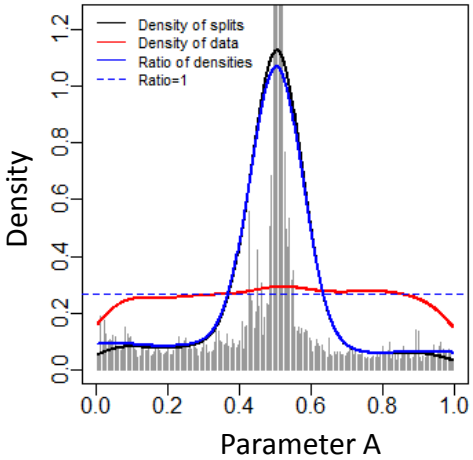
Random forest

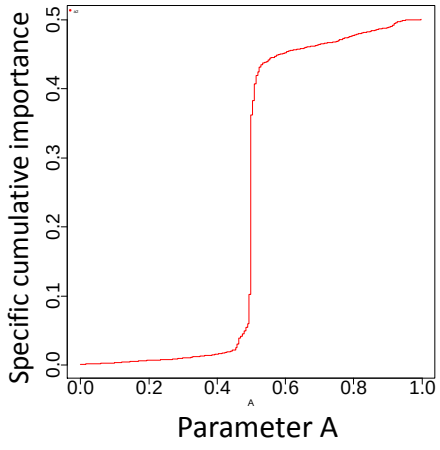
➢ **Species R²**

1) Variable importance



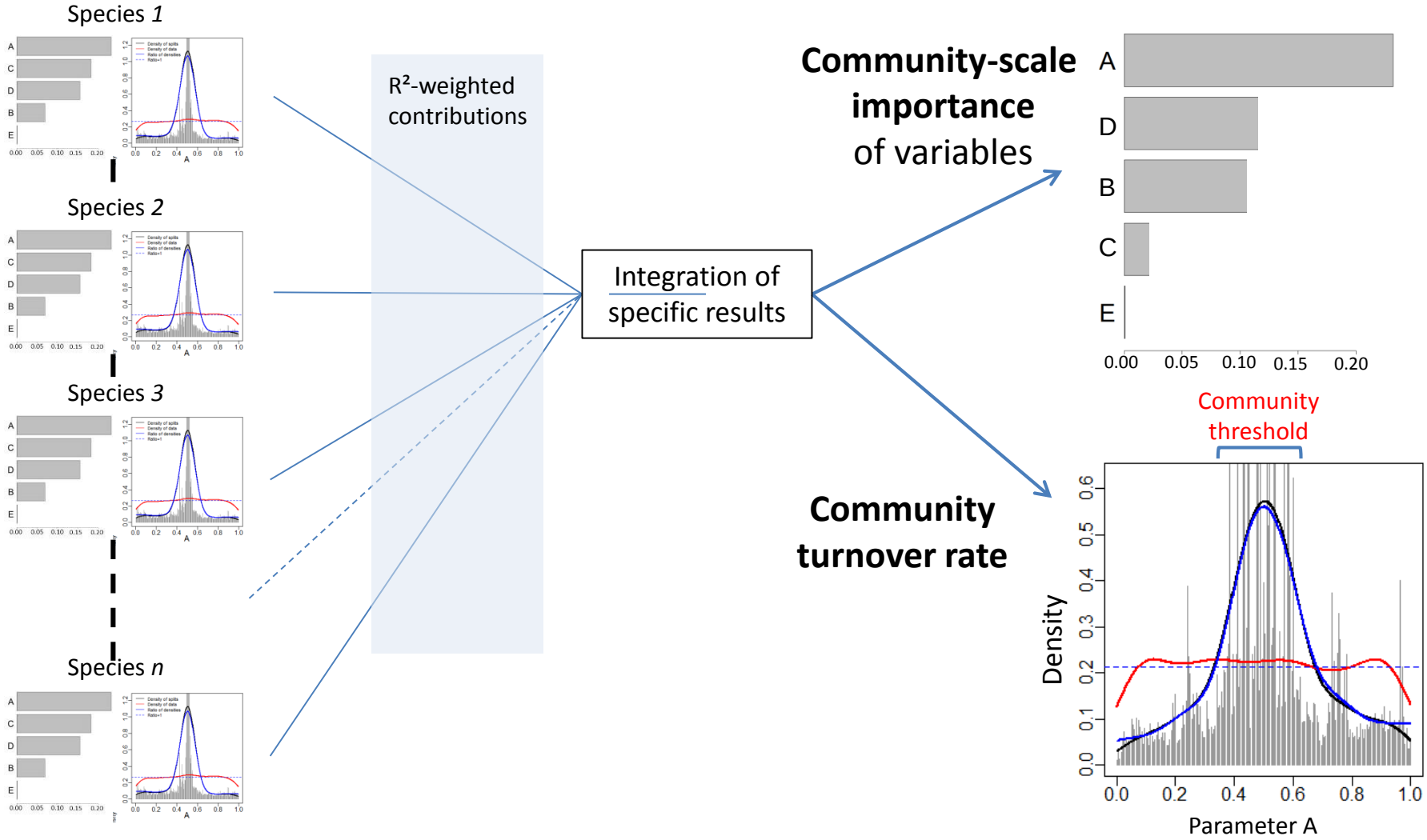
2) Split density



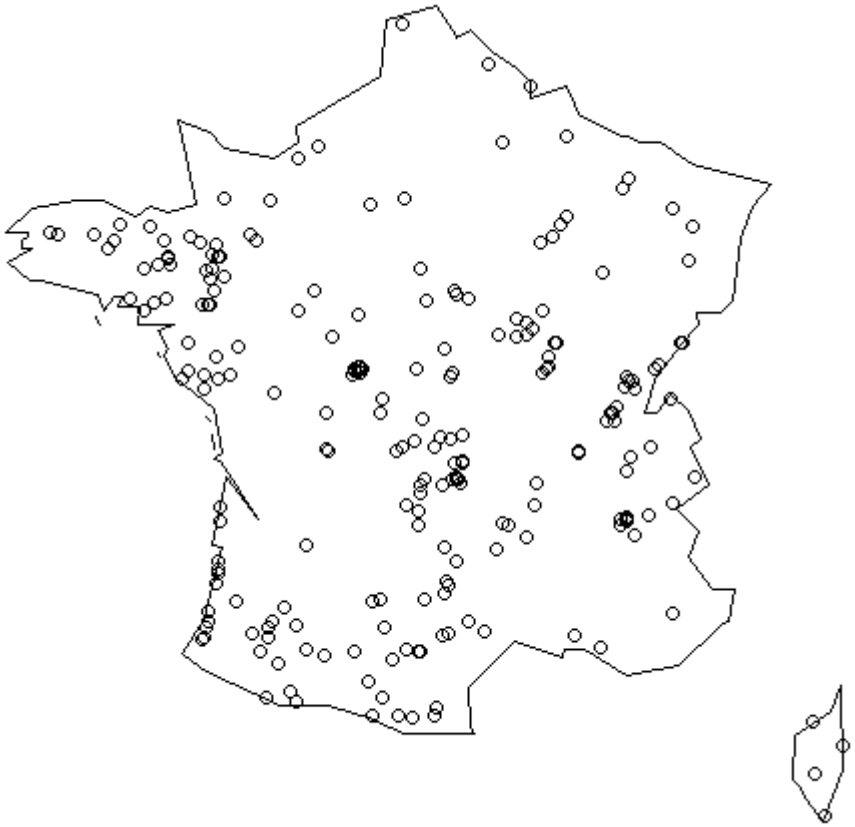


How to detect community thresholds?
2. Gradient forest

- Combination of results <u>from all species</u> -> **Gradient forest** (Ellis *et al.,* 2012, Ecology)



Data



French national WFD survey :
Several hundreds of lakes
(all types)

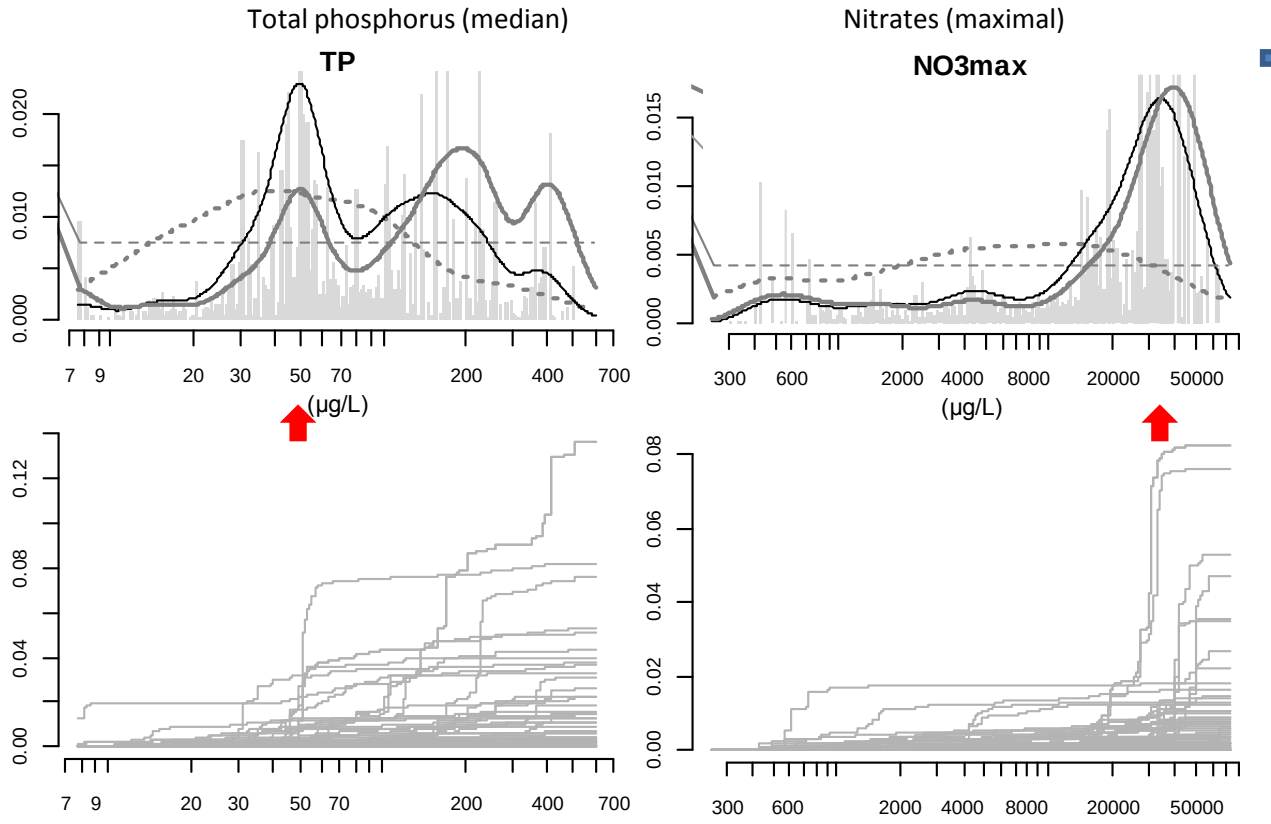
- Water physico-chemical measurements
(4 profiles in one year at one point)

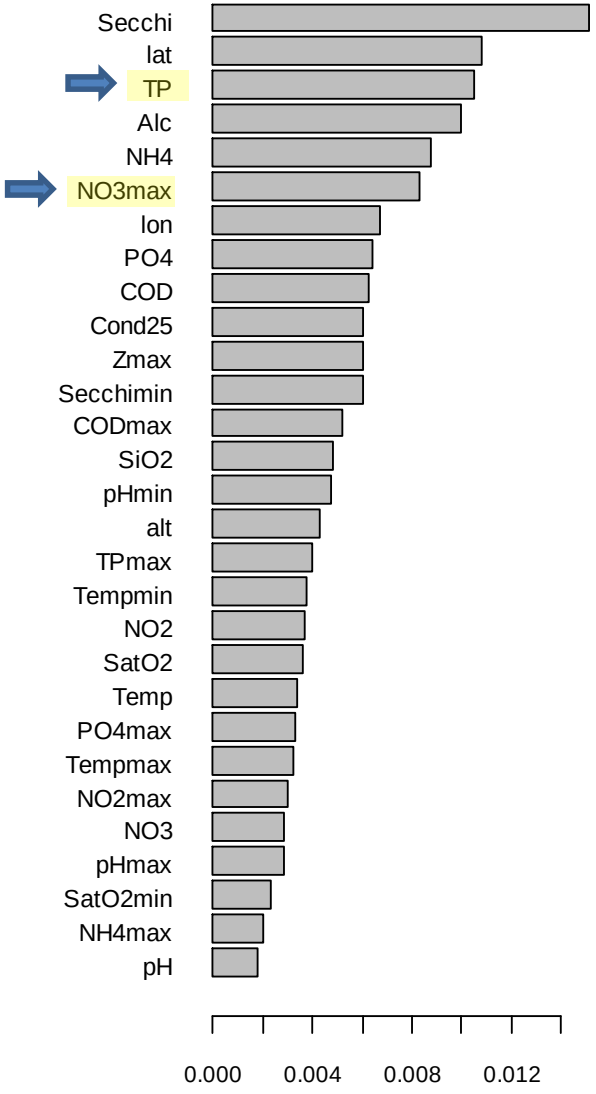
- Species inventory :
  - **Phytoplankton** (4 samples/yr)
  - **Fish**
  - **Macrophytes**

➢ **Gradient forest** analysis for each biological group

Results : Phytoplankton

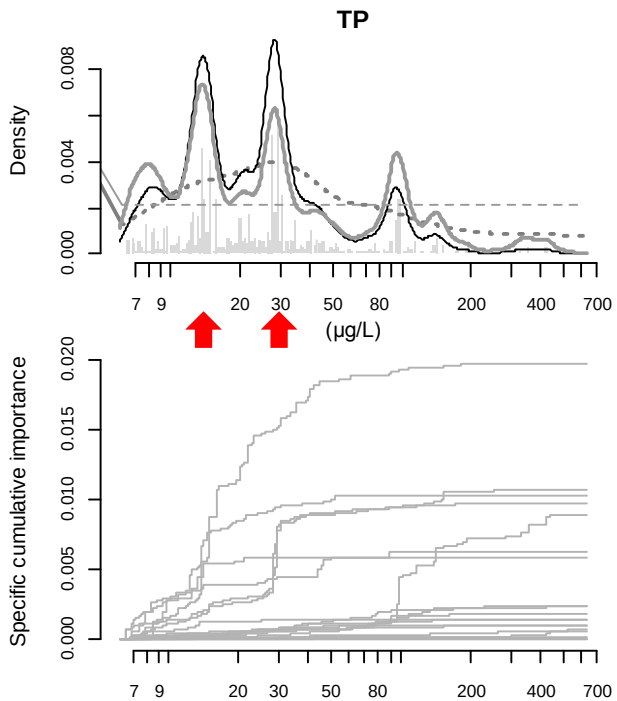
130 lakes (subset excluding East and South)
29 variables
147 species (mean annual abundance)

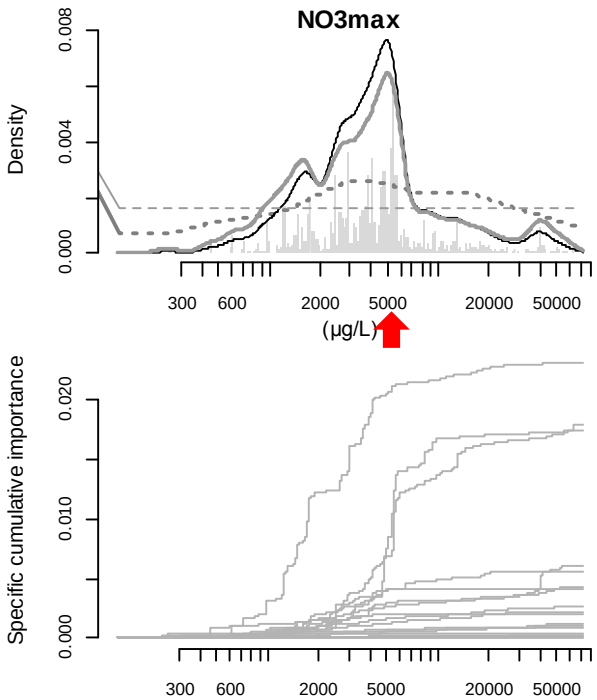


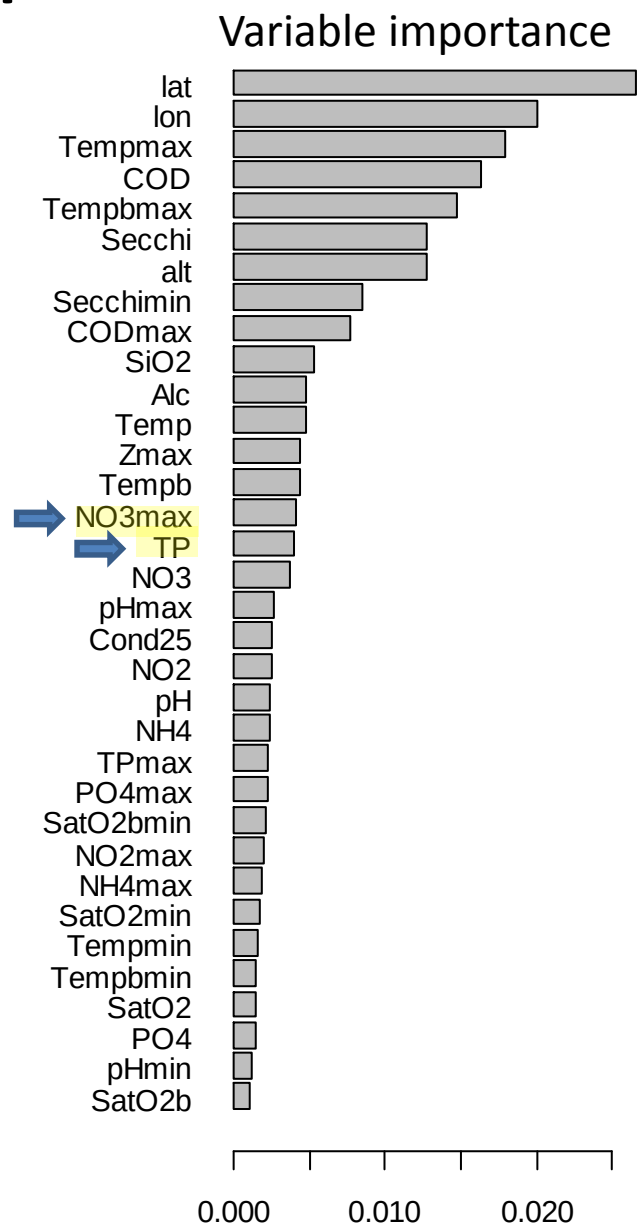


Results : Fish

216 lakes
34 variables
25 species (BPUE)

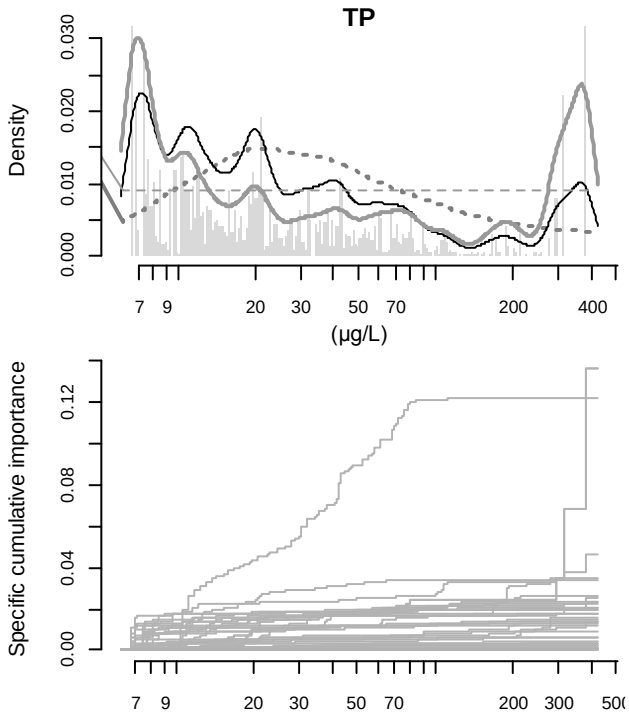


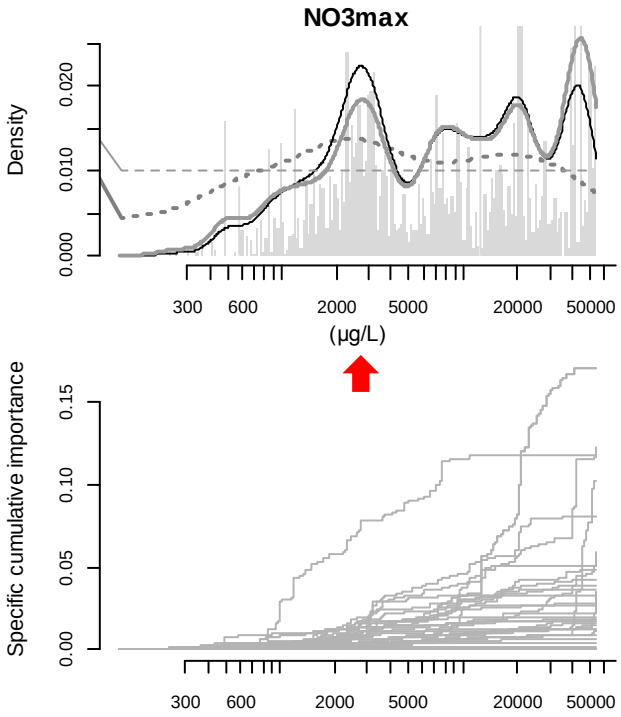


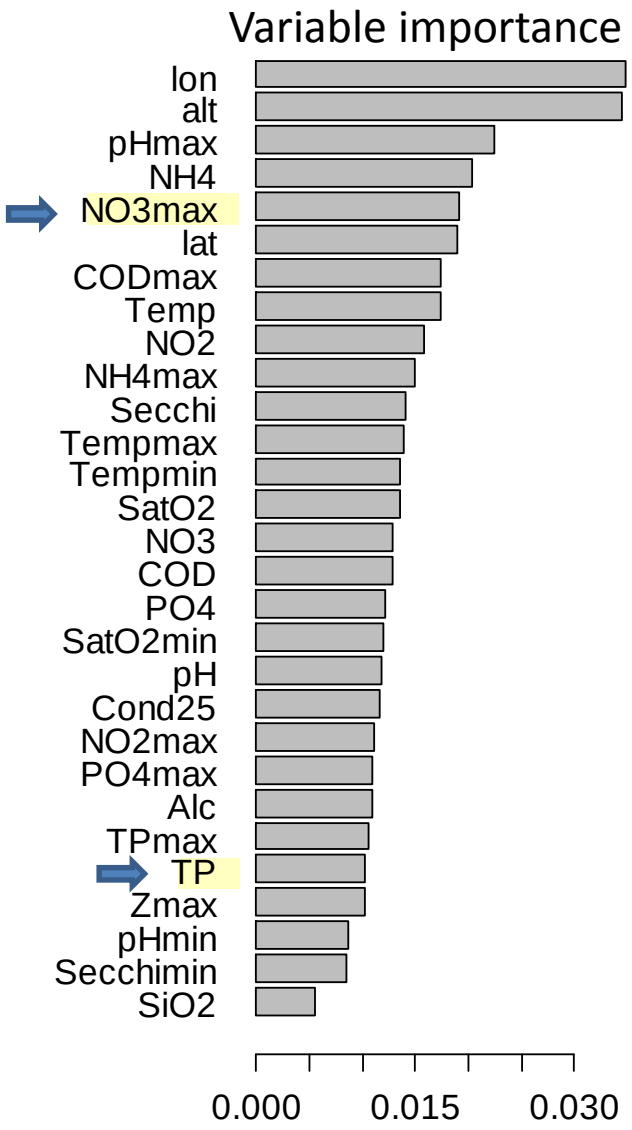


Results : Macrophytes

132 lakes
29 variables
45 species (Presence/Absence)

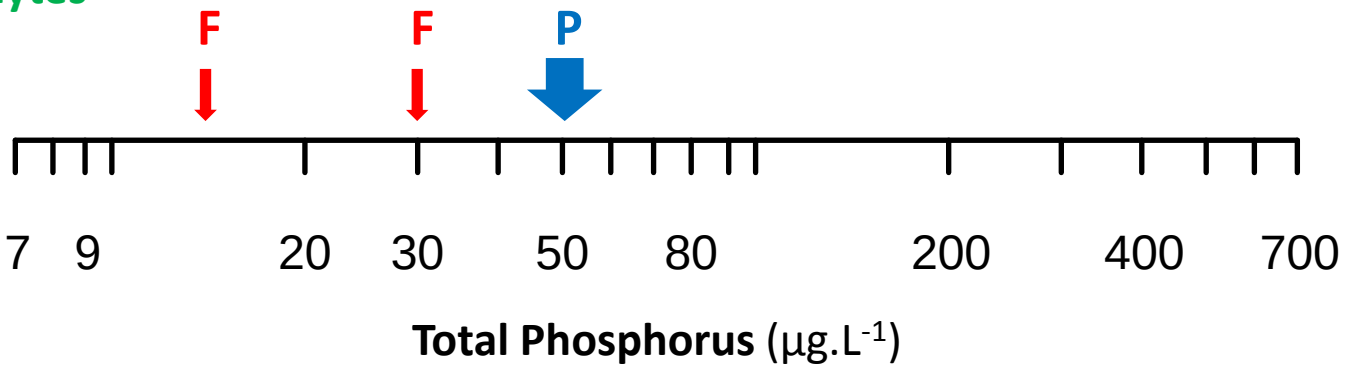


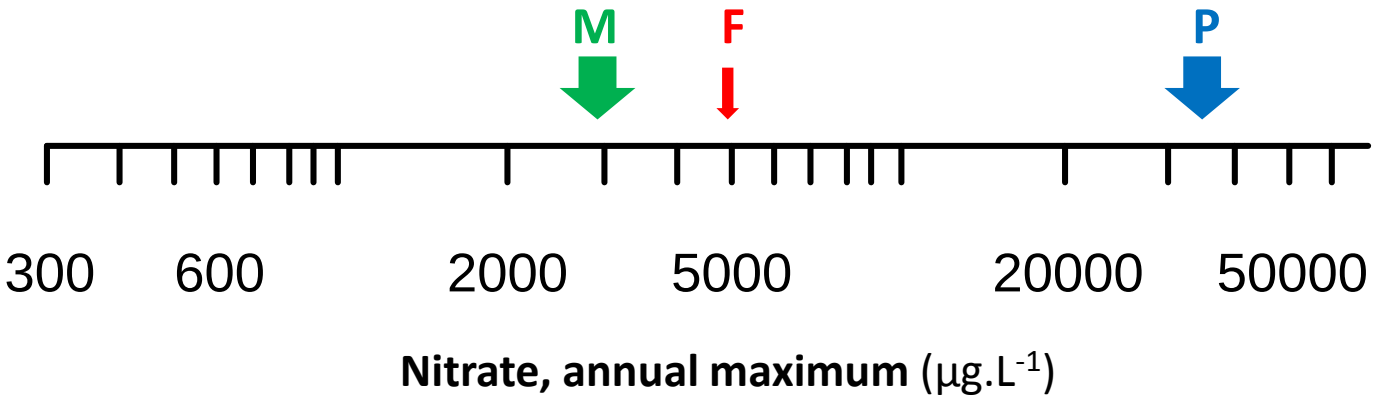




Conclusion

P: Phytoplankton
F: Fish
M: Macrophytes





- Different indications of the three biological groups
- Basis for setting **ecologically-relevant environmental standards** for nutrients in lakes

Thank you for you attention !