Adapting to climate change: example of the use of the Explore2 ensemble of climate and hydrological projections in assessing the vulnerability to climate change at local scale.

Gaillot A.[1], Pelte T.[2], Pressurot A.[2] and Sauquet E.[3]

[1]Université Paris Saclay, INRAE, AgroParisTech, UMR ECOSYS, Palaiseau, France

[2]Agence de l'eau Rhône Méditerranée Corse, Lyon, France

[3]UR RiverLy, INRAE, Villeurbanne, France

CONTEXT

Recent hydroclimatic projections from the Explore2 project (Sauquet et al., 2025) show that climate change would have a significant impact on the water cycle: decrease in low flow, increase in the duration of low flow, increase in the number of days of soil drought, etc. These results confirm the need to adapt territories to climate change and give public decision-makers the opportunity to base adaptation strategies on these new hydroclimatic projections.

This study developed and applied a method for **integrating knowledge about the current state of ecosystems with hydroclimatic projections to guide water public policies for climate change adaptation**

Four topics were focused :

1. **Soil drought**
2. **Surface water resources quantity**
3. **Surface water resources quality**
4. **Biodiversity in rivers**

GENERAL METHOD

Site study : sub-catchments of Rhone river and mediterranean rivers
Climate projections used : RCP 8.5 in 2041-2070
Consistent with IPCC work (Reisinger et al., 2020)

Climatic factors

EXPLORE2 Les futurs de l'eau

17 GCM-RCM

2 Hydrological models

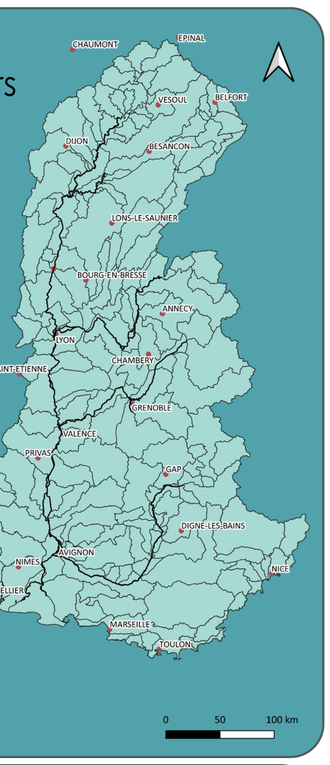
GRSD | J2000

exposition (1 2 3 4 5)

sensibility (1 2 3 4 5)

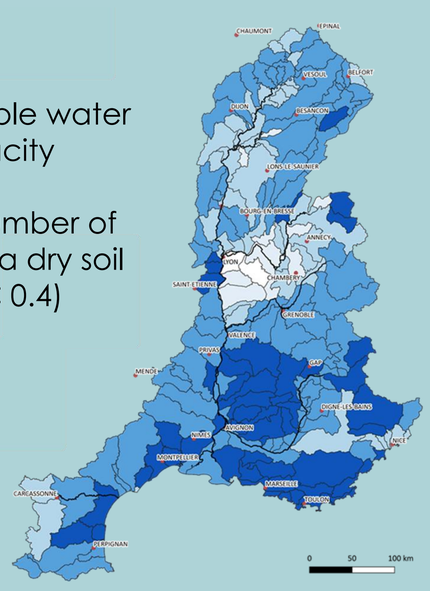
Non-climatic factors

Vulnerability: Moderate → High



Soil drought

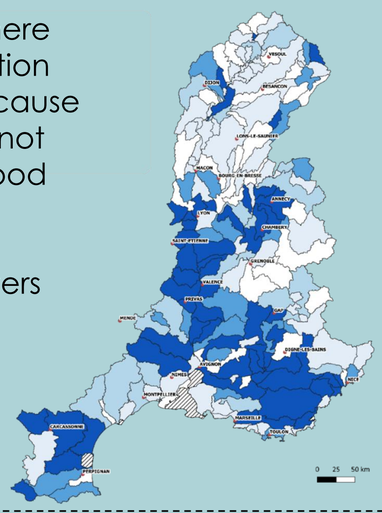
Soil available water capacity
x
Actual number of days with a dry soil (SWI < 0.4)



Surface water resources quantity

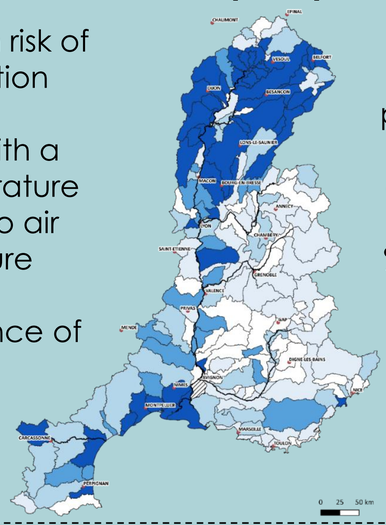
% of rivers where water extraction pressure is the cause of the risk of not achieving good status
x
% of small rivers

SENSIBILITY: Moderate → High



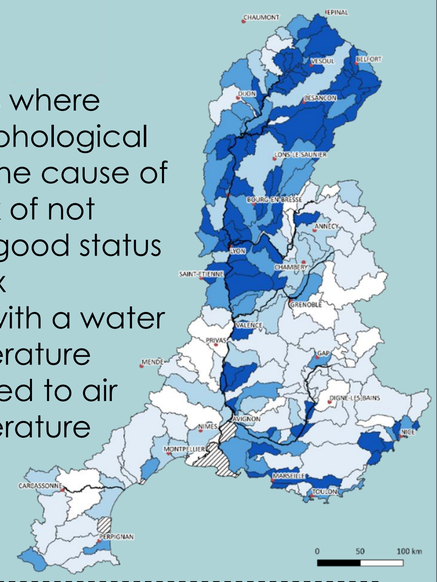
Surface water resources quality

% of rivers with risk of eutrophication
x
% of rivers with a water temperature correlated to air temperature
x
lack or presence of lagoons



Biodiversity in rivers

% rivers where hydromorphological pressure is the cause of the risk of not achieving good status
x
% of rivers with a water temperature correlated to air temperature



EXPOSITION

Soil drought	Surface water resources quantity	Surface water resources quality	Biodiversity in rivers
Evolution of number of days with a dry soil (SWI < 0.4)	Change in 5-year minimum monthly discharge Change in low-flow duration	Change in 2-year annual minimum 10-day discharge Change in of low-flow duration Change in of summer temperature	Change in of VCN10 Change in of low-flow duration Change in of summer temperature

RAW VULNERABILITIES

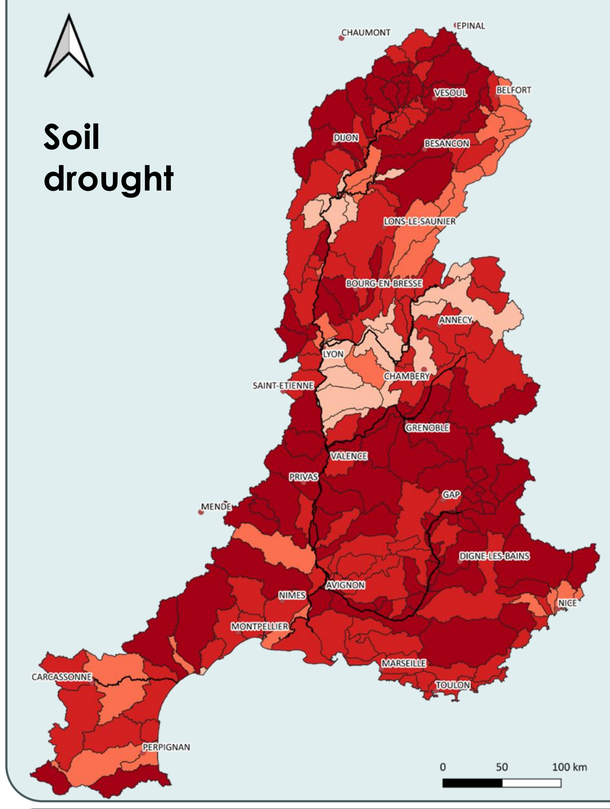
Soil drought	Surface water resources quantity	Surface water resources quality	Biodiversity in rivers
11 Vulnerabilities / catchment	36 Vulnerabilities / catchment	22 Vulnerabilities / catchment	22 Vulnerabilities / catchment

Definitive vulnerability class = maximum majority class of raw vulnerabilities

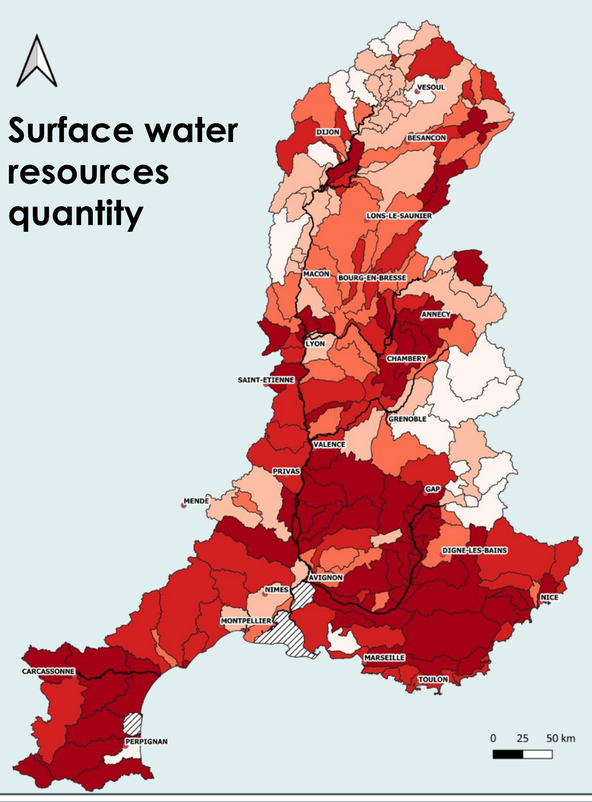
RESULTS

Vulnerability: Moderate → High

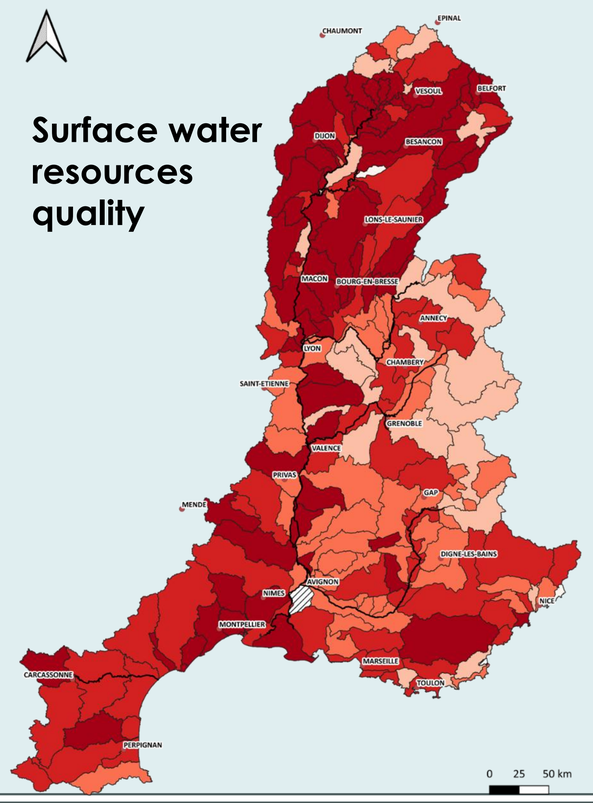
Soil drought



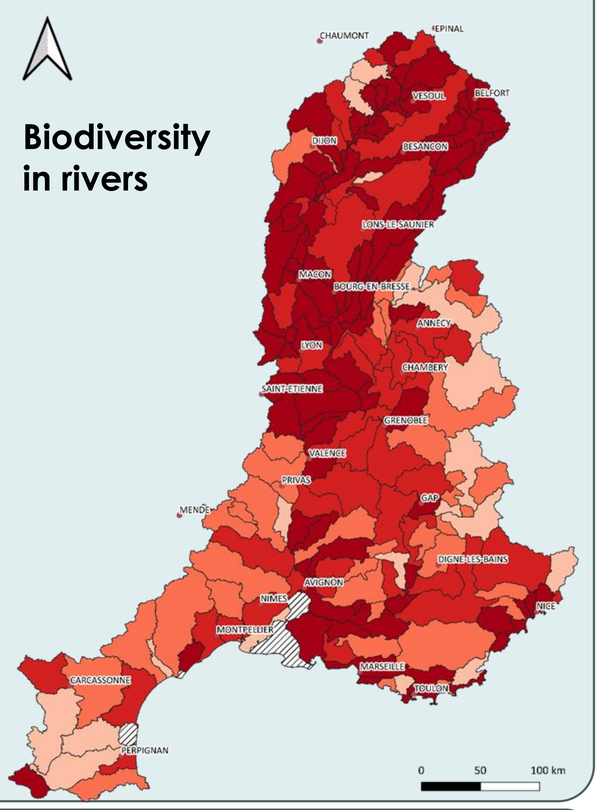
Surface water resources quantity



Surface water resources quality



Biodiversity in rivers



CONCLUSIONS and PERSPECTIVES

- First study assessing vulnerability to climate change at the regional scale in France
- Combination of academic results, water operators and public consultation that can help public policy development
- Supports local managers in grasping climate change challenges and emphasizes the actions they can take.
- Local studies must be carried out to support adaptation actions taking account local specific features
- This work could be regularly updated to measure the efficiency of adaptation actions and help public policy to be always up to date

References

Sauquet, E., Evin, G., Siauve, S., et al., 2025. A large transient multi-scenario multi-model ensemble of future streamflow and groundwater projections in France, Hydrol. Earth Syst. Sci. Preprint.

Reisinger, A., Howden, M., Vera, C., et al., 2020. The Concept of Risk in the IPCC Sixth Assessment Report: A Summary of Cross-Working Group Discussions. Intergovernmental Panel on Climate Change, Geneva, Switzerland. pp15