VULCAIN Project

VULnerability of Hydrosystems to combined effect of Climate change and Human Activities in Mediterranean area

A project funded by ANR (National Research Agency)

AQUIMED Project

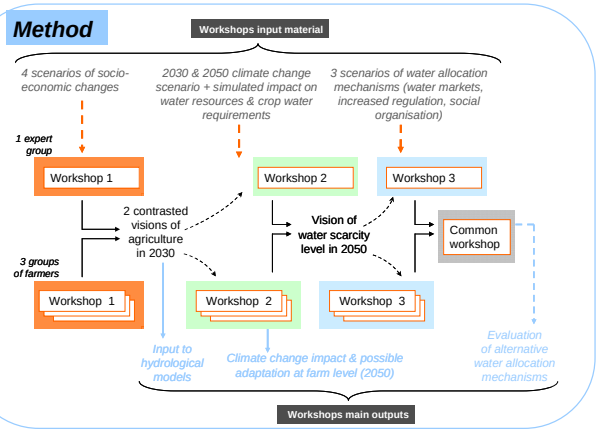
Participatory design of adaptive groundwater management strategies and instruments in Mediterranean coastal water scarce areas as a response to climate change

A project funded by ERA NET CIRCLE

Using participatory foresight approaches for improving agriculture preparedness to increased water scarcity in the long term

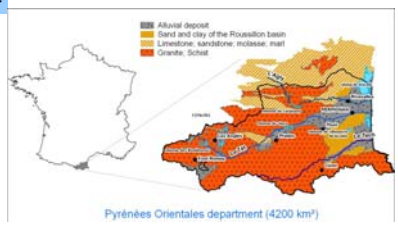
Climate change and growing water demand will result in increased water scarcity in most coastal Mediterranean areas. Adaptation will be required both in terms of water use at farm level and in terms of water allocation at resource level. In VULCAIN and AQUIMED, long term water scenarios are constructed using climate and hydrological models together with participatory foresight approaches.

Method



Case study area

The research was conducted in the département des Pyrénées Orientales. This area is representative from Mediterranean river basins in terms of resources (river basins regulated with reservoirs, presence of karstic and sedimentary coastal aquifers) and water demand (irrigated agriculture, tourism, growing urban demand).



Agriculture relies on three main productions: wine, fruits and vegetables. It benefit from a very favorable climate (mild temperatures in winter, dry wind, high solar radiation) but also from significant surface water resources (rivers, dams, dense irrigation network) and groundwater resources. Changes in climate and water resources availability could however threaten its comparative advantage.

Preliminary results

Four visions of agriculture in 2030

Four visions of agriculture in 2030 were constructed and provided as input material to workshop participants.

S1 : Ultra-compétitive agriculture

Farms : modernisation, concentration capitalisation
Social demand: cheap food, standardised products
Policy: end of CAP, trade liberalisation

Irrigation: ↘ area, ↘ volume, ↗ groundwater use

S2 : Two-tier agriculture

Farms : large competitive & environmentally friendly farms
Social demand: protection of rural areas & cheap food
Policy: payment for environmental services, strong CAP

Irrigation: → area, → volume, → Optimisation of existing resources

S3 : Intense South (Europe of regions)

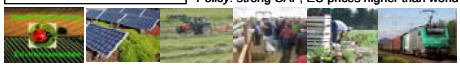
Farms: maximise comparative advantage, high quality
Policy: regional policy, integrated development of agriculture industry & tourism, strong regional trade mark

Irrigation: → area, → volume, → new resources

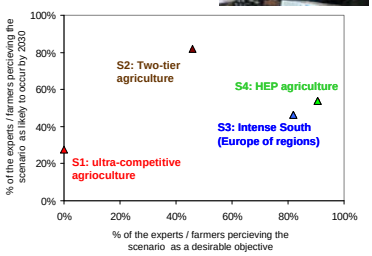
S4 : High Environmental Performance Agriculture

Farms: no pesticides, organic practices, major employer
Social demand: environment & food security
Policy: strong CAP, EU prices higher than world market

↗ area, ↗ volume, ↗ new ressources



Perception of scenarios

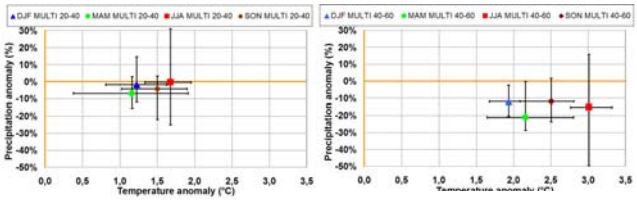


A main result of this first series of seminars was the increased awareness among participants of the **diversity of possible futures**. Moreover, participants clearly realised that the workshops could help them identifying control levers which could be used (at individual, collective or regional levels) to increase the chances of survival of local agriculture in different unfavourable economic contexts. At the end of this first series of seminars, experts and farmers alike were clearly able to consider long term horizon, whereas they were only concerned by very short term issues when they entered the room. They were then ready to look at changes in climate and hydrology likely to occur after 2050.

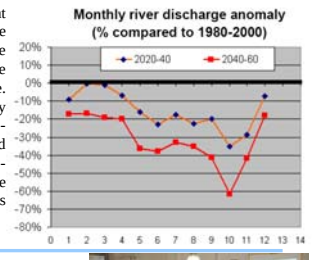
Climate change & hydrological impact

Future temperature and precipitation climate scenarios were built as part of the VULCAIN project, using outputs of **5 climate models** that have been used for the IPCC's last assessment report.

The results shows a **temperature** increase with mean seasonal values ranging between +1.2 and +1.7°C for the 2020-40 period and between +1.9°C and 3°C for the 2040-60 period. Concerning **precipitations**, no significant changes are expected for 2020-2040 period. For the 2040-60 period, anomalies range between -12% and -21%

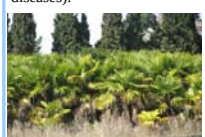


Hydrological models were built on different watersheds. The climate scenarios were downscaled at the study region scale (using the SAFRAN **downscaling model**) in order to simulate the climate change impact on the river discharge. The results show that water resource availability will drastically decrease in the future. At 2020-2040 time horizons, average in-stream flow should decrease by 20% in spring and summer. At 2040-2060 time horizons, the reduction in available discharge could reach 40% to 50% of current levels between March and November.



Perception of climate change

Climate change impacts: farmers are mainly concerned by predicted **temperature** increase: impact on vegetables in green-houses in summer, impact on the maturation of fruits, charac-teristics of wines produced in the area. Concerning **precipitation**, the most concerned are winegrowers as they already experienced declining yields during the last ten years. Another key issue of concern is the risk that wind regime would change, with less dry wind coming from inland and more humid wind coming from the sea. Such an evolution would reduce the comparative advantage of the region for organic farming (wind helps preventing diseases).



Palm trees, citrus or mangoes ? Which new productions in a changing climate ?

Adaptation: Overall, farmers are relatively optimistic concerning their possibility to adapt to the new hydro-climatic context:
- Cultivation of new crops (citrus) currently present further South
- Change type of vines and trees variety
- More efficient irrigation techniques (underground drip irrigation system) & generalisation of wines irrigation

⇒ **Increasing water demand in a context of reduced resources: a looming water crisis ?**
⇒ **Future evolution of urban water demand ?**
⇒ **Development of alternative water resources (desalination)?**

Authors

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