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.

**Preliminary results**

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

- **S1: Ultra-competitive agriculture**
  - Farms: modernisation, concentration, capitalisation.
  - Social demand: cheap food, standardised products.
  - Policy: payment for environmental services, strong CAP.
- **S2: Two-tier agriculture**
  - Farms: large competitive & environmentally friendly farms.
  - Social demand: protection of small areas & cheap food.
  - Policy: regional policy, integrated development of agriculture and tourism, strong regional trade mark.
- **S3: Intense South (Europe of regions)**
  - Farms: maximise comparative advantage, high quality.
  - Social demand: protection of rural areas & cheap food.
  - Policy: regional policy, integrated development of agriculture and tourism, strong regional trade mark.
- **S4: High Environmental Performance agriculture**
  - Farms: no pesticides, organic practices, major employer.
  - Social demand: protection of rural areas & cheap food.
  - Policy: strong CAP, EU prices higher than world market.

**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 show a temperature increase with mean seasonal values ranging between +1.2 and +1.7°C for the 2040-60 period and between +1.9°C and 3°C for the 2040-60 period. Concerning precipitation, 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 waterbodies. 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 greenhouses in summer, impact on the maturation of fruits, characteristics 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).

**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)
- Generalisation of 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 (desalinisation?)
- Financial support

**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 benefits from a very favourable climate (mild temperatures in winter, dry wind, high solar radiation) but also from significant surface water resources (rivers, dams, dense irrigation networks) and groundwater resources.

Changes in climate and water resources availability could however threaten its competitive advantage.