

Water management strategy and climate change Case of the Rhone-Mediterranean basin

Note Writed in 2009 by
Jacky COTTET

Former President of Management Board
of Rhone-Mediterranean-Corsica Water Agency

I) The Rhone-Mediterranean Basin: Some Main Features

II) Climate Change and Water: Observations and Prospects

- Already tensions for water resources ...linked to economic and social developments;

- An increase in air temperature;
- Longer and more frequent periods of drought;
- An increase in rainfall levels in the winter and a decrease in summer;
- Glacier shrinkage;
- The decrease in snow cover
- A more changeable climate

And major consequences therefore for aquatic environments...

III) A strategy to meet Today's Challenges...

While Preparing for the Future...

An integrated and balanced resource management policy, combined with the implementation of a forward-looking approach...

- 1) Save water!
- 2) Prevention and management of drought and water shortages
- 3) Mobilization of new resources
- 4) Higher aspirations with regard to water quality and biodiversity
- 5) Prevention of flood-related risks
- 6) Forward-looking approach

IV) Conclusion

I) The Rhone-Mediterranean Basin: Some Main Features

Obviously, issues relating to water management are very closely linked to geographical, climatic, economical and social circumstances...

So, I will start by giving you a brief overview of our Basin:

- Located in Europe, in the south-east of France (centred on latitude 45°N)
- A temperate climate, with contrasts however between the mountain ranges (Mont Blanc 4807 m / 15,770 ft) and the warm and dry Mediterranean Basin;
- Rainfall amounts showing major differences between the mountains (1,400 mm/year) and the southern area (600 mm/year in 80 days);
- A basin with a surface area of 120,000 km², or approximately 25% of the country, characterised by abundant yet unevenly distributed water resources, with:
 - the presence of the French and Swiss Alps, which form a huge “water tower”;
 - the Rhone River emerging from its glacier to run like a backbone all the way to the sea over a course of 810 km, with an average flow rate of 1,700 m³ at its mouth in Beaucaire (1,000 in summer, 2,000 in winter, and floods of 13,000 m³!), and tributaries coming down from the Jura Mountains, the Massif Central, etc.;
 - a Mediterranean area which, even though dryer, retains major potential, with a water supply that can be harnessed from powerful aquifers in the West and via a robust hydraulic infrastructure.
- socio-economical features:
 - 15 million inhabitants;
 - a diverse agriculture: contrasting with hill farming in the North of the Basin, vineyards, vegetable and fruit crops, etc.
 - significant industrial activity, and in terms of France’s energy generation, 25% of nuclear power and 65% of hydroelectric power generation;
 - an area attracting huge numbers of tourists (the Alps and the Mediterranean coastline in particular), with major population changes from one season to the next;

All in all, when considering the planet as a whole, a geographical and hydrological area with significant assets.

II) Climate Change and Water: Observations and Prospects

I will now give you a, very brief, overview of some phenomena observed, their effects on water and the environment, and the likely outcome or the experts’ forecast for our Basin...

1- Before examining the issue of climate change, however, I will discuss briefly the situations of tension over water resources which we are beginning to experience, due in particular to

- Local overuses;
- The development of irrigation and industrial uses;
- New types of uses, requiring very high volumes of water (e.g. swimming pools);
- Seasonal tourist population concentrations;
- The population trend, in general, but mainly on the coast, where water is scarcer;
- But also to diffuse water pollution, which can jeopardise water quality.

In my opinion, it is essential to consider and solve these issues first, issues which we may be able to impact, since these are effects which fall directly under man’s responsibility (urban development, agricultural and industrial production, lifestyles, etc.), rather than attributing today’s evils to global warming!

Obviously, this should not exonerate us either from paying the utmost attention to major developments for the climate, hydrology or the quality of aquatic environments, whether observed or predicted.

2- The increase in the near-surface average temperature:

- Is a proven fact over the past century, with an increase in France equalling (0.7°C) or slightly exceeding (1.1°C in the South) the global average;

- And, according to the most widespread analyses, **this should only be the beginning of global warming**, with average global scenarios ranging from +1.8 to 3.4°C at the end of the 21st century...

with maximum daily temperatures increasing by an average 6°C in the summer in the South of France (extreme scenario called A2, for the experts);

3- Longer and more frequent periods of drought: with, as a worse case scenario, 50 days/year of temperature > 30°C against 6 at present, the climate in Lyon may become like the climate now typical of Madrid...

4- The consensus over the importance of rainfall is not as clear; in France, an increase has been observed in yearly rainfall amounts over the 20th century, with the exception of the Mediterranean region, but with overall decreases in the summer and increases in winter rainfall rates.

The outlook for the future is therefore leaning towards more changeable rainfall rates in general, with more acute low water periods in the summer, and similarly more violent flood episodes...

5- Glacier shrinkage is evidently unquestionable

The Rhone Glacier has shrunk by 1.3 km over 150 years, while during the same period, the Mer de Glace has lost 1 km over a total length of 12, compounded by a reduction in depth of several dozens of metres; in addition, shrinkage has occurred at a much faster pace over recent years (the Bossons glacier: 550m in 30 years!).

It goes without saying that the intensification of glacier melt rates, which is generally assumed for the future, will impact very strongly on the minimum water flow of the Rhone which is due to remain at its current level or increase in the short-term, to subsequently decrease dramatically...

6- The decrease in snow cover, with the withdrawal of the snow blanket now occurring earlier, already has consequences in hydrological terms (less acute winter low water levels for Alpine rivers, earlier flood peaks in the spring, lower water levels in the summer), or with regard to the production of artificial snow, which is now almost the rule in Alpine ski resorts.

Despite all the reservations due to the still prevailing doubts, it is possible to predict that we need to prepare for:

- An increase in water temperature, with its consequences on the biodiversity and quality of environments;
- A decrease in minimum water levels in the summer, resulting in conflicts regarding use and tensions between users;
- Rivers bursting their banks, with the potential for major flooding and damages;
- An increase in the sea level, with the consequences associated to this in terms of coastal erosion, potential flooding, destruction of lagoons or salination of coastal water bodies.

III) A Strategy to meet Today's Challenges, While Preparing for the Future...

It is on the basis of these observations and forecasts that we have defined a resource management policy, which faces the problems of shortage and the tensions that we are already experiencing locally, or temporarily in some areas of our Basin, and while taking the view that the foreseeable natural changes will only aggravate imbalances.

- All in all however, in our circumstances which remain manageable when compared to many other regions of the world, and at this stage, our policy in the end is based on the main principles of the integrated management of water resources, without omitting any of its components:

- -A policy focused on prevention;
- A policy incorporating both water quality goals and aspirations of quantity (search for a balance between the availability of the resource and consumption);
- Shared diagnoses and action plans at various levels, i.e. basin, sub-basin and water bodies;
- The real involvement of stakeholders at all levels: by involvement, we mean much more than just information and participation: to sit together around a table to understand and analyse issues, identify the solutions and decide to implement them.

Such is the philosophy of our Basin Strategic Plan, which has been developed to implement the European Water Framework Directive (EWFd)

In addition however, as it seems plausible that climate change is intensifying the existing water deficit, in the summer in particular when demand is at its peak (irrigated crops, household needs, leisure activities, etc.), it is essential to adopt a forward-looking approach from now on as regards resource management, and to work out regional scenarios for future trends, so that tomorrow's political choices can be made.

Our strategy is based on adding a very broad range of measures, all of which cannot be discussed here.

As a result, I decided to simply list a few useful measures, of varying importance and often well known, and I will only describe in detail the new ones, which are well adjusted to the changes that we are experiencing and which may be more unusual in nature, while meeting our expectations at the same time... since "they are working" .

III 1) Save water!

Of course, the first impulse is to promote a management that uses less water.

- **Inform and make citizens aware** of the fact that water is a precious commodity, which must be protected and used sparingly.

This long-standing action is beginning to bear tangible fruit and a change in behaviour can now be perceived, a special awareness among children for instance and even, for the first time, a drop in the overall drinking water consumption.

- The optimization of collective management of water services, with for instance a new trend encouraging the **reduction of water losses in networks**, stipulated under a new law enacted this year;

- **Incentives for rain water harvesting**, granting tax allowances to those inhabitants who install recovery systems, and setting of standards for the household use of this water (August 2008);

- For the benefit of agriculture, the **development of the best possible technologies and methods in irrigation**;

- **The reuse of treated waste water**, naturally in compliance with quality standards, environmental protection and economic efficiency, in watering public spaces or golf courses (with which agreements have also been reached for a more careful use of water);

- **The recharge of aquifers**;

- The implementation of charges and taxes on water use, which have the result of promoting a reduced use, also combined with the widespread use of meters, whether for drinking water, sinking wells or for raw water for irrigation;

III 2) Prevention and management of drought and water shortages

Following a number of strained situations, France and our Basin have had to design a prevention and management system for drought and water shortages, incorporating statutory, operational and financial aspects.

1) **With regard to legislation**, the following is planned:

- The definition of territories called "**water distribution areas**", which are characterised by a chronic shortage of resources in relation to demand and where it is possible for the administrative authority to limit abstractions;

- **The establishment of quantity goals to be met during low water periods**, at 200 strategic points for water management (confluence points, aquifers), which are called "nodal points" and encompass two aspects:

- a "minimum water flow objective", allowing to still meet the needs of all reasonable users 8 years out of 10 on average;

- a critical flow rate, below which only the needs of priority users may be satisfied, i.e.:

- the supply of drinking water to the population;

-public safety and sensitive facilities;

-and the needs of natural environments.

2) **At operational level**, management of the system is carried out at the 'Departement' level, under the responsibility of the Prefect, the State's local representative, who organises information and consultation meetings with all the stakeholders. These meetings are useful whatever the season:

- When minimum water levels are almost or have been reached, for the purpose of implementing a plan for the shared abstraction of water for each use;

- At the end of winter, to assess the replenishment of aquifers and examine weather forecasts, which allows farmers for instance to select the type of plant that they will sow, more or less impacted by drought (sorghum, maize), based on the probability of availing of water locally.

Obviously, to be operational, the approach requires a collective organisation of irrigation management, bringing the farmers/users together in order for them to share out among themselves (quantities, hours, etc.) the water assigned to them.

This system is very successful in some areas of our Basin and we would like to invite you, if this suits you, to come and see for yourselves the organisation and the relevant stakeholders, in situ and in detail.

Yet again, this proves that when faced with a problem or pressures, it is necessary to always start by sitting together at the table to discuss and define the appropriate project.

3) Naturally, a financial component is necessary and our plan calls for:

- A higher water charge imposed in deficit sub-basins
- Tax allowances each time an organisation for the concerted management of irrigation already exists or is put in place.

III 3) Mobilization of new resources

1) In our basin, which combines mountain areas featuring considerable resources, temperate and dry areas, there is a genuine **tradition of dams, reservoirs and water conveyance structures**...from the Pont du Gard aqueduct, built by the Romans, to present times.

Our current policy is based on **two main principles**, which even though simple in theory are obviously more complex than it seems. :

a) The top priority, beyond of course a spatial development policy which includes the issue of the availability of water resources, is to **start by implementing, and exhaust all the most proactive measures to save water...**

b) The projects aimed at mobilizing new resources must be **sound from an ecological and economical standpoint** (or if summed up as much as possible, they must be environmentally friendly, with the need for the price of the water thus mobilized to "cover the project, its management and maintenance").

Only if all these conditions are met and to satisfy proven needs, does the Water Agency subsidy the execution of:

- new reservoir dams (e.g. case of the Rizzanese dam in Corsica);

- water conveyance projects, which not only have a limited impact on the environment, but are also a way to satisfy a genuine need, and furthermore – what is indeed good integrated management – to reduce water abstractions from sensitive environments: e.g. the case of a planned outfitting in the Languedoc-Roussillon region, **which would take water from the Rhone River, thus meeting the needs of the population development on the coast, while, at the same time relieving the low flow of small water courses and reducing abstractions from an overused aquifer.**

2) For the future, our Basin also includes local natural resources which have yet to be harnessed, either due to lack of knowledge, or to technical difficulties (karst aquifers, etc.)

We are trying to better understand their characteristics, and are implementing an active strategy for the protection of their quality, by putting together preventative pollution abatement measures in the catchment areas of these precious aquifers.

3) Thanks to both this development strategy and this far-reaching range of actions, within our Basin's context, we have so far been able to **avoid resorting to sea water desalination facilities...**

III 4) Higher aspirations with regard to water quality and biodiversity

Due to the current or forecast water temperature rise and the considerable variability of hydrological regimes, the need to meet the quality goals set by the European Water Framework Directive (EWFD) will no doubt become even stronger, as this is essential to:

- **maintain biodiversity and fish resources;**
- **as well as protect the resources that are actually available, for the various uses, whether in rivers or in aquifers.**

This is why it is critical that the required effort be produced to achieve the objectives of good ecological status.

France has just opted for:

- a proactive approach aimed at establishing **effective protection systems for the catchment areas of aquifers;**

- setting up an "ecological connectivity" (called "**Trame verte et bleue** – an ecological 'green and blue' spatial frame) throughout the country, allowing to lift obstacles to the free circulation of aquatic (blue frame) or land fauna (green frame);

- the identification of biological reserves** for fish reproduction and breeding, sections of rivers that benefit from a special protection and are kept under close watch.

For its part, the Water Agency has developed a proactive policy for the protection of **wetlands**, also involving subsidies to land acquisition.

III 5) Prevention of flood related-risks

1) Recent events this century have sometimes led the population to think that a major climate disruption has already occurred, when, in fact, such severe river floods were recorded in the past however.

What is undeniable though is the fact that the frequency, the level and the cost of the damage caused are definitely exceptional, due for the most part to:

- Urban development carried out in areas which “have proven liable to flooding” (I use inverted commas to indicate that we had sometimes a bit forgotten that they were so);
- Developments which had the effect of increasing the level of downstream flooding;
- The poor maintenance of flood-control structures.

2) As a result, the policy implemented is first based on these observations, and, since we are involved in Integrated Water Resource Management (GIRE), it calls for:

- The widespread implementation of risk prevention plans (integrated in urban development documents), taking into account a sufficiently high number of unknown factors (100 year return flow rate or corresponding to the highest levels of flood recorded);

- The information of citizens on risks;

- An efficient flood forecast and alert system: the recent concentration of our resources (drop from 100 to ... flood forecast centres), an increase in the professionalization of these centres, their integration within a national network, and the development of a specific alert system (amber, red, etc.) broadcast on the radio and on the Internet has already been successful;

- And **the management of small and large rivers, in all their aspects: Naturally, there is a need for flood barriers in some places, but the Water Agency, for its part, only subsidises those measures which also have a broader ecological dimension: such as for instance the reintroduction of flood storage areas, the recapture of an appropriate river width, or the restoration of natural diversions considered not very interesting up to now, which contributes to achieving a great many advantages, including at the same time:**

- **A reduction in downstream flood levels and damage;**

- **Environments that perform better, thanks to:**

- the recharge of alluvial groundwater**

- the reconnection with wetlands**

- the rehabilitation of river arms which had been regarded as “dead”, and**

- very positive effects on biodiversity and fish reproduction.**

Such is our policy, embodied in a “**Rhone plan**” for example, **stemming originally from the need to curb flooding, but which also includes components relating to the environment, transport, the economy and even culture.**

This is, I believe, a great way to illustrate the merits of an integrated approach to water management.

III 6) A more forward-looking approach

Even though policies already include progressive dimensions to be able to face present and short-term challenges, they must also allow for a great deal of anticipation...

This is why the Agency, which serves all the water stakeholders, is also involved in a more forward-looking approach, which entails:

1) **First and foremost, efforts to obtain from the water sector a contribution in reducing greenhouse gas emissions...** which starts with the optimization of the energy use by the water production and management “system”, though possibly also combined with multiple development opportunities which have yet to be thought of or exploited (e.g. the concept of heat recovery from waste water to heat up buildings).

2) A watch in relation to global climate change and the development of new technologies;

3) An attempt to research and develop scientific and technical knowledge, and to gradually apply global benefits on climate change at local level; I think that we are now going to be able to outline little by little the possible development scenarios, and give our decisions a direction in anticipation of the next decades:

- by strengthening our policies, keeping a continuity of purpose or with some reorientations;

- or else by preparing ourselves for rifts if necessary in relation to water management or economic and human development, in particular with regard to urban development, energy (hydropower generation) and agriculture (geographical shift of production areas / farming system less impacted by drought, etc.).

Obviously, the difficulty and complexity of the task at hand should not be underestimated, since all the phenomena are interacting all at once and we also need to move from general considerations, combined with substantial doubts, to visions of the future that are clear enough to be useful (e.g. go from a forecast of average yearly rainfall to more local and seasonal predictions, etc.).

This serves as the background for the prospect of creating, within the Water Agency, a referent and working group entrusted with the tasks of setting up an environmental observatory, provide for and stimulate futures research and ensure that knowledge is transferred to the decision-makers.

IV) Conclusion

Without doubt, the recent adjustments to our policies, which reinforce effective prevention and the appropriate and balanced management of water resources are relevant for the present and will help facilitate transitions towards the future in a basin such as the Rhone's.

However, at a time where there is the possibility of a consensus on future atmosphere and climate changes, and in spite of huge uncertainty, it is vital that we put together a country-wide forward-looking approach, which would allow for the continuous adjustment of our strategy and action plans, while taking part in the implementation of the territorial climate plans by local communities.