

# FRANCE



This vision aims to generate at local, national and global level, an awareness of the importance of a sustainable management of water resources.

France has always shown a strong interest in water policy, through its public and private bodies. The 1964 Water Law defined the legal framework within which France has organised water management at basin level with a high effective participation of the civil society as stakeholders. The new 1992 Water Law, implies that « Water is Everybody's Business », which is the ultimate goal of the Vision exercise promoted by the WCE.

The French vision is an integrated water management vision, with main emphasis on a sustainable and planned use of water resources, within a balanced natural eco-systems.

This vision contemplates a harmonious balance between the rural and urban worlds and is based on a sustainable management of the landscape. French agriculture aims to both sustain a balanced rural development and food production.

## 1. WATER, FOOD AND LAND MANAGEMENT

In France, supplying the food needs of the population has been a long-term target for the development of new infrastructure for water resources mobilisation and distribution. Throughout history, water projects have been the prime influence in the development of agricultural and rural areas, from the Galo-Roman era down to modern times. For example, the Watteringues in the North in 1169 (Dunkerque-polders), the Canal de Durance by Adam de Craponne in 1555, the Roussillon projects and the Canal de la Neste in the last century.

More recently, technical progress and modernisation of farming systems have allowed France to become a net exporter in agricultural products. The agricultural activity has thus become an important component of the economical national development and of the policy in rural development.

In recent decades, sociological and economical changes have been rapid and profound. The development policy carried out in France has allowed a more harmonious development than one that would have resulted purely from economical driving forces.

An economical focus would have tended to concentrate the French population in a few main centres, particularly Paris, whereas the population density distribution has remained largely stable. Voluntary actions have been carried out with the double objective of avoiding the desertification of the rural zones and avoiding too much urban concentration.

It is clear, everywhere in the world, that the uncontrolled development of "mega cities" generates acute social, economical and political problems. The desertification of rural areas, and the abandonment of farming may generate some risks of soil and landscape degradation, of increased natural hazards (fire, erosion, ...) and jeopardise the entire rural economies within these areas.

A balanced development, within rural areas, preserving the natural system, is also beneficial for leisure activities. It helps to avoid a harmful and costly hyperconcentration of visitors along the seacoasts by offering alternative and attractive venues elsewhere and thereby spreading the tourist load throughout the country.

Despite some failures and the fact that there has been a slight decline of rural zones compared with urban zones, this policy has generated the development of regional metropolises and middle range towns. Thereby it has helped to contain the growth of the megalopolis PARIS.

Actions have been launched to create and maintain sufficient employment (agricultural, industrial, services) in small cities and in rural areas. In this endeavour it is clear that water is an important challenge, especially in dry zones, for example the Mediterranean regions. Water is needed for agriculture (irrigation), for cities and for the development of some industries (food processing), for tourism (to support the quality of natural systems, bathing, domestic supply to tourist areas,...). But to make sure that all these actions are appropriate and efficient, it is required to consider "water" and all accompanying actions, not sector per sector but in terms of integrated development.

Thus for example, recognising the impact of land use on the water cycle is essential. Protecting water resources and more generally encouraging a sustainable development implies taking into account territory management and land use. In upstream sections of the watershed, the impact of forestation on soil and water conservation is well known. A harmonious combination of forest, livestock and agriculture is the best solution to prevent fires, to maintain terraces and reduce erosion; and as a consequence, to reduce flood peaks and increase groundwater recharge.

Human activities have a tremendous impact on water quality and on aquatic natural systems. Carefully planned location of activities along with an efficient control of withdrawals and spills and the development of fair agricultural practices, strengthens the protection policy of the ecosystems, wetlands and natural systems. All these are indispensable for protection, and sometimes rehabilitation of the water quality.

Acquisition of lands along the sea-coast (Conservatoire National du Littoral et des Rivages Lacustres) are made to create buffers, protected zones and National Parks (totally protected). Moreover, Natural Regional Parks have been established where a concern for protecting the environment is the driving force for the economical development. All these measures are important as they create sanctuaries and pilot areas, which can serve as examples for good practices in land use management.

At the international level, issues may be quite different from France. In particular the demographic growth does, in some developing countries, increase the risks of overdeveloping agricultural and over grazing inappropriate and fragile soils, resulting in the threat of a massive rural migration towards the cities. This can be dramatic, particularly if there are insufficient jobs. Water is a paramount factor for both domestic water supply in cities, and for food supply (irrigation) and employment in rural zones. However, despite some difference in the degree of the crisis, the basic principles are similar, and the main issue is a balanced development of the national territory for which comprehensive thinking is required.

## **2. AGRICULTURAL WATER: CONTROLLING THE DEMAND**

### **Agricultural water to support lively rural areas**

The control of water in agriculture favours a stable activity by reducing the variability of water inherent in climatic sources. It allows a balanced land use and maintains an economical activity in the area. This factor has proven to be crucial in France in the maintenance of sufficient activity in rural areas and the control of migratory fluxes.

The water projects undertaken during recent decades have been instrumental in maintaining economical equilibrium in rural areas. French agriculture is today extremely dynamic and efficient. In particular, in the South regions of France, water infrastructure has been able to compensate for climatic insufficiency and has allowed producers to cope with permanent changes in the food market.

Thus France has been able to maintain a well spread high performance agricultural activity throughout the country. This has made the country a net exporter in the European market. Out of the 35 Mtons of wheat produced each year, France exports 15 to 20 Mtons. Missions and objectives assigned to the agricultural sector have evolved considerably with time, and are still evolving today as the result of a continuously changing economical environment. Among the significant changes, one finds an increasing requirement for quality and reliability linked to the food processing industry, the increasing integration of Europe and an increased concern for environmental protection.

With a 6 %share of the national product, the agricultural sector, along with forestry and the food processing industry, supports and maintains the economical rural activity which covers some 85 % of the national territory, including the mountains. This development has been made possible by the improvement of farming system techniques, among which is the control of water to the soil and plants.

### **Irrigation a regularity factor in production**

Agricultural land under Irrigation has increased constantly in recent decades. It reached 1.9 Millions Ha in 1997, which constitutes 6% of the agricultural domain and covers one out of seven farms. In terms of area the dominant crop is corn, with 43 %. "Indispensable irrigation" was first developed in the south part of France. However more recent development in irrigation has covered the west, central and the north part of France, as supplemental irrigation. In France, irrigation is also valued by farmers as a resource to aid in providing for a continually changing economical context, resulting from permanent market fluctuations and of European and international law modifications. Irrigation improves the capacity of farms to adjust their cropping patterns.

For farmers, the motivation to increase yields and net income has given way to production diversification, yield regularity, and reliability of product quality. Today the cash crops grown under contracts with food processing companies are only possible if access to irrigation is guaranteed.

## **Irrigation as an employment factor**

Irrigation plays a key role in controlling jobs in the agricultural and food processing sectors. Farms where there is irrigation, have a lower average cultivated area than those running under rainfed conditions; and they have a higher density of employment. They are globally more dynamic and are a key asset of the rural development. Recent studies show that areas where irrigation has been introduced (partially not totally at farm level) have experienced a lower agricultural decline and have more jobs available than in others. It is estimated that approximately 5 jobs per 100Ha are generated when cereal farming land is switching from rainfed to irrigational supply. In orchard production, the increase in jobs is much more (1 job direct or indirect per hectare).

## **Irrigation and Water Resources**

Annual consumption in irrigation is about one third of the total consumption in France, i.e. 2.4 out of 8 km<sup>3</sup>. These volumes represent a very limited part of the total precipitation volume for France (480 km<sup>3</sup>) as well as of the fraction of the latter that can be mobilised (150 km<sup>3</sup>). However the abundance of water shown by these figures is misleading, and local and temporal water scarcity does exist. Recent summer droughts have generated conflicts and tensions among the water users, including the support to natural systems during low periods. This imbalance between limited water resources and a growing demand for water is becoming socially unacceptable. The growing scarcity of water that can be mobilised at a low cost, along with a higher concern for the environmental impacts of major hydraulic structures, and a decrease of investment from the state, has led water professionals to change their policies. Today policies promote solutions that aim for a better control of the water demand along with an economically sound development of new resource. This is the aim for instance, in the collective management of individual irrigation systems.

The effect of water withdrawals for irrigation on the natural system is negative, from a strictly quantitative point of view. On the other hand, irrigation has some advantages with respect to water quality, when compared with rainfed farming. Due to the regulating effects of irrigation on yield, and because irrigation allows a better control of the other practices such as the application of fertilisers and treatment against diseases, it minimises the risks of excess chemicals being carried away from the field and contaminating other water resources. When irrigation is well controlled, it is less harmful to the environment than a similar rainfed farming situation.

## **Controlling the uses and the demand for water**

In an atmosphere of growing competition for water and financial resources, it is now clear that the focus in France is in controlling the demand and the uses of water. There are still situations and specific cases for which rural development and regional re-equilibrium will require the mobilisation of new water, including water for agriculture. However these situations will be limited. In general the water supply will not see any increase and if there are changes they be moderated in a prioritised way, to satisfy other uses than agriculture.

The challenge for agriculture today is to manage the demand for water, in the most equitable manner within the farms, to increase the efficiency of the water use, to improve agricultural practices and to minimise the impacts on the natural environment.

## **3. A RESTRUCTURED LEGAL FRAMEWORK**

### **The French legal framework for water management**

Water management in France is characterised by a clear demarcation of the roles of the State (regulation, control and policy), Basin Committees (general trends for future management), Water

Agencies (solidarity among share holders and financial incentives for activities in line with the recommendation of the Basin Committee), and local management companies.

It is noteworthy to recall that the regulating and legal role of the State has been strengthened during recent times. Its role in investment is nowadays more limited than it was, while the role of local and regional political bodies is on the increase at decision level and to a lower extent on the financial side. Public investment is fully integrated in a comprehensive policy of development for each regional territory. Investments are restricted, today, to those aiming to ease the access to water resources and to correct certain regional natural handicaps.

In France, two major laws have recently modernised the legal framework; one is on water, the other on agriculture.

The 1992 water law modified and complemented the 1964 water law. The combination of the two laws creates a framework for water management in France. The 1964 law stated the unity of water resources (groundwater, surface water and coastal sea-water) and established its management through basin units; the 1992 law put forward the objective of a balanced management of water resources considered as a national asset. This latter is based on two major principles:

The first principle is that water belongs to the commons (common asset) of the nation and therefore, a comprehensive and balanced management must be undertaken to reconcile the user's needs and the protection of the environment {natural systems}.

The second is the principle of subsidiarity, which specifies that water management must be decentralised, negotiated and collected at the most appropriate level.

These two principles are meant to enrich and reinforce the existing approaches having the following main features:

The unity of water resources and the interdependency among uses of water leads to an integrated approach where the natural domain of the basin is put forward in place of the traditional administrative bodies (region, department).

The protection of natural systems is considered as a use of water similar to others.

The decentralisation goes along with the recognition of the importance of the local debate and negotiation.

The implementation of appropriate evaluation and measurements means is compulsory.

It must be noted that this legal framework will soon be modified by the coming water European directive, scheduled for 2000. This directive will be most likely to strengthen the above principles.

A decentralised and participatory management of water and landuse

Basin institutional bodies, basin committees and water agencies, established by the 1964 water law in France, have improved and adapted with the times, and particularly as a result of the 1992 law. Currently there is a new law under preparation, which will aim to strengthen the solidarity principle within these bodies.

Decisions concerning water policy within the six French basins are taken on an agreement basis for all the users represented in the Basin Committee (politicians, farmers, industrials, environmental associations, and consumers associations, State). The committee expresses the agreement in the general interest of the basin by voting with financial means. These are fed by

taxes on withdrawals and on pollution from all users. These financial means allow support of the local managers in improving water quality and water resource.

Furthermore, the 1992 law favours, all users, in a decentralised manner, at small basin and watershed levels. The involvement and responsibility of users at a local level is in line with the recommendations made at the Rio de Janeiro Conference June 1992 and further reinforced during the Paris Conference on water and sustainable development in March 1998.

### **The agricultural policy framework**

The Common Agricultural Policy (CAP) is a pillar of the construction of the European Union. This policy constrains the development of national agricultural of each member of the union as well as the demand for irrigation water. Initially the policy was aimed at generating a significant production growth. It has allowed security in farmer's incomes during the sixties and the seventies.

The inflexion in this policy came in the eighties, when the success generated huge agricultural surpluses. Controlling the surpluses then became the first priority. At the end of the eighties, the French agricultural department made its policy more explicit in its concerns about the environment. This has led to evaluation of the impacts of agricultural activities on natural systems, especially on aquatic systems. The agricultural sector was then asked to value quality more than in the past. Quality in this case refers to high quality products grown with respect to the environment. Maximising production is no longer the only goal for farming and the social demands of society must be considered. Water is no longer considered as an unlimited resource.

This trend has been strengthened during the nineties, and sustainable management became the central concept of agricultural policy. Water resource conservation requires a balanced and sustainable management. Agricultural development must be made with a long-term view and must combine economical efficiency, social equity and environmental protection.

The trends within the common agricultural policy (CAP), which avoid targeting growth yields and aim rather to control the quantity produced, have not led so far to a decrease in the irrigation demand.

### **A new mission for agriculture: landuse management**

The new agricultural law of 8 July 1999, redefined the legal framework for agricultural activities, and extended the missions of farmers to that of landuse, environment and territory management. A contract CTE (Contrat Territorial d'Exploitation - Contract for Landscape Management) will, in the future, link the farmer and the State for a four to five year period. This contract will consider both the creation of economic value and protective landscape management. This contract modernises the job status in the agricultural sector, especially the status of a Farmer's partner, which is usually a women. It specifically defines and remunerates missions aimed at protecting the environment. For instance, it specifies, for the farmers who irrigate, a special commitment for reasonable irrigation practices.

## **4. DIVERSIFIED IRRIGATION MANAGEMENT MODES**

There are three main modes of management of irrigation infrastructure in France. The choice between them results from specific climatic features but is also linked to the historical development of the country. The three modes are: Associative Management, Regional Development Companies (Sociétés d'Aménagement Régional SAR) and individual irrigation schemes.

### **The Associative Management**

For very old developments in the south of France, in the 19th century and even before, one found mainly associative structures for management. These grouped landowners and users of shared equipment in an ASA (Association Syndicale Autorisée - Water User Association). These associations have been created to undertake collective works, as well as to manage the equipment and maintain the structures once in operation. .

This management mode has been successful for a long time and in France, today, one finds about 1800 associations with collectively 134 000 members and covering an irrigated area of 450 000 ha. This gives an average of 75 members and 250 ha per association. Their legal status allows them to act on behalf of the general interests to equip irrigation schemes, build structures and to raise fees among their members.

The success met by this type of management (1/3 of the total irrigated areas in France) is due to the strong link between the membership of the association and the landownership, and to the reliability of the fees collected; this is because they are ensured through the general tax collection system. Associative management structures have lasted for many years which is a sign of their success. They reach a fair level of solvency - the price of water covers at least the operating and usually the maintenance costs, and in some cases even part of the initial investment.

As a result of their status, the function of the associations is decentralised and farmers are responsible for the collective decisions of the association. However the size of the association seems to make a difference in this respect. In small associations (lower than 10 members), collegiality and responsibility of each member are high. The large associations are usually well structured, in a professional way, and generally efficient. However the middle sized association have more difficulty in combining collegiality and professionalism.

The overall success of this type of management does not hide some weaknesses that are the result of two main causes. The first is that farmers are usually more inclined to manage with a short term perspective rather than considering the long term, and therefore they usually do not plan for sufficient maintenance and renewal of the main equipment. The second is that the status based on landholding is inflexible. It does not allow for adjustment of landuse (e.g. in the fringes of the cities) or of farming systems. This lack of flexibility is also a problem when social demand evolves and leads to conflicts between urban and rural and between young and old farmers, which jeopardises the whole system.

Maintenance used to be regularly carried out in the past, often through collective {co-operative} works involving each associate. Today, maintenance faces technical and financial difficulties that will require some associations to be fully modernised.

This associative mode can function effectively together with the other modes. It is not rare to have associations within the large domain supplied by a regional development company (SAR). In fact some SARs carry out parts of the missions of the association beyond water supply (e.g. maintenance).

### **The Regional Development Company (SAR)**

Most modern development since World War II, has been undertaken by regional developing agencies (Sociétés d'Aménagement Régional -SAR). The Agricultural Department created SARs between 1956 and 1964, with the goal of developing the South of France. There are 5 regional companies in France, 3 of them directly manage equipment for irrigation totalling 275 000 ha within their own concession, and another 90 000 ha for which distribution is the responsibility of others (support supply to associations and to individual irrigating farmers).

The SARs have been involved in the development of new resources and/or in projects aiming to better use existing resources. They have acted as the arm of a strong political move, aiming to eliminate the lag of development found in the south of France, where the structural effect of

water is fundamental. Although agricultural water is very important for development, domestic and industrial uses are equally important for some SARs. . For these SARs, water demand development provides a perfect illustration of balanced regional development between the rural and urban worlds.

The initial development investment is partially subsidised, to a level depending on the water use. Loan reimbursement (for the non-subsidised part of the initial investment), the operating costs, maintenance costs and the cost for renewing the equipment are totally covered by the charges for water, without subsidies. The system is operated under the following principles: equity (for all users), high quality of service (guaranteed by a contract with customers), continuity and sustainability (perennial maintenance and adaptation of the structures), transparency and responsibility. Farmers are represented on the board of the SAR.

Generally the infrastructure is well developed and the management efficient, compared with other regions in France :

- There are rarely conflicts between users of water within the SAR Concessions.
- The sustainability of the equipment is ensured thanks to an original mechanism for renewing the structures.
- Users pay for the operating costs, whilst maintenance is partially funded through the initial investment.
- Nowadays the accounts of the operators are usually balanced.

The long-term missions of the SARs have not been fundamentally modified since their initiation; but they have been regularly updated, focussed and adjusted through successive mission letters. However the internal functioning of the companies has radically changed. Beyond the regional development of irrigated agriculture, each SAR has been asked to fulfil other missions including water resource management, supply to non-agricultural users (Urban industrial), and the development of engineering capacity (consultant company).

Initially SARs were a direct creation of the state, mainly governed and supported by the state. They have now evolved, with reduced state influence, towards a function aimed at the benefits of the local territorial political bodies and water users. They therefore provide an original example of a "semi private or semi public" function in which the companies, while assuming some public or collective mission, are run under the private company principle with the necessity of balancing the accounts.

### **Collective management of individual irrigation schemes**

An important part of the recent development of irrigation is based on individual initiatives. These may be the creation of new resources using a farm reservoir or more often the withdrawal from shallow groundwater or direct offtakes from rivers. In terms of cultivated area, this type of irrigation is in the majority with 1.2 million Ha. The collective management of these individual irrigation initiatives is an important challenge for the integrated management of multiple uses of water. In summer the crop demand for water is at its highest, whilst inversely the surface natural streams are at their lowest levels. Maintaining an acceptable water quality in these streams requires that nearby shallow groundwater withdrawals and direct river offtakes are planned and controlled. The collective management of individual irrigation schemes therefore became a very important challenge by the end of the eighties, particularly in those areas presenting high quantitative deficits, for example in the South West of France (Gascogne, Charente,...). The solution of acute conflicts arising in these basins required the development of a new approach to integrate management as well as the implementation of specially adapted economical tools (quotas and tariffs).

### **The importance of the regulating role of the State**

The State has largely withdrawn from the management and operation of water infrastructures, however it remains the only safeguard (warranty) for a good long-term management of resources and infrastructure. In this perspective the role of the State, or of any other public body, should not be diminished. Large irrigation systems represent huge investments, paid by the community as a whole, and it is completely legitimate and important that their management and maintenance be controlled by a public body and not by the users of the systems alone. The total withdrawal of the influence of the State would be dangerous. An appropriate maintenance<sup>1</sup> supposed a long term management policy which can contradicts with the usual profitability criteria of private business. The consequences of inadequate maintenance are not immediately obvious, but may emerge many years later when it is either too late, or the situation is such that the public authority is forced to fund costly rehabilitation works. The users themselves are price sensitive and may not understand the long-term economic benefits of an appropriate and sustainable maintenance programme. These potential conflicts of interests are important and must be taken into account.

The necessity of modifying the water management modes implies the Development of new methods of management, new decision making tools and new economical tools. Pilot schemes are needed to test these new ideas in the field, with local operators and partners, with the goal of documenting results and useful information and making these available to the entire profession. In this regard the State has a key role to play to instigate and co-ordinate a consistent policy of Research and development into management, with particular emphasis on regional factors useful to local partners.

French actors in the field of water have agreed to underline the importance of the role of the state and to reinvest in new missions for the sustainable management of water resources and infrastructure alongside local operators.

## **5. THE VALUE OF WATER AND MANAGEMENT TOOLS**

Irrigation management can be split into two subsets: management of the resource and of the uses, and the management of transport and distribution infrastructure. The two are linked and complementary when, for example, the irrigation system is downstream of a reservoir, or dissociated for instance when individual pumping equipment shares a common source (examples: Charente, Beauce).

Through management tools irrigation aims to either ensure a reliable response to the demand for water, using the resource available, and/or to balance the accounts of the operators in charge of transport and distribution of water to users.

Tariffs and quotas have been thoroughly investigated to evaluate their effectiveness.

Professionals are currently collaborating to instigate many investigations with research centres focused on the value, the cost and the price of water. The water law of 1992 specifies that water is a common property of the nation. It therefore gives a special status to water of being both an "economical good" and a "social good", the management of which cannot be left to market forces alone.

### **The value of water**

The economical value of water, necessary for comparison of different uses of water within the same category or between regions, is one, but not the only determinant of management decision making. In irrigated agriculture, the economical value is :

- a strategic value linked to the decision about the proposed cropping pattern at the start of the season. It is equal to the ratio of the differential of added value between irrigated crops and non-irrigated crops to the volume of water required for irrigation (in \$/m<sup>3</sup>).

- a tactical value during the irrigation season which is equal to the marginal gain of added value per unit of water volume.

### **The cost of water services**

The notion of cost is very variable depending on the components incorporated in the computation. The full cost includes the initial investment, the operating and maintenance costs, the renewal of the investment and the cost linked to the withdrawals from the natural system (value of water at the withdrawal). The sustainable cost is equal to the full cost minus the financial cost of the initial investment. It therefore includes the operating and maintenance costs, the renewal of the investment and the cost of withdrawals from the natural system. The sustainable cost does not allow for the creation of new investment but is designed to cover the long-term operation and equipment maintenance without the use of additional public money.

In the main French systems, managed by the SARs, water price is higher than the sustainable cost, and is nearing the full cost (initial investment partially subsidised by the state); the average price for agricultural water is about 1F/m<sup>3</sup> (0.15 Euro or \$ per m<sup>3</sup>).

In France today professionals are aiming at the realistic objective of the recovery of the sustainable costs for the main infrastructure for water storage and transport. This position is justified as these components are usually multipurpose structures and they are part of a comprehensive regional development. For irrigation distribution systems the objective is to generalise a tariff policy allowing recovery of an intermediate between the sustainable and the full costs. In the case of multipurpose structures, all users of water must contribute equitably to cover the costs.

### **Metering water withdrawals**

The 1992 water law requires the implementation of evaluation and measurement of all the uses of water. Generally collective systems are equipped with meters. However there is a significant trend to equip individual irrigation schemes as well, particularly in the basins where co-operative management is proving difficult. This trend is the result of an equity concern among the farmers, as well as a concern of communication with other water users. Metering devices enable negotiation with real, reliable and incontestable figures. Thus the density of meters in the Charente Maritime departement, where the pressure on the resource is very high, is also very high reaching 81%.

### **Tariff and quotas**

The analyses of the value and cost of water feed into a comprehensive investigation of a 'fair' tariff policy. This policy must be efficient enough to enable a balance of the accounts of the local operators without being unduly cumbersome, and should also allow the regulation of water allocations in regions where water is limited. Answers are site specific and depend on the type of management (ASA-SAR-Individual).

All users of water in France must pay a fee to the water agency, based on their consumption. For irrigation, the recovery of the fees is generally achieved in the collective systems of ASAs and SARs but is less successful for individual irrigation schemes.

## **6. TECHNICAL PROGRESS**

During the era of high growth of irrigated areas, the trend has been to classify a hierarchy of irrigation techniques according to their assumed level of performance. Thus localised (or drip) irrigation has been assumed to perform more efficiently than sprinkler irrigation, and the latter more efficient than surface irrigation. After years of practical experience in the use of all these techniques, it is now recognised that this hierarchy is not so clear. There is no perfect technique

for irrigation, and what is important is the appropriate adaptation of the equipment to the site constraints, the nature of soil the crop, etc.. In some cases, sprinkler irrigation can be more efficient than localised irrigation. The main factor contributing to the performance lies in controlling the supply to the crop whilst using other water resource inputs effectively and in conjunction with irrigation. Irrigation control is now recognised as a major factor in the performance.

Thus at the field level, the area of expected technical progress is in the irrigation techniques, but particularly in the techniques for controlling the water supply to the crop; and in this way helping the users to increase their irrigation efficiency.

For main system management (storage, transport and distribution infrastructure), important progress has been recorded during the last forty years or so, in methods of regulation and in the automatic control of structures (Dynamic regulation, remote control, and telemetry). These methods have proved their effectiveness in improving the management of water supply in situations with fluctuating demand. They have also enabled management to minimise water losses. These modern and efficient operation and management methods were developed by the SARs and are today widely used by them on basins with important irrigation schemes in the south of France. These methods should be extended to the basins of the central and western parts of France.

## **7. FLOOD CONTROL**

Recent massive floods (November 1999) in the South of France (Aude, Tarn and Pyrénées Orientales) have reminded us, in a cruel way, how floods can have devastating material and human consequences, particularly flash floods.

A full protection against flooding is impossible {or prohibitively expensive}. We know that this kind of events will occur from time to time and we can even estimate, on average, how often they will occur. However we are not in a position to anticipate them as they come without warning. Whatever the techniques used, the economic resources employed and the human will, no physical infrastructure<sup>2</sup> will guarantee complete protection from flooding and be universally acceptable. In addition the size of flood alleviation schemes required to capture the biggest (and therefore most infrequent).

If we cannot completely avoid damage then the goal should be to minimise it, with a high priority on actions that aim to suppress or decrease the loss of human lives; damage that cannot be rehabilitated.

Two types of complementary actions, must be contemplated :

- Structural actions: dikes, reservoirs, and river rehabilitation schemes.... These are costly but in some cases there appears no alternative.
- Non-structural actions: a better understanding and knowledge about the phenomenon, risk identification, information, landuse rules, warning and alert system, crisis management,.... These are often less costly and still can be very efficient; particularly in minimising human loss.

Full protection must be limited to areas of absolute priority, and these are the major urban areas. This is because full protection is very costly and it is necessary to have large undeveloped expansion areas where the flood can spread and be attenuated. Whatever we do, extremely high floods represent huge volumes of water that cannot be drained instantly, and there is a need to provide storage areas to minimise damage. Limited zones with high priority must be protected and for the remaining areas special crisis management must take place.

Choosing between the two options is not an easy task as there are conflicting interests (which zones will be flooded to allow others to be protected, with what frequency, intensity, duration etc.) and still one has to be realistic in terms of financial commitment.

The decisions are mostly political. They required a high level of negotiation and discussion among the interested parties, in order to reach a consensus sufficiently high for implementation.

## **8. WATER FOR FOOD AND RURAL DEVELOPMENT IN 2025 IN FRANCE**

### **The objective: reinforcement of already engaged set of actions**

French actors in the agricultural water sector do not anticipate any radical changes in policy for the future. France is not facing a water sector crisis, which does not mean to say that water quality is not a major concern in some cases.

### **Agriculture as part of an integrated management of both water and territory.**

The modern goal is to consolidate landuse practices (avoiding desertification) using modern agricultural methods, which respect and are sympathetic to the environment. The follow up of improvements already implemented with regards to the reduction of non point source pollution will require tremendous effort to ameliorate current agricultural practices. The considerable efforts used to promote reasonable irrigation and fertiliser application (program Irimieux and Fertimieux) will have to continue. However, the new initiative will be the complete integration of agricultural practices with collective water management and the implementation of the environmental missions assigned to agriculture by the recent agricultural law (CTE).

### **A balanced management of development**

Through the development of dialogue and negotiation, the objective will be to reconcile "project developers" and "ecologists", to favour reasonable decisions and to implement collectively agreed actions in the development of infrastructure and in the rehabilitation of natural aquatic systems.

### **The use of modern economic tools for management**

Efforts towards the use of modern means of management (meters, tariff) must continue and be generalised to each and every water withdrawal scheme. The integration of each water use in the integrated financial system (taxes and supports from water agencies) must be completed. Lastly there is a need to balance the finances of the infrastructure management leading to target at least the recovery of the sustainable cost, for which maintenance and renewal of the equipment is paid by the users.

### **The use of modern techniques for basin management**

Modern techniques for main system management (automation, remote control technique) have been mainly developed successfully in the South of France. They will be generalised to basin of the central and western parts of France. The goal is to improve the performance of the water resource system in responding to the variable needs of multiple users (agriculture, municipal and industrial supply, environmental needs).

### **Improving management structures**

In the past the Regional Companies (SAR) have shown a great capacity for adaptation to new constraints and requirements from their customers, and from their supporting bodies. This capacity will certainly be further stimulated in the future, although no one knows today in which direction. As far as the Associations are concerned, their situation is quite variable. Many of them

will have to modernise their status to allow better adjustment to landuse changes, and to better cope with maintenance requirements. Lastly the collective management of individual irrigation schemes, which proved to be successful in some French regions, will have to be generalised and incorporated into the integrated water management of all water uses.

### **Agricultural Landuse management and flood control**

The goal here will be to control the risks of flooding by strengthening the flood prevention policy for upstream watersheds, and moreover using real time flood forecasting and management. In this context, it is clear that the agricultural domain will be highly encroached upon for flood alleviation expansion.