

# RECENT TRENDS IN WATER POLICY IN SARDINIA. FILLING THE GAP BETWEEN INCREASING DEMAND AND DECREASING AVAILABILITY

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## **Abstract**

Water policies in different parts of the world are increasingly called to control an ever increasing demand that is often conflicting with decreasing availability. One of the main tools to control water demand is an effective price policy that is able to find a balance between social equity and economic efficiency. The Italian region of Sardinia is an interesting case study, as it shows the increasing difficulties experienced by a Mediterranean island facing recurrent water shortages. Decades of weak planning determined an emergency situation characterized by widespread environmental conflicts. New trends aim at centralizing water management and curbing the growing demand through increasing water prices.

**Keywords:** water policy, climate change, environmental conflicts, Sardinia.

## **Introduction. Water as an economic good: the difficult management of supply and demand (Monica Iorio)**

For a long time, water has been seen and managed as an unlimited resource. As water covers a basic human need, the idea of its abundance has often led to an incorrect management based on a growing supply provided at a political price. Considering the increasing number of water-related social and environmental conflicts, this kind of resource management has proven irrationally generous and largely unsuccessful. The big hydraulic infrastructures built over the past decades have caused significantly negative environmental impacts without fully satisfying social demands, neither quantitatively nor qualitatively. The extremely low water prices, generally much lower than distribution costs, have produced widespread overuses and wastes, mainly in the agricultural sector. At the same time, extensive tax evasion has reduced the available budget for equipment maintenance and new infrastructure building. As a consequence, problems and policies related to sustainable water management and adequate pricing are currently being debated in the whole world, generally assuming that water demand should be curbed and controlled through economic policies. This kind of approach seems to imply that water resources should be transformed into economic goods, thus leading to a highly controversial but increasingly widespread water privatisation policy.

From an economic point of view, water can be defined as a renewable resource, since it is regularly and naturally regenerated, thus providing, if well managed, an infinite quantity of useful and necessary services. However, the availability of a renewable resource is not fixed and can increase or decrease. The latter scenario occurs when consumption rates systematically exceed the natural regeneration rates of the resource itself and the available stock falls below a critical level, ultimately leading to its deterioration and extinction.

Growing water pollution and climate change, which are expected to amplify potable water scarcity and droughts in coming years, are turning water an even more scarce resource. Nowadays, structural water shortages already affect many regions and whole countries in Africa, Asia, the Middle East and South America, and are not uncommon in the more developed European, North American and Pacific countries.

New directions in water management tend to stress the importance of “demand policy”, since it is more and more evident that water supply can not be indefinitely increased. The year 1992 marked an important turning point for the effective adoption of long-awaited strategies oriented toward sustainable development. In Rio de Janeiro, governments, international organizations and NGOs met for the first Earth Summit (the United Nations Conference on Environment and Development). The fundamental output of the conference was the Agenda 21, a comprehensive action plan to be adopted

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globally, nationally and locally to promote the sustainable development of the planet over the 21<sup>st</sup> century, also including specific measures related to water management.

In the same year, during the International Conference on Water and Environment (ICWE), held in Dublin, a new revolutionary assertion was made: since water is a scarce resource, it has an economic value. This means that water resources are expected to be managed as an economic good, in order to maximize the efficiency and minimize wastes and environmental damages (the Dublin Statement on Water and Sustainable Development, 1992).

The European continent, in spite of its stationary or declining population, is still experiencing intense increases in water consumption and widespread environmental conflicts caused by competing water uses, further worsened by persistent pollution problems, relatively unpredictable climate changes and recurrent droughts, particularly serious in the Mediterranean region. In order to prevent further deterioration, in 2000 the “Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy” was finally adopted. The Directive established common principles in order to “coordinate Member States’ efforts to improve the protection of Community waters in terms of quantity and quality, to promote sustainable water use, to contribute to the control of trans-boundary water problems, to protect aquatic ecosystems, terrestrial ecosystems and wetlands directly depending on them, and to safeguard and develop the potential uses of Community waters”.

Among the key innovation points of the Directive is the “river basin policy”, which includes the sustainable and systemic management of the portion of land drained by a river and its tributaries, encompassing all of the land surface dissected and drained by streams and creeks that flow downhill into one another, and eventually into rivers, lakes, estuaries, seas and oceans. Each river basin is assigned to one single “river basin district”, which is “the area of land and sea made up of one or more neighbouring river basins, together with their associated groundwater and coastal waters, which is identified under Article 3 as the main unit for management of river basins”.

The fundamental aim of the Directive is to promote the establishment of international basin authorities, as a result of co-operation among various States, in order to achieve common management of trans-boundary waters. Water basin management, economic analysis of water use and correct water pricing systems are some of the main tools identified by the Commission in order to promote sustainable water policies.

According to the Directive, the prices users pay for water should cover the operational and maintenance costs of supply and treatment and allow further investments in infrastructural improvements. Moreover, the Directive requires that prices paid by users also cover the environmental costs. In spite of widespread concern and protests related to progressive “privatization” of water, this is a key step towards the implementation of the economic principle that polluters and users should pay for the natural resources that they exploit and for the damage that they cause. In order to recover the costs of water services, the European Union’s Member States are expected to consider all the activities that use water resources, including agriculture, industry, tourism and domestic consumption. Key costs can be classified into three categories:

- financial (including the maintenance costs of existing water supply systems and the investment costs of new water supply systems or wastewater treatment systems);
- environmental (including the costs related to the environmental damages caused by water use);
- resource costs (including the negative externalities to be faced by some water users as a result of incorrect water uses made by others).

Since access to potable water is also considered a fundamental human right, a viable water pricing system for domestic uses needs to guarantee, at the same time, economic efficiency and social equity. This aim can be achieved through the adoption of progressive tariffs for different groups and categories of users, guaranteeing moderate prices for small consumers, thus encouraging water savings while safeguarding the principle of water access as a human right, and punishing large consumers through higher costs. Technically, the implementation of this strategy implies strict and efficient controls on consumption, thus combating illegal and unregistered withdrawals and consumptions that are still relatively widespread in urban and rural contexts.

Water demand analysis, including its structural determinants and its reactions to price increases, is necessary to understand and estimate the possible effects produced by quantitative and qualitative changes in water supply. One of the key elements settled by the Water Framework Directive is the

introduction of economic methods, based on the “he who uses and/or pollutes pays” principle, which are expected to encourage efficient water use and curb needless losses. At the same time, the Directive maintains its focus on the broader and often intangible value of water, also stating that “water is not a commercial product like any other but, rather, a heritage which must be protected, defended and treated as such”.

### Water in Sardinia: conflicts and new trends (Andrea Corsale)

The Mediterranean island of Sardinia is an interesting example of environmental and social conflictuality caused by increasing water scarcity, curbed in recent years through new trends in water demand policies aiming at structurally correcting the seriously unbalanced relation between consumption and availability.

The Autonomous Region of Sardinia is characterized by a typically Mediterranean climate with moderate rainfalls concentrated in the wet winter months and drought conditions that span for 3-5 months during the warm summertime. The recent dynamics of precipitation trends is progressively turning Sardinia into one of the driest islands of the Mediterranean. While rainfalls recorded between 1922 and 1991 averaged 779 mm/year, or 19,300 Million m<sup>3</sup> per year, recurrent droughts occurred between the late 1980s and the early 2000s, probably anticipating climate changes that are expected to further reduce precipitation in most of the Mediterranean Region over the next decades. In the early 1990s 32 reservoirs had an overall capacity of 1,200 Million m<sup>3</sup>, were still substantially sufficient to cover the internal demand. Most reservoirs, with the exceptions of those devoted to power production, have a distinctive multisectoral vocation, in order to satisfy agricultural, industrial and civil consumption demands (Brandis, 1981; Progemisa, 1996).

Figure 1 - Map of Sardinia



Source: RAS, 2004.

The climate dynamics recorded since the late 1980s, however, worsened the situation showing a clear tendency towards drier winters and wetter springs, with overall decreasing rainfalls and increasing evapotranspiration. During this period, Southern and Eastern Sardinia have been experiencing particularly severe droughts, while the situation is less dramatic in the Northern and Western parts of the island. Particularly severe droughts occurred between 1988 and 1990 and between 1994 and 1995, followed by temporarily wetter years. The situation further deteriorated during the years 1998-2002, the driest ever recorded during the 20<sup>th</sup> Century. Following this trend, water runoff in the main rivers of the island dramatically decreased and the amount of water collected by reservoirs has dropped by 55% since 1990.

The year 2000 was particularly difficult, as, following the decreasing water levels in all the main reservoirs of the island, water availability dropped to just 260 m<sup>3</sup> per capita, determining serious social, economic and environmental emergencies and leading to strict water rationing. The average water availability, for residents and tourists alike, is currently estimated at 153 litres per capita per day, largely below the average availability for Southern Italy (242 litres per capita per day).

The peculiar physical characteristics of Sardinia, notably its insularity and the resultant isolation from continental Italy, imply the existence of an enclosed hydrologic system that has to fully rely on its local resources, thus being particularly exposed to the negative effects of wrong or inadequate water policies. Over the past thirty years, Sardinian water resources have suffered increasing pressures caused by growing demands in the agricultural, industrial and tourist sectors.

Since the 1960s, irrigation, industry and tourism, albeit showing different development trends, have relied on the unrealistic idea that the use of water resources did not need specific planning or control, thus leading to substantial detachment from real water availability and causing serious environmental problems. A generous and costly policy of dam construction, increasing water supply and extremely low prices further encouraged the expansion of consumption till it reached unsustainable levels during the 1980s.

While in the industrial sector, thanks to its modern infrastructures and techniques, water shortages have not produced significant impacts, and while tourist and domestic consumption usually pay a higher price for the water they use, the agricultural sector has been cause of serious concerns.

Around 58% of the irrigable agricultural surface of the island, 310,000 hectares, has already been provided with irrigation infrastructures, with a 70% increase between 1985 and 2006, in spite of stationary or declining water availability. The recurrent and persistent drought periods experienced over the past twenty years, leading to severe water rationing, reduced the real use of irrigable lands to just 30%, with a tendency to further decreases. Agriculture is currently responsible for 60-70% of total water consumption in Sardinia, while producing only 5% of the island's GDP (CRAS, 2005). Problems in water management in the agricultural sector are amplified by the persistence of a traditional water pricing system based on the irrigated surface instead of the real consumption.

Only during the past few years, under the pressure caused by increasingly recurrent rationing and conflicts with other water users, agriculture has accepted the deep changes implied by new pricing policies based on effective consumption. The prices themselves, though, currently around 0.02 €/m<sup>3</sup>, remain largely below the real cost of the service. Considerable fragmentation of land properties, weak public support for production and commercialization of agricultural products and traditional, highly water consuming irrigation techniques further complicate the definition of a viable relation between water demands and availability.

Domestic consumption is considerably smaller than the agricultural one but has shown a consistent tendency to sharp increase during the past decades, generating recurrent emergencies and leading to frequent rationing in summer and even winter months. A widespread tendency towards excessive consumption and inappropriate use of potable water has been further strengthened by a generous pricing policy that substantially provided water for free until the early 1990s. Moreover, the obsolete aqueducts are responsible for significant losses, as water pipe systems in urban areas showed, in the year 2000, significantly low quality standards, with only 22% of pipes recording losses lower than 20%, 38% recording losses between 20% and 40% and 40% recording losses of 40% and more. This situation generated a constant emergency that has been faced in recent years through heavy investments of over 140 millions € between 2004 and 2006, aiming at progressively replacing the

inefficient water pipes. Other investments have been devoted to the increase of water quality, according to the stricter national and international requirements. ~~Il periodo fra gli anni 1998 e 2002 risulta il più siccitoso dei circa 80 anni per i quali sono disponibili i dati idroclimatici della Sardegna.~~

Approximately 76% of the population is served by sanitary sewer systems (lower than the average for Southern Italy, 85%) and 69% is served by wastewater treatment plants (84% in Southern Italy). The efficiency of wastewater treatment plants is generally insufficient or scarce in most cases. The situation is relatively better in the industrial sector, as 19 industrial areas out of 22 that have their own wastewater treatment plants, often serving urban areas, too. In this situation, large quantities of untreated wastewater risk to pollute reservoirs already characterized by advanced eutrophication and threaten significant portions of coastlines, already menaced by large waste deposits left in the internal areas by the former mining activities that flourished between the 19<sup>th</sup> and 20<sup>th</sup> centuries ([RAS, 2002](#); Di Gregorio, 1990).

Only 3 wastewater treatment plants out of 465 have been provided with recycling facilities to produce treated water for agricultural uses. The tourist sector could also benefit from further spreading of wastewater recycling plants, as it is generally able to pay higher prices to purchase water to invest in swimming pools, fountains, golf courses and gardens that do not require potable water and often produce more wealth than irrigated crops.

Groundwater resources, particularly vital in coastal areas with significant industrial or tourist activities (Caputerra, Sarrabus, Sassarese, etc), in absence of effective planning, have been either overexploited or ignored. The amount of available and renewable groundwater is estimated around 380 Million m<sup>3</sup> (Regional Register of Geologists, 2005). Groundwater is heavily exploited (111 Mm<sup>3</sup> for domestic use, 76 Mm<sup>3</sup> for industry and 64 Mm<sup>3</sup> for irrigation). About 100,000 wells, a number that rapidly increased during the recent drought emergencies, further exploit about 100 Mm<sup>3</sup>, although this source of exploitation is particularly difficult to estimate (Regional Register of Geologists, 2005).

Overall, a research recently promoted within the new Regional Basin Plan estimates for the whole island a structural water deficit of about 200 to 400 Mm<sup>3</sup> of water. The 32 dams and reservoirs already built do not seem able to guarantee sufficient water availability because of increasing consumption, decreasing rainfalls and infrastructural delays implying significant water losses. This situation predictably tends to generate serious conflicts for water resources among different social and economic sectors.

After dealing with the dramatic water shortages and conflicts experienced between the 1980s and the 2000s, and taking advantage of the considerable resources provided by the European Union (Community Support Framework for “Objective 1” Regions), a form of integrated management of water resources is rapidly being established in the island.

Following a delay of many decades, effective territorial planning has recently been enhanced according to the Italian national requirements (Water Protection Plan, Hydrogeological Plan, Aqueducts Plan, etc). In 2006 the Regional Government created the Regional Basin Authority, establishing for the first time a centralized institutional organization and radically modifying and replacing a traditional and complex pattern of 180 regional and local authorities characterized by confused and often overlapping and conflicting competences in water policy. Considering the substantial infrastructural delays, about half of the public investments planned for the decade 2000-2010 are going to be devoted to water policies ([RAS, 2000](#)).

Since 2005, important changes are deeply modifying water policies in Sardinia through a series of programmes and plans aiming at redefining the operative strategies. In spite of the controversial results already observed during the past decades, the largest portion of the investments is still going to be devoted to further supply increase, although demand reduction is not a secondary objective.

An agreement between the Regional and the National Governments, for the decade 2000-2010, aims at reducing losses in water pipe systems in both rural and urban areas and at catching a higher percentage of natural runoff waters, estimated at 700 Mm<sup>3</sup>, to be added to the existing capacity of 1,200 Mm<sup>3</sup> of water through the construction of new dams and reservoirs. These projects, financed through public investments estimated at 1,875 Million € are expected to cancel the water deficit by 2010. The Community Support Framework of the European Union, moreover, added 1,644 M€ for the years 2000-2006, to be managed by the Regional Basin Authority.

Generally speaking, sustainable water management ultimately depends on:

- the capacity to forecast the changing relations between resources and demands in medium/long terms, considering climate variations, changing demand trends and structural characteristics (reservoir capacity, losses in distribution pipes, etc);

- price, as a tool expected to regulate the market according to quality and efficiency goals.

As for the Sardinian case, some specific policies seem to be able to provide at least partial solution to the structural unbalance between water demand and consumption in the island (Silvano et al., 2003; Sistu, 2004):

- definition of a viable pricing system in order to ensure cost recovery and to promote efficiency;

- creation of an effective monitoring system in order to detect consumption and losses;

- investments on the efficiency of water transportation and stocks;

- co-ordinated and controlled use of groundwater resources;

- promotion of water recycle and reuse;

- transfers between different geoclimatic areas;

- educational campaigns to promote correct and sustainable use of water.

Further and indefinite increases in water supply, albeit popular measures in the short term, are clearly not able to provide a definitive solution to the water shortage problems that occurred during the past decades and that are expected to worsen in the future. It is thus necessary to ensure a significant and permanent contraction of water demand, particularly in the agricultural and domestic sectors, and pricing policies can obviously play a major role. Defining an equitable price for water, though, is not an easy task. The price of water in Sardinia is close to the Italian average but significantly lower than in other European regions. However, the information provided by the price does not actually show the level of effective environmental, social and economic sustainability of water policies. The prices of water in Sardinia are fixed annually by the Regional Water Authority and currently range from 0.02 to 0.60 €/m<sup>3</sup> in the agricultural sector (minimum for small consumers and maximum for large consumers), from 1.09 to 1.96 €/m<sup>3</sup> in the industrial and tourist sectors and from 0.13 to 1.96 €/m<sup>3</sup> in the domestic sector, showing a steady tendency towards further increases, balanced by gradual improvements in the quality of water and services.

The increase in the efficiency of the whole system appears to be the first step towards sustainable water use. The creation of one single Basin Authority for the whole island and the foundation of one single management authority, named "Abbanoa" ("New Water" in Sardinian language), have introduced fundamental elements of innovation that are likely to produce significant impacts, curbing and ultimately reducing the unsustainable gap between increasing water consumption and decreasing available resources that originated during the 20<sup>th</sup> century.

### **Conclusion. New trends in water pricing (Andrea Corsale)**

The price of water is increasing, sometimes dramatically, throughout the world. Yet consumers rarely pay the actual cost of water. The price people pay for water is largely determined by three factors: the cost of transport from its source to the user, total demand for the water and price subsidies. Treatment to remove contaminants can also add to the cost. The essential factor affecting water prices for the population is the amount of public subsidies. Water subsidies can be very large. On average worldwide, nearly 40% of municipal suppliers do not charge enough for water to meet their basic operation and maintenance costs.

Water is currently managed as if it were worthless instead of the life-sustaining, valuable, and increasingly scarce resource that it is. A key step in moving toward more rational water management is to place a price on water that reflects its value and scarcity. This can, of course, result in substantial price increases that particularly hurt low-income families. The best way to avoid this problem is to use a block rate pricing system where a low level of consumption, required to satisfy basic needs, is very cheap, while prices increase at higher levels of consumption.

Although pricing water at a reasonable cost can generate political problems in the short run, it can lead to substantial efficiencies in the longer run and eliminate a perverse drain on government budgets. Higher prices are likely to lead farmers, industries and tourist operators to use water more efficiently and to encourage households to buy more water-efficient appliances and reduce the amount of water they waste. Social equity, economic efficiency and environmental protection depend on how

carefully water resources are going to be managed in the next decades, in order to ensure the sustainable use of such a scarce and precious resource.

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