

## The “Water-tamers” and the Construction of the Hydraulic Society in Mendoza, Argentina

### Author

Elma MONTAÑA

### Affiliation

National Scientific and Technical Research Council (CONICET, Argentina) researcher at the Human, Social and Environmental Research Institute (INCIHUSA)-CCT Mendoza. Full Professor at National University of Cuyo, Mendoza, Argentina. Address: CCT-Mendoza (CRICYT), Ruiz Leal s/n, (5500) Mendoza, Argentina  
[emontana@mendoza-conicet.gob.ar](mailto:emontana@mendoza-conicet.gob.ar)

### Abstract

As other South American dry-lands, Mendoza Province, in central-western Argentina, develops in two opposed landscapes: On the one hand, green oases with neat rows of grapevines, tree-bordered roads and streets, and irrigation channels and drains. On the other, non-irrigated lands (“desert”) are a “no-man's land” and subordinate spaces perceived as being empty and void of interest. This scene developed in the context of a “modern” society-nature relationship paradigm that nurtured public policies oriented to “order” first and then to “progress”. This work aims at giving evidence of the significant role played by the Mendocinean water bureaucracy in shaping this *hydraulic society*, in building its contrastive territory and in explaining a good deal of the deep social and spatial inequities. For doing so, it explains the current territorial configuration of Mendoza as a result of social powers unfolded over time on water use and administration. In the context of this historical process, the work highlights the clash between engineering and environmental world views, issues about water mercantilism to later explore the symbolic mechanisms that legitimate the power of this water bureaucracy. The conclusions reflect upon the future of this water governance system, its possibilities for a transition towards equity and the challenges to be faced for adaptation to water shortening climate change scenarios.

### Keywords

Power; Space-society relationships; Nature-culture paradigm

# The “Water-tamers” and the Construction of the Hydraulic Society in Mendoza, Argentina

## Introduction

Lying on the eastern side of the Central Andes, the Province of Mendoza is situated on the “South American arid diagonal”. With an average rainfall of only 200 mm per year, human settlements are only possible in the areas in which the systematic use of water from the rivers descending from the cordillera make irrigation possible.

In these dry lands, over five centuries of human labor have given rise to artificial irrigated oases. They follow the same pattern from north to south along the central Andes, developing in the interface areas between the foothills and the plains. Here, the oases resemble green islands in a vast arid ocean.

In Mendoza, for example, the oases occupy only 3 % of its surface. Although this is a very small area, it hosts 98.5 % of the province's population and concentrates most of the market activities, among which, the emblematic grape growing and wine making stands out. A web of medium and small sized towns spreads over this rural area which is intensely exploited.

Like other “appropriate spaces”, these dry land territories not only are the physical support for human settlements and their resources for economic activities, but also an active matrix of social relations (Raffestin, 1981 and 1996, and Claval, 1978). From this perspective, territoriality is indissoluble from relations of power (Raffestin, 1981).

But if space is in itself an object of quarrel because of its being -by nature- finite, resource shortage in dry-lands makes these territories an undeniable field of disputes. Social power relationships can be read from the management of limited water and irrigated land. At this point, dry-land territory configuration is deeply tied to water management, and we recognize here a *modern hydraulic society*, in which the social tissue is strongly associated with a comprehensive and intensive water resource manipulation within an order imposed for controlling a hostile environment (Worster, 1985). As power distributions are associated to water management, water would have the capacity to express -and also model- hegemonic and subordinate social relations of a hierarchical system. The state, the private sector and the communitarian actors of public-private irrigation put in place water policies while they construct spaces and societies by the same process.

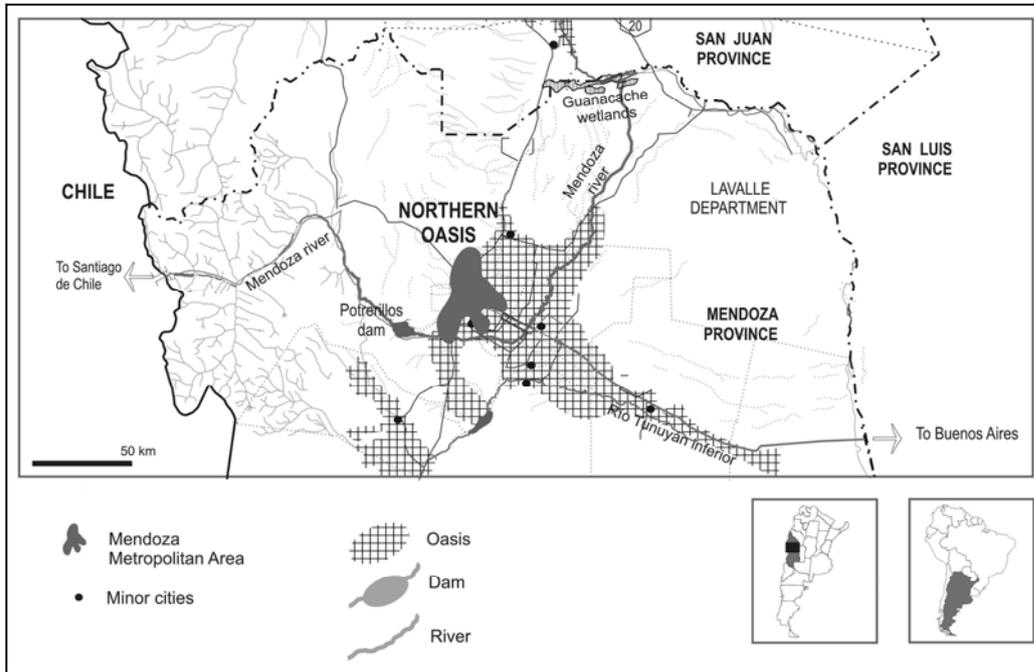
This work aims at giving evidence of the actor interplay in this process and the significant role played by the Mendocinean water bureaucracy in shaping this *hydraulic society*, in building its contrastive territory and in explaining a good deal of the deep social and spatial inequities. Doing so, it explains the current territorial configuration of Mendoza as a result of social powers unfolded over time on water use and administration. In the context of this historical process, the work highlights the clash between engineering and environmental world views and issues about water mercantilism to later explore the symbolic mechanisms that legitimate the power of this water bureaucracy. The conclusions reflect upon the future of this water governance system, its possibilities for a transition towards equity and the challenges to be faced for adaptation to water shortening climate change scenarios.

## The conquest of the desert

Built in the encounter of history with geography (Scheibling, 1994), the territory of Mendoza is the product of society-nature interaction processes where the central factor is, undoubtedly, the management of its scarce water resources. Strongly contrasting desert and oasis constitute, paradoxically the fruit of the same logic that, while concentrating resources, population and power in a small portion of its territory –the irrigated oases– does so at the expense of the minority groups' exploitation and resource exhaustion in the not-irrigated spaces, this being the case of the Northern Oasis in Mendoza.

The Northern Oasis (figure N° 1) was developed on lands where the indigenous Huarpes had already carried out a rudimentary systematized use of the Mendoza river waters. Although the first encounter with the Spaniards (in the year 1551) had been peaceful, this was soon followed by a process of native labor force export to Chile (Prieto et al, 2004) as well as an expansionist movement over the irrigated foothills, previously occupied by the same indigenous Huarpes (Prieto and Abraham, 1994). Land concessions began on the foothills near the Mendoza river and slowly pushed the native inhabitants toward the more peripheral zones close to the Guanacache wetlands, in the department of Lavalle, the lowest portion of the River Mendoza basin, where there was a minor Huarpe settlement. At the same time, the Spanish domination gave impulse to land cultivation of cereals and fodder; the aim was the fattening of cattle for live export to Chile; and, secondly, to produce alcohols and wine, all of this with the help of irrigation. By the end of the 17 century and by the last decades of the 18 century, a grazing cattle export circuit was set up; with it followed the economic and political social ascension of a network of interrelated families originating a local oligarchy of “cattle lords” (Prieto et al, 2004).

Figure N° 1: Northern Oasis of Mendoza



A large part of this founding nucleus of the Northern Oasis is known through documents dealing with law suits sustained during the 18 century by neighbors over the usufruct of irrigation channels and water rights (Ponte, 2006). The indigenous Huarpes did not take part in these disputes, since they were shifted to the more distant zones of the river basin and far from Spanish interests. The “neighbors” were only some Spaniards landowners who had had land and Indians granted by the Spanish Crown. They enjoyed full water rights and the use of irrigated lands.

Already during the period of independence (in the year 1816) the local ruling class was formed by clans united by economic interests who kept power in their own hands and a place of hegemony over half-breeds and Huarpes.

Favored by external and internal conditions, by 1860 Argentina entered into what was known as the “exporting primary economy”. Thus taking part in the international economic flow due to the offer of its cereal growing and cattle breeding agricultural production (Ferrer, 1986). This international division of labor took place in the whole national sphere. In consideration of the great competitor, the humid Pampas region, Mendoza slowed down its cattle production while the local ruling class and the governing authorities decided on the second restructuring of its economy: the production of low quality wines on a grand scale to supply the growing domestic Argentinean market.

This was carried out within a political framework for stimulating immigration, associated with the expansion of national and provincial economies. The European migratory flows that arrived in Mendoza by the end of the 19 and beginnings of the 20 century came from European countries with a grape growing and wine producing tradition. These immigrants found themselves involved in an ascending social mobility process which facilitated land owning (Salvatore, 1986) and forming of strategic alliances with old families of the oligarchy. Political coalitions and marriages allowed an elite to sum social and economic capital (Bragoni, 1999).

Within this framework and that of the “campaign to the desert” (a national organization policy that sent armed forces to gain territory over the spaces controlled by native Indians), the government of Mendoza materialized its own “conquest of the desert” by extending its irrigation network. The construction of new irrigation works, not by private initiative but by the state's direct action, precipitated the need to establish a law that would normalize the rights and obligations of the beneficiaries, the irrigation works and the functioning of a water administration entity. Therefore, in 1884 a Water Law was promulgated which set the foundation for the conception of water as being a public property. It also gave irrigation rights to a group of landowners, leaving the original Huarpes, the majority of which were living in the desert and the wetlands along the furthest portion of the river basin, without any right to legal claim. After several re-organizations, the provincial Constitution of 1894 decided that the General Irrigation Department (DGI) should be the entity charged with the administration of water use. A year later, this entity broke away from the Ministry of Public Works and began its escalation of growing power and political autonomy in the provincial sphere.

The local oligarchy and the provincial state -strongly interrelated in the productive restructuring towards vitiviniculture and the necessary water network widening-, together with immigrant arrivals at the beginning of

the 20 century,- played the central roles in what became the “traditional viticulture model”. It took nearly a century of territory construction to expand the agrarian border in favor of the vine growing culture, providing new spaces for the agrarian activity of the latest European immigrants.

While the foothill oases irrigated by the Mendoza river expanded upstream, the desert of Lavalle, downstream of the river basin (where the surviving Huarpes had taken shelter) was being plundered of its natural resources: *algarrobo* trees were being cut down to provide vine props and the volume of river water lowering due to intensive use upstream. Over a hundred years later, the growth of the urban oasis in the foothills continues to expand and the regulation of the Mendoza river has definitely sealed any opportunity for production and growth. The operation of the *Potrerillos* dam, built in 2002, neither contemplates the water needs of the descendants of the original settlers still living there, nor the minimum flows necessary to keep up the ecosystem basic services.

Similar to other dry lands of the Argentinean West, Mendoza is the “Kingdom of Oases”. There it is that the most dynamic activities of the regional economy take place and exert their influence. Seen from the oases, the non-irrigated lands appear like “empty” spaces, “uninhabited” and “unproductive”, becoming virtual invisible. Totally absent from the social representations of the Mendoza inhabitants, they are not part of their identity and, therefore, are not considered a priority to most of the local society. (Montaña et al, 2005).

Except for some extractive activities (principally oil extraction) which are carried out far from human settlements, in the non-irrigated areas there is only a scarce dispersed population dedicated to activities of survival and affected by desertification processes.

The oldest problem might bring about the most innovating challenge: to develop and put in place political, institutional and technical mechanisms that may effectively allow a more equitable water administration. However, as will be seen further on, the existing social forces are closely related to a water bureaucracy in which not all the participants are equally represented.

### **The engineered management and the environmental view**

Mendoza has the greatest number of experiences and developments of all Argentinean provinces in water management. Even if, as has been shown, water management goes back a long time, the late 19 century appears particularly significant in consolidating this tradition and defining its administration and water management style.

After the period of organization as a nation during the second half of the XIX century Argentina overcomes its Hispanic-Creole past by a process of modernization similar to those that broke out in Latin America due to independence movements and in the consolidation of national states, contributing to replace the culture linked to colonial cultures for another modern culture based on reason and on positivism. Once “order” obtained with pacification and unification of the country, it was time for “progress” to be aimed at. In this context, scientific-technical knowledge and liberal professions acquired a very important mediator role in the conversion of necessities into works and in the relationship between economic forces, civilians and the leading sectors of society (Cirvini, 2004)

In mid geopolitical project of oases expansion, the province of Mendoza (its government and leading social class) trusted its most strategic mandates to Argentinean, and also foreign, civil and hydraulic engineers especially hired for that purpose. It meant “conquering the desert” by applying powerful technical knowledge of specialists who linked “knowing” to “doing”.

The case model is that of the Italian hydraulic engineer César Cipoletti who was hired by the provincial government to carry out irrigation works needed for the extension of the Northern Oasis water network (Figure N° 2). From then on Cipoletti is venerated in Mendoza's history and named “the Water Tamer” and the engineering tradition in water management has grown very strong, giving rise to a technocratic approach to rural development. The idea of infrastructure determines a variety of diagnoses about biophysical and socioeconomic situations. In this context, efficiency is a recurrent theme and problems and solutions tend to be seen in terms of finished works or of those being made. On the institutional level, the achievements of the Irrigation General Department (DGI) are measured according to the number and extension of the finished hydraulic works.

Figure N° 2:  
Engineer Cipoletti statue and tomb, by the Mendoza river



“Engineer César Cipoletti.  
Visionary and forerunner of Mendoza’s nobility”

In order to understand the institutional arrangements associated with the water power in Mendoza, it is necessary to mention that the DGI enjoys a position of great autonomy in the provincial government. It owns its own seat outside the Government House and even outside the Civic Center neighborhood, seat of most of government buildings. The maximum authority is proposed by the governor of the province and can only take office after being voted in by the legislature, where he is the object of intense negotiations with the different political lobbies. So that the title of “Superintendente” of this entity is a symbolical landmark in any politician's career. The staff of the DGI highlights the preeminence of engineers: agricultural engineers, civil engineers, construction engineers, and hydraulic engineers.

In the late 1980's the environmental paradigm bursts into this traditional scene. The Ministry of the Environment and Public Works (MAyOP) is created in 1989, along the line of a sustainable development and inspired by the mandates of the Bruntland Report. These refer mainly to the elaboration and implementation of a environmental policy destined to create conditions of prevention, protection and preservation of nature and the human habitat, as well as the use of natural resources and a defense against natural disasters and accidents. Conceived at first with a certain amount of independence as Environment and Housing Ministry, it was later pigeonholed within the dominant structure of the Environment and Public Works Ministry. Recently it has been lowered to the rank of Undersecretariat. This agency has no direct authority in matters of water; rather it coordinates the management between the DGI, the Provincial Electricity Regulating Entity (EPRE), the Provincial Water and Sanitation Entity (EPAS) that regulates running water and the local governments (*municipalities*). The objective of this Ministry is no longer to “conquer the desert” but to “fight against desertification”.

From this moment on, there exists permanent strain between both entities: the DGI is supported by a long tradition in water administration, occupied with the hydro system's planning and operation, with special emphasis on the agricultural irrigation, approaching the subject from the angle of resources and sectors. On the other hand, the MAyOP functions are inspired by all the good wishes of the sustainable development. Although it disposes of sound legal tools to carry out its functions, the DGI exerts the powers that it has accumulated over a hundred years of water administration and asserts (as we will show further on) a regional identity of hegemony built upon the heroic epic of Mendoza's inhabitants who have learned how to tame water, conquer the desert, and bend a nature perceived as hostile (Montaña, 2005). The sustainable paradigm has not imposed itself yet over the prestige of the “water tamers”, and when it does it is due to a rationality that proclaims that if something has gone wrong this is because the people (engineers) have not been in full control. As Norgaard (1994) writes: “We have become so effective at dividing and conquering, that problems that can be treated in this manner are no longer problems”. This is when more data, more studies, more science and more technology could result in betraying sustainability.

The territorial effects of this situation are evident in the case of the regulation of the Mendoza river. The first antecedents go back to the reports and projects of Engineer Fuchs in 1909. These were followed by a

number of alternatives, proposals, projects and even tenders which were never put into action but which showed the damming-dike as the great work expected by Mendoza's entire society. The dam building was a commonly agreed point figuring in all the political platforms of candidates campaigning for governor in the decade of the '90s. Everyone wished to attribute to himself the construction of this century old project. The idea underlying was that works –especially hydraulic works- implied “progress” and benefits for all the inhabitants. By using, in a great measure, funds obtained by the privatization of state owned companies, the Potrerillos dam was finally built and made operational in 2002.

The damming-dike compensates the spring and end of summer irrigation deficit peaks, but represents a harder technological alternative against the previous non-regulated flow. It is at this point that unclear costs appear in the option taken. For instance, the necessity of lining the channels to avoid the negative impact of “clear waters effect” that manifests itself in greater water losses along the distribution network, with the ensuing loss of efficiency. Accounts are not clear as to who must pay for waterproofing the distribution network, the State or the irrigation users. The benefits of regulation are also not so evident for the small producers who cannot reconvert their watering systems from the traditional one to dripping, aspersion or micro aspersion to avoid clear water irrigation cause the losing of soil fine materials. Mendoza's agriculture is mainly made up of small producers who are unable to face a globalized economy and are placed in a precarious position. Reconversion is impossible for them without subsidies. On the other hand, the initial accounts of the project did not consider these works deeming them “complementary”. Finally, the dam favors the use of greater volumes of water in the oasis, thus definitely extinguishing the downstream flows in the desert of Lavalle. The desert dwellers do not figure in the list of casualties: they had been already dispossessed of water and of the right to complain a long time ago.

The great political temptation presented by the building of the *Potrerillos* dam minimized the need to insure the volume of ecological flow that would maintain basic ecosystem functions in the wetlands, classified as RAMSAR sites. The process of environmental impact evaluation developed by the Ministry of the Environment was unable to impose itself over the technocratic ideas of progress nor over the clientelistic practices operated during the project's process and tender, of which latter neither the DGI nor the MAYOP were ignorant.

### **The merchandizing of the resource: inherence of water and land vs water marketing**

Water resources regimes are different on either side of the Andes Cordillera. In Chile –and within the framework of macro-economical policies since 1973– water resources constitute a negotiable ware in private hands. This is because the *Código de Aguas* (Water Code) of 1981 allows the possibility of a private system of rights legalized in a water market in which water is separate from land and left in the hands of the best bidder. Some economists consider this market as efficient and successful (Briscoe, 1996; Briscoe et al., 1998; Cristi et al., 2000; Gazmuri and Rosegrant, 1994; Hearne and Easter, 1995; Ríos and Quiroz, 1995; Romano and Leporati, 2001) although others recognize that the high efficiency of this market does not alleviate the rural poor (ECLAT, 1995; Dourojeanni and Jouravlev, 2001) and this has generated speculation (Garduño; 2003) or been criticized due to attention drawn to the efficiency of the market and ignoring social dimensions in the discussion (Bauer, 1997 and 2005).

On the Argentine side, the macro-economical reforms of the '90s were not able to alter the conditions of water resources being considered of public domain and also being “inherent to the land”. Under this regime, the property of both can not be dissociated; in order to accede to the water one must buy land with the water rights. The “registered” hectares (possessing water rights) cannot lose those rights, unless the owner renounces them; in which case the water returns to a common fund to be distributed by the holders of rights. The land is not a subject of rights, whoever detains this right is not the land itself but its owner. The latter may not cede them to another person. He may renounce his rights (e.g. when land is bought for urban purposes) but he does so in favor of the group and cannot be ceded to a third person. On the other hand, legislation points out that rights may lapse through lack of payment, contamination or other reiterated causes, duly verified, always in favor of the system. Contrary to the water market, the inherency regime makes it difficult to take measures to increase the efficiency of the water use since each plot of land receives a volume of water according to its surface, with no reference to the crop or even if it is not cultivated. In spite of this, the local water bureaucracy refuses to change the regime. Several arguments explain that water is cataloged as being of public domain, that the system is aimed at benefiting the general public (in a universe defined by water-rights owners) and that the distribution system intends to provide an equal supply of water to all the users. Although these are legitimate arguments against the merchandizing of water, it is also true that the water bureaucracy is not disposed to discuss anything that may menace the status quo.

Although no market of water in Mendoza exists, it can be acquired by buying land or, exceptionally when the water-rights owner does not use the water, the administration can favor a powerful agent and allow the latter to use “borrowed” water.

However, the most important exception to this superficial water regulation is observed in the access to groundwater. Its use answers to a scheme that favors access to agents with greater economic power who

are the ones able to face the costs of perforation and pumping. As will be shown later, the big players of the *new vitiviniculture* of the 90's are able to expand the agricultural border over the foothills by using underground water, while the old traditional farmers located downstream should resign themselves to a complicated water governance system for accessing to more scarce and contaminated surface water. All the forecasts made viewing it as a public and shared resource fade against the exploitation of aquiferous reserves that greatly depends on the individual decisions of the more powerful private investors. The pressure of economic power is evident here bending the water bureaucracy in its favor.

### **Modernization: decentralization of the irrigation system for the users**

The economic reforms of Argentina's economy that began in the last decade of the '80s made their impact on the provincial state. In the vitiviniculture sphere, for example, the state ceded its entrepreneurial role in favor of a cooperative model. Social housing was decentralized in favor of the municipalities, for instance. In the case of water, these policies did not produce basic changes in its legal status nor in its administration. However, they materialized in the so called "decentralization process" which tried to strengthen the users' organizations. In the case of water, the decentralization policy did nothing more than what the Law of Waters of 1884 decreed, inspired by the political liberal principles of the epoch.

The aim of this decentralization policy was that the DGI might keep and strengthen its roles of formulating and implementing water policies and control developing activities in all the basins, while the users take greater responsibilities in the operative phases of the irrigation system. The users are now organized in communities known as "Inspections" and these are also grouped in "Associations" which –on a larger scale– offer legal and other services to the inspections.

It is worth pointing out the legal nature of the Inspections as public, non state, autonomous and autarkical organs with a capacity to act in a public and private legal extent. They elaborate their budgets according to their revenues and elect their authorities by vote chosen by the nominal rights holders of the river-bed area in question. The members are usually private agricultural users linked through the management of a public resource under the aegis of the state. Actually the borders within the DGI and the Inspections responsibilities and activities are not clearly defined, but the organization is shown as an example on how the public and the private sectors can articulate with the result of a close-to-the-soil administration.

Thus, from a higher ranking position, the DGI formulates and executes the provincial water policies and decentralizes operations in these users' communities. On the other hand, the MAyOP, not without certain ambiguities in jurisdictions and obligations, has no direct responsibility on the water resources although it must care for the preservation of the resource in the best conditions to ensure its sustainability.

Apart from the miss-encounters between the DGI and the MAyOP, the lack of articulation of water policies with the municipalities is notorious. The decentralization of the DGI was made within the users and there are no institutional channels by which the water policies can be conciliated with the local government's development objectives. This is a problem in a territory that depends on water availability for urban developments, industry and agriculture. The municipalities are also the ones to give impulse to local development projects (for themselves or as decentralized agents of provincial state social policies) and the ones receiving demands from the poorest groups of the community. But the DGI is not well disposed towards sharing its powers. The DGI is responsible for water management plans, and the local governments are responsible for the use of the soil, and both spheres are disconnected. Therefore, the powers of the water bureaucracy leave out not only the desert inhabitants but also those of the oasis.

### **Water value and marketing within the framework of the globalized economy**

Over the miss-encounters in the state triangle, DGI – MAyOP - local governments, there are private agents operating, among which can be found the powerful foreign agents of the new viticulture.

The opening of Argentine economy in the '90s brought foreign capital to Mendoza (France, Italy and Chile among others). These practiced a new viticulture intensively turned to export, a great contrast to the traditional viticulture carried out by the small traditional producers. Within the frame of a relatively permissive regulation of groundwater exploitation, technologies of modern irrigation plus large economic resources have allowed these capitals to expand the agricultural frontiers over the foothills upstream of the basins; contrary to the older zones where cultivators have to make do with increasingly contaminated and salinized surface water. There are, of course, cases of producers who use superficial water but also dispose of perforation that gives them access to subterranean water to help them during periods of scarce superficial water.

Two contrasting situations of irrigation can now be appreciated. On the one hand, the small and medium producers in the traditional zones of the oasis joined in irrigators associations in which the members are "organized democratically" under the aegis of the state and enjoy irrigation turns in the use of superficial water, always scarce. On the other hand, the capitals of the new export viticulture whose high incomes allow them pumping costs –even from important depths– thus escaping from the complexities of the "community" system. For them irrigation is only a question of lighting the water-pumps.

The consequences of this situation affect the whole territory. The expansion of the agricultural frontier on the foothills is detrimental to agronomic-ecological conditions in lands downstream (Chambuleyron, 2002) that - never of the best- tend to be abandoned. From a social angle, this degradation affects the small producers downstream, harassed by economical difficulties and low income they become vulnerable to expulsion from the circuit and their lands liable to be ceded to urbanization or simply abandoned. It is a desertification process, this time not in the desert space downstream the oasis but within the oasis itself. "Recovering land from the desert" upstream (or losing it, according to the point of view) while desertifying downstream is a kind of moving of the oasis upstream and making a "mining use of space" (Montaña, 2008a).

Additionally, there is an old process of urban sprawl over the rural oasis that is reaching critical levels of water and soil consumption. With water resources that do not augment, the magnitude of the oasis development -particularly in the Northern Oasis with its huge Metropolitan Area- strongly competes with agricultural uses in water and irrigated soil consumption. This situation tends to aggravate, considering climate change scenarios that anticipate a 7 to 13 % lowering of the Mendoza river's volume for the years 2020 to 2030 (Boninsegna and Villalba, 2008).

As with other oases, there is a tendency toward a greater residential, industrial and recreational consumption of water that goes against the agricultural sector. The economic valuation of irrigated lands by urban development places agricultural uses at a disadvantage, once more affecting the small and middle producers in the periphery, whose incomes can in no way compete with the suburban real estate valuation. Besides, Mendoza's legislation -among others in the Latin America Southern Cone- that was made in epochs of great agricultural development and of relatively low urban development is not adapted to the new challenges facing changes in the use and, with it, to new disputes over water.

This conflict is made more complex by the presence of private running-water service operators that appeared during the privatization process of the '90s. These have received part of the concessions of water-rights which were previously state managed and have taken the state place in the corresponding Inspections. This changes the qualitative composition of these Inspections. Running-water now has a market value and negotiations over water-rights have become more complicated. The scenario shows greater complexity and more conflicts among the rights holders, due to higher consumption, with volumes that do not augment and will even diminish in climate change future scenarios.

Finally, industrial uses have also continued to develop. There are Inspections in which industrial agents (especially agro-industry) intervene as drainers. The challenge in this case is how to maintain an industrial development without compromising the quality of the surface and groundwater resources, especially since the agricultural uses, the residential and the industrial coincide over the same peripheral spaces of the oasis.

### **The invisible forces of the water bureaucracy**

Why are these situations of social and spatial inequality and unsustainable conditions resulting from public policies not reverted or at least denounced? What can explain that this "water club" continues its self-oriented operation within a national and provincial administration that claims to be politically oriented in support of the more disadvantaged groups?

The fact is that, in the context of this hydraulic society, the water bureaucracy has a card up its sleeve: an ideological apparatus that supports it against all odds or complaints. It is about an identity built in the encounter of history with geography, whose main theme is water: nature control and water taming. The main epic on which Mendoza's regional identity is built around is the shaping of its territory, a process in which water played, and still does, a major role. Its principal achievement was the collective effort of "vanquishing the desert" and of establishing a vine-growing and wine-making culture by creating an irrigated oasis. Its main protagonists - near heroes - were the "water tamers" and the "tenacious farm-laborers", as they are publicly recognized in the press.

This official identity, so well represented by the water engineers and the descendants of 19 and 20 century immigrants possessing water rights, denies or silences other social representations, like the one of the recent immigrants from neighboring countries, mainly Bolivians, who work hard in the same vine-yards - generally not as land owners- and whose efforts are not glorified and even not mentioned. It is also the case of the native Huarpes turned invisible. None of them are as white, European or "civilized" as the water tamers. As on a material plane, the symbolic values around water have been appropriated by the Mendocinean water bureaucracy to legitimize its supremacy (Montaña, 2006 and 2007).

## Conclusions

Analysing these processes and water conflicts for Mendoza's case has shown not only how dependent dry land societies are on water resources, but –most significantly- the importance that the ways of controlling and manipulating water have in shaping its social tissue and in consolidating their powers.

It has thus been possible to appreciate in what way hegemonic powers have shaped a water bureaucracy that commands not only the appropriation and use of both the resource and the territory but the all the relationships linking social forces.

It is clear that a good part of the water bureaucracy's powers have their origin in a modernistic paradigm based on the faith in man's progress and labor and in technology as a means to attain it. Institutional arrangements have also had a bearing by sustaining this water bureaucracy to retain its powers while showing itself democratic and oriented toward the satisfaction of all demands. In a deeper and more subtle way under cover of official identity, the symbolic mechanisms to legitimize and perpetuate the water bureaucracy's powers have been disclosed.

These processes have resulted in situations of ecological unsustainability and inequality expressed in latent and manifest conflicts. The socio-natural system is threatened by population growth, economic activities and an increasing complexity. The social system –already suffering from globalization forces– tend to widen the breach of inequality. It is imperious to develop a system for getting close to equity and sustainability objectives. However, every transition toward sustainability is threatened by such asymmetrical powers that the results of any process of negotiation are compromised.

If to this panorama we add the scenario of climatic change that will diminish the river's volume of water and increase social conflicts, we are seriously worried about the challenges that this society will have to address in order to adapt to an increased water stress (Montaña, 2008a, 2009a and 2009b). As in the case of equity and sustainability objectives, the main adaptation challenges seem to be not only in a growing population on a fixed or reduced amount of water resources or in technical issues of water management, but specially in the possibilities of untying the knots of this water bureaucracy, deeply operating on the way in which the hydraulic society is structured and ruled.

## References

- Bauer, C.J. 1997. Bringing water markets down to earth: The political economy of water rights in Chile, 1976-1995. *World Development* 25 (5): 639-656.
- Bauer, C.J. 2005. In the image of the market: the Chilean model of water resources management. *International Journal of Water (IJW)*, Vol. 3, No 2.
- Boninsegna, J. and Villalba R. 2007. La oferta hídrica en los oasis de Mendoza y San Juan. Los escenarios de cambio climático y el impacto en los caudales". In: *Jornadas de Investigación en Recursos Hídricos*, CELA / ICA-UNCu / INTA / IANIGLA, Mendoza, 27 de septiembre de 2007. <http://www.imd.uncu.edu.ar/contenido/index.php?tid=53>
- Bragoni, B. 1999. *Los hijos de la revolución. Familia, negocios y poder en Mendoza en el siglo XIX*. Buenos Aires: Taurus.
- Briscoe, J., 1996. Water as an Economic Good: The idea and what it means in practice. Paper presented at the *World Congress of the International Commission on Irrigation and Drainage*. Cairo.
- Briscoe, J., Anguita, P. and Pefia, H. 1998. Managing Water as an Economic Resource: Reflection on the Chilean Experience. Toward Environmentally and Socially Sustainable Development, *Environmental Economics Series*. Paper No. 62. The World Bank.
- Chambuleyron, J. (Ed) 2002. *Conflictos ambientales en tierras regadías. Evaluación de impactos en la cuenca del río Tunuyán, Mendoza, Argentina*. Mendoza, Argentina: Nacional University of Cuyo.
- Cirvini, S. 2004. *Nosotros los arquitectos. Campo disciplinario y profesión en la Argentina moderna*. Mendoza: Zeta.
- Claval, P. 1978. *Espace et pouvoir*. Paris: PUF.
- Cristi, O.; De Azevedo, L.G.T.; Baltar, A. and Vicuña, S. 2000. *Markets for Water used for Irrigation: an application to the Paloma System of the Limarí Water Basin, Chile*. Draft version prepared for the World Bank Training Seminar on Water Rights, March 27-28.
- Dourojeanni, A. and Jouravlev, A. 2001. Governance crisis in water management. *Natural Resources and Infrastructure Series*, No. 35, LC/L.1660-P. Economic Commission for Latin America and the Caribbean (ECLAC) Economic Commission for Latin America and the Caribbean (ECLAC), 1995. *Water Rights market: legal framework*. LC/R.1485.
- Ferrer, A. 1986 (16ª ed). *La economía argentina*. Buenos Aires: FCE.
- Garduño, H. 2003. *Administración de derechos de agua. Experiencias, asuntos relevantes y experiencias*. Estudio legislativo. Roma: FAO.
- Gazmuri, R. 1992. Chile's Market-oriented Water Policy: Institutional Aspects and Achievements". In Le Moigne, G.; Easter K.W.; Ochs, W.J. and Giltner, S. (Eds), *Water Policy and Water Markets*. Selected Papers and Proceedings from the World Bank's Ninth Annual Irrigation and Drainage Seminar, Annapolis, Maryland.
- Gazmuri, R. and Rosegrant, M. 1994. Chilean Water Policy: The Role of Water rights, Institutions, and Markets. Paper prepared for the *Irrigation Support Project of Asia and the Near East (ISPAN)*, International Food Policy Research Institute, Washington, DC.
- Hearne, R.R. and Easter, K.W. 1995. *Water Allocation and Water Markets in Chile: An Analysis of Gains-from-trade in Chile*. World Bank Technical Paper N° 315.
- Los Andes newspaper. 1988. "El labriego tesonero". Mendoza, 5/30/88.
- Mathus Escorihuela, M. (Ed). 2006. *Derecho ambiental y de los recursos naturales. Mendoza, Argentina*: Author's edition.
- Montaña et al. 2005. Los espacios invisibles. Subordinación, marginalidad y exclusión de los territorios no irrigados en las tierras secas de Mendoza, Argentina. *Región y Sociedad*, (32) 3-32, Sonora, México.

- Montaña, E. 2006. Mendoza, The city-forest. Social identity and urban landscape on the dry lands of Argentina". In: Nail, S (Ed), *Urban Forests in Latin America. Uses, functions, representations*, pp. 56-78. Bogotá: Universidad Externado de Colombia.
- Montaña, E. 2007. Identidad regional y construcción del territorio en Mendoza, Argentina: memorias y olvidos estratégicos. *Bulletin de l'Institut Français d'Etudes Andines*, 36 (2): 277:297. Lima: IFEA.
- Montaña, E. 2008a. Las disputas territoriales de una sociedad hídrica. Conflictos en torno al agua en Mendoza, Argentina". *Revista Interamericana de Economía Ecológica (Revibec)* Vol. 9, pp. 1-17. Quito: FLACSO.
- Montaña, E. 2008b. Central Andes Foothill Farmers Facing Global Environmental Change. In *IHDP Update*, N° 2, October 2008, pp. 36-40. Bonn: International Human Dimensions Programme on Global Environmental Change.
- Montaña, E. 2009a. La dimensión humana del cambio ambiental global. La vulnerabilidad de las comunidades rurales de Mendoza. In: *Compromiso Ambiental por Mendoza*, N° 1, pp. 58-66. Mendoza, Argentina: Universidad de Congreso.
- Montaña, E. 2009b. Vulnerability, Social Power and Conflicts under Water Scarcity Scenarios in Andean Drylands: Mendoza, Argentina. In: *IHDP Open Meeting 2009 Proceedings*. Bonn: IHDP - United Nations University. Available at [www.openmeeting2009.org](http://www.openmeeting2009.org)
- Norgaard, R. 1994. *Development Betrayed: The End of Progress and a Coevolutionary Revisioning of the Future*. Routledge.
- Ponte, J.R. 2006. *De los caciques del agua a la Mendoza de las acequias. Cinco siglos de historia de acequias, zanjones y molinos*. Mendoza, Argentina: Ediciones Ciudad y Territorio-INCIHUSA-CONICET.
- Prieto M. and Abraham, E. 1994. Proceso de Ocupación del Espacio y Uso de los Recursos en la Vertiente Nororiental de los Andes Centrales Argentino-Chilenos. *Cuadernos Geográficos* 22-23.
- Prieto, M. ; Dussel, P. and Pelagatti, O. 2004. Indios, españoles y mestizos en tiempos de la colonia en Mendoza (siglos XVI, XVII y XVIII). In Roig, A.; Lacoste, P. and Satlari (Eds), *Mendoza a través de su Historia*. Mendoza, Argentina: Caviar Blue.
- Raffestin, C. 1981. Pour une géographie du pouvoir main, D. Réseau et territoires. *Significations croisées*, pp. 5-11. Paris: Éditions de l'Aube.
- Rios, M. and Quiroz, J. 1995. *The Market for Water Rights in Chile: Major Issues*. World Bank Technical Paper No. 285.
- Romano, D. and Leporati, M. 2001. *The Distributive impact of the Water Market in Chile: A Case Study in Limarí Province, 1981-1997*. Unpublished report.
- Salvatore, R.D., 1986. Control de trabajo y discriminación: el sistema de contratistas en Mendoza, 1880-1920. *Desarrollo Económico*, 26(102):229-253.
- Scheibling, J. 1994. Au croisement de l'histoire et de la géographie: le territoire. In: *Qu'est-ce que la Géographie?* Chapitre 7, pp. 141-146. Paris: Hachette.
- Worster, D. 1985. *Rivers of Empire. Water, Aridity and Growth of the American West*. New York: Pantheon Books.