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WATER TRANSFERS BETWEEN AGRICULTURAL AND URBAN USERS IN THE REGION OF VALENCIA (SPAIN). A CASE OF WEAK GOVERNANCE?

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Abstract

This paper analyses recent experiences of water transfers between rural and urban areas in Mediterranean Spain (Valencia Region) to assess the validity and sustainability of these procedures, and their fairness and consistency with the spirit of the current legal water framework. In order to investigate the transfer mechanisms, three case studies were selected. Semi-structured interviews were conducted with urban and agricultural users' representatives, who provided administrative documents regarding water exchanges. Additional information was obtained through two participatory workshops with irrigators. The water transfer cases analyzed in the Valencia Region demonstrate a significant success in practical terms, solving contextual or local water crises, providing flexible mechanisms to adapt to a growing urban demand, or to find temporary agreements during periods of water scarcity. However, the cases also highlight significant problems within the water resources system, such as poor transparency and a governance framework that fails to include a number of affected stakeholders. Furthermore, in these cases the integrity of water resources systems has not been managed, resulting in unequal distribution of burdens and benefits.

Keywords Water exchanges, water rights, inter-basin transfers, irrigation, water supply, water commodification.

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1. Introduction

The expansion of the global urban sprawl is altering the distribution of water rights and the configuration of allocation procedures in different regions throughout the world. Numerous cities implement largescale water transfers, diverting or extracting water from neighboring areas or far regions in order to supply cities through different formulae: bureaucratically, offering compensation or acquiring water rights (Molle and Berkoff, 2006, 2009; Meinzen-Dick and Ringler, 2008). This modifies historical equilibriums between urban and rural areas. Competition for water resources among cities and agricultural areas is expected to grow in subsequent decades due to the increasing urban water demand and climate change (OECD, 2015; Flörke et al, 2018).

Water allocation to meet urban demands has been well analyzed from an economic perspective (Dinar et al. 1997; Civitelli and Gruére, 2017). Transferring water from agriculture to urban, industrial or recreational uses with higher economic value is widely seen as a desirable formula (Dwyer et al, 2005; Ali and Klein, 2014), and some research has highlighted the flexibility (and neutrality) embedded in water markets as a tool to respond effectively to supply crises (Chong and Sunding, 2006), and to eliminate conflict resolution by politics (McIntosh, 2003).

Recently, some authors have advocated for a more holistic approach (Molle and Berkoff, 2006, 2009; Meinzen-Dick and Ringler, 2008) and new perspectives on social science have provided new methodologies to analyze these conflicts. The studies of *policy regionalism* has focused on the institutional and territorial articulation of control over resources (Ward and Jonas, 2004; Scott and Pineda, 2011) to obtain an integrated analysis of the appropriation of rural water (Scott et al. 2007; Celio et al., 2009), whereas research on *political ecology* has highlighted cases in which water re-allocation is perceived as water capture or water grabbing (Swyngedouw, 1997, 2004; Boelens et al., 2016; Hommes and Boelens, 2017) and have raised questions about environmental (Roa-García, 2014) and social justice (Komakech et al, 2012). The impact of these transfers on third-parties (Heaney et al., 2006) or land use changes have been also recently assessed (Díaz-Caravantes and Sánchez-Flores, 2011).

In Spain, competition between urban and rural users has been a source of conflict since the beginning of the 20th century. Between 1926 and 1928, irrigators and city rulers clashed in Valencia, and farmers organized massive demonstrations to defend their rights (Sanchis-Ibor and Gómez-Alfaro, 2012). More recently, other cities have undergone political crises during or after drought periods, due to the social complexity of constructing new reservoirs, such as in Sevilla after the 1992-1993 event (Del Moral and Giansante, 2000; Del Moral et al., 2016), or because of the territorial and political difficulty of developing inter-basin transfer projects (Barcelona, during the 2008 and 2017 droughts).

In 1999, the 46/1999 Law allowed the temporary trading of water use rights through two instruments: temporary transfer of rights and centers for exchanging rights (García-Mollá et al., 2019). This legal change was an attempt to introduce more flexibility to the Spanish institutional system of water allocation (Arrojo, 2008), traditionally based on administrative concessions given by the water basin authorities. Both instruments were designed to solve this sort of water conflict among urban and rural users (among other water crises), but have had a very limited use so far. Contracts for ceding rights and water exchange centers have been almost exclusively activated during periods of drought (Ferrer, 2013; Gil and Rico, 2015; Garrido et al., 2012; Palomo-Hierro et al., 2015) mainly because the water legislation establishes that structural scarcity must be managed through a wide array of non-market instruments.

Most experts have positively assessed the implementation of these measures, although many criticize the lack of transparency of these operations and the lack of competition in the markets (Gómez-Limón and Calatrava 2016). Some authors have identified negative impacts on ecosystems (Hernández-Mora and Del Moral, 2015; 2016) and analyzed this experience critically in the context of a general 'marketization' process of water

management in Spain. They have highlighted the necessity of developing a better social, environmental and economic assessment of these exchanges.

In addition to these formal markets, promoted and controlled by the public authorities, water users have frequently reached agreements among themselves to temporarily transfer water with some economic compensation (informal water markets). In other cases, the water authorities have negotiated agreements (non-market arrangements) with agricultural water users to cede water to urban users (De Stefano and Hernandez-Mora, 2016). In some cases, these exchanges have been facilitated by the use of private groundwater. This was possible because before 1985 groundwater was considered private while surface water was a public resource. The Water Law of 1985 changed this legal framework, declaring all water sources to be public, honoring all groundwater rights in effect prior to January 1st, 1986 temporarily or in perpetuity.

This article analyzes recent water transfers and exchanges between rural and urban areas in Mediterranean Spain (Valencia Region), in order to assess the validity and sustainability of these procedures, and their fairness and consistence with the spirit of the current legal water framework.

2. Methods and study area

The Valencia Region has a marked territorial duality. The inner lands are occupied by intensely karstified mountainous areas, which contain important aquifers and are crossed by several rivers, which became regulated during the second half of the 20th century. The coastal areas are alluvial plains with deep, well-structured soils, where irrigation has been successfully developed through an expansive process which started in the Medieval period and achieved a peak two decades ago (around 250.000 ha). Farmers collectively manage irrigation through water users' associations (*irrigators' communities*) and hold generous historical water rights, have only very recently been revised and adjusted by the water basin authority (*Confederación Hidrográfica del Júcar*, CHJ). Water resources systems have been intensively mobilized and exploited, and most of them have reached a basin closure stage and have a structural deficit (CHJ, 2015). Since the 1960s, urban developments, both of high and low density, have occupied the coastal area, and the population has grown exponentially. Tourism and industrial development have altered the traditional structure of water demand in the region, and have changed the land-use pattern. This phenomenon has been particularly extensive in the Marina Baixa district, where 75% of water demand is urban and 25% agricultural, an inversion of the historical pattern of water allocation (Torregrosa, 2009).

In the Marina Baixa, the irrigated area expanded during the 20th century, reaching a peak of 6,200 hectares by 1980. However, in the ultimate decades this area has decreased, and in 2017 there were only 3,471 hectares of crops under irrigation (mainly citrus 45% and loquat 25%), due to farmers retiring, urbanization and increasing market competition. At the same time, the population grew from 47,000 inhabitants in 1950, to 79,709 in 1981 and 185,015 in 2018, due to unprecedented tourism development. During the last four decades, the Marina Baixa district has been the scene of a recurrent exchange of water between urban areas and local water users' associations, based on the availability of grey waters managed by the Marina Baixa Water Consortium (*Consorcio de Aguas de la Marina Baixa*, CAMB). Treated wastewater reuse is 27% in the Valencia Region, but

36% in the Marina Baixa, and currently, in some water users' associations (WUAs) treated wastewater provides 50% of their total water used. These WUAs have also been the destination for water resources sent from the River Júcar Low Valley (Ribera del Xúquer district).

The Ribera del Xúquer is a wide floodplain with 56,000 hectares of irrigated land (55% citrus, 20% rice paddies and 16% khakis) and a dense network of scattered towns and villages (223,000 inhabitants). After the Civil War of 1936-39, the historical irrigation water users' associations of this valley created a common association, the Júcar River Trade Union (Unidad Sindical de Usuarios del Júcar, USUJ) in order to build the Alarcón reservoir. Traditionally, they have depended on river resources, and groundwater has been only used during exceptional drought periods. For this reason, during the last 20 years, groundwater resources have been able to be used for intermittent water exchanges with southern districts through non-market arrangements.

Semi-structured interviews were conducted with urban and agricultural users' representatives (USUJ and CAMB). They provided documentation such as minutes and statistical data on water exchanges, tariffs and agreements. Additionally, other information was obtained through two participatory workshops with irrigators that took place in the Marina Baixa and the Ribera del Xúquer districts in September and May 2018 respectively, which were focused on the exploration on water uses issues within the agricultural sector, to diagnose their problems and needs, and to propose possible solutions. 26 Representatives of different WUAs attended the meeting in Callosa d'En Sarrià (Marina Baixa) and 38 WUAs attended the workshop in Carlet (Ribera del Xúquer).

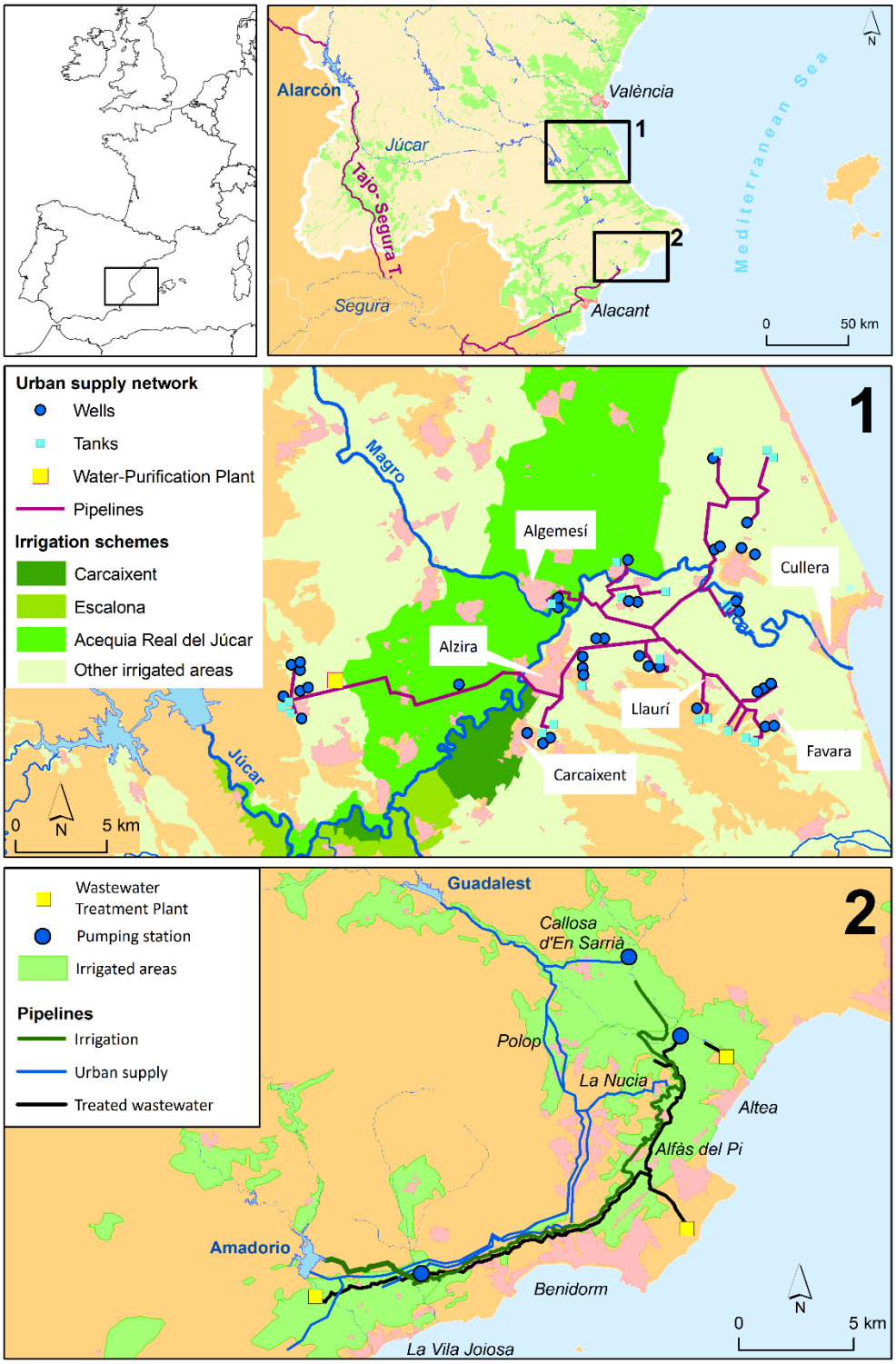

Figure 1. Sketch of the study areas of Ribera del Xúquer (1) and Marina Baixa (2), representing the main infrastructures and irrigated areas.

3. Results

3.1. Transfers in the Marina Baixa Water Consortium

In the Marina Baixa district, the severe drought of the late 1970s forced the authorities to adopt extraordinary structural measures. In 1977, the water authority (CHJ), the provincial government and various town councils created the CAMB in order to meet the growing urban demand through the integrated management of water resources. At the same time, these authorities undertook a large-scale infrastructure project for urban water supply and sanitation, to facilitate the exchange of groundwater and treated wastewater between agricultural and urban users.

The consortium did not include the agricultural users. In order to organize the water exchanges, the CAMB reached several agreements with various irrigators' associations, that were formalised by signing yearly private exchange contracts. These agreements stipulated the annual exchange of groundwater transferred from agricultural to urban users and, in return, the transfer of treated wastewater from the cities to the agricultural water users' associations (WUAs). Contracts were signed by the most important WUAs in the district, representing almost 70% of the irrigated lands. Other smaller WUAs were not included in these negotiations for logistic and strategic reasons. The lack of conveyance infrastructures to connect these small and scattered WUAs, and the sufficiency of resources obtained from the larger WUAs enabled the CAMB to avoid including the smaller WUAs in these negotiations.

The most important agreements that have been signed by the CAMB and four WUAs include: the Canal Bajo del Algar Irrigators' Association, for the shared use of surface water in the Algar River-Guadalest system; the La Vila Joiosa Irrigators' Association, for use of water from the Amadorio reservoir; the Callosa d'En Sarrià Irrigators' Association, for water from the Sacos-Algar wells; and the Altea and La Nucia Irrigators' Associations, also for use of water from the Algar-Guadalest system. The latter agreements are more sporadic and concern a smaller amount of water. In return, WUAs can use water from the wastewater treatment plants in Benidorm, Altea and La Vila Joiosa, except the Callosa d'En Sarrià irrigators, who do not want to use treated water, but instead share use of surface water in return for compensation. Besides maintenance costs, the consortium's annual contributions are varied and depend on each agreement signed, but they range from €120,000 a year to the Canal Bajo del Algar Association, to over €600,000 to the Algar Irrigators' Association (Torregrosa, 2009; Gil and Rico, 2015; CAMB Reports, various years). These contracts do not fulfil the terms for the transfer of rights as established in article 67.1 of the Water Act, since there is no such transfer of rights, nor is an amount, price or frequency established for the volume transferred. They can be considered as informal or non-market arrangements that establish compensations for the temporary use of water. The contracts stipulate the maximum volume to transfer, the amount paid by the CAMB to the irrigators' association (in return for maintaining infrastructures and energy costs), and the supply of treated water to irrigate crops when necessary. In some cases, they establish a minimum amount to be paid to WUAs, calculated as a percentage of the total budget of each WUA (50% of the total budget of the Canal Bajo de Algar and 70% in the Altea Association).

The CAMB currently manages 45 Mm^3 per year, 50% for irrigation and 50% for urban uses. The volume of water transferred varies annually, and depends on rainfall, reservoir

water levels and aquifer levels. Demand is highest in the summer, when rainfall is lowest, crops need most irrigation and urban demand is greatest due to tourism. In the driest years, the percentage of treated water used for irrigation exceeds the use of white waters (Gil and Rico, 2015). The city councils belonging to the CAMB have encountered constant economic problems due to the debts incurred, necessitating debt cancellation plans or renegotiation of conditions. At present, the total debt owed by municipalities to the CAMB exceeds eight million euros (CAMB, 2018). Meanwhile, the irrigators' willingness to continue collaborating has also fluctuated, particularly due to the poor quality of the treated water. In fact, during the last drought that struck the area from 2014 to 2016, low rainfall led to heavier use of treated water. The irrigators expressed their discontent about the lack of available surface water, seeking an increase in annual financial contributions when the agreements were renewed. This was reflected in the CAMB report issued in June 2018, which also approved an increase to the €120,000 paid to the Altea Irrigators' Association, the €100,000 paid to the Callosa d'En Sarrià association and the €120,000 paid to the Algar association. In addition, the CAMB has planned the installation of a tertiary treatment system at the wastewater treatment plants in La Vila Joiosa and Altea, like the one already installed at the Benidorm treatment plant to improve the quality of treated water.

Despite the significant economic compensation, the WUAs are not completely satisfied with this situation. Some of the interviewed WUAs feel that the water resources are now controlled by the CAMB, and they have no control over the water resources management because the CAMB negotiates individually with some WUAs. They think that the WUAs should be represented in the consortium, together with the municipal, provincial and basin authorities. The most important criticism comes from those WUAs that have never been offered contracts with the CAMB. They do not receive treated wastewater from the coastal cities, but they are affected by the extractions of groundwater that other agricultural users are regularly sending to the urban areas. These abstractions decrease the water levels of the same aquifer which is their only source of supply, notably increasing their energy costs and threatening the sustainable exploitation of the groundwater bodies. Farmers that have signed contracts with the CAMB also complain because the salinity of the treated wastewater hinders their productivity and obliges them to mix the waters with other resources. This is caused both by the quality of the wastewater itself, and also by the marine intrusion in the coastal sewage networks.

3.2. Inter-basin water transfers through substitution of surface for groundwater resources

The first transfers of water from the Júcar to other river basin districts began prior to the Water Act reform (46/1999), which came into force in January 2000. These operations were carried out to alleviate the extreme scarcity of regulated resources in the Amadorio and Algar rivers (Marina Baixa district) between 1999 and 2001. The inability of the Algar and Beniardà aquifers to supply urban demand in the Marina Baixa region without compromising sustainability forced the basin authority (CHJ) to seek a solution by sending water from the Júcar river resources system. At that time, the river Júcar had recovered from the drought of 1994-1995, and held sufficient resources to meet these

demands. In May 1999, the CHJ approved the transfer of 5.5 Mm^3 to the CAMB. The water was sent from the Alarcón reservoir, which at that time was property of the Unidad Sindical de Usuarios del Júcar (USUJ), an association formed by the traditional WUAs of the low Júcar Valley (Ribera del Xúquer). Water was sent using the Tajo-Segura aqueduct, part of the network managed by the Taibilla Canals Association, and the Fenollar-Amadorio canal. A period of 5 months was established to transfer the water, and given the short-term and exceptional nature of the operation, it was agreed to suspend the transfer immediately in the event that rainfall generated a sufficient rise in water levels in the Amadorio and Guadalest reservoirs.

As priority users of river resources, USUJ had agreed to the operation. USUJ had to be compensated for the full cost of substituting the volumes subtracted with groundwater resources to be extracted in their irrigation area or with resources from any other source. USUJ could substitute these resources with water collected in wells that had been built by the public authorities (CHJ) during the drought of 1995. These wells were located in the service area of three WUA irrigation zones belonging to the USUJ: the Acequia Real del Júcar irrigation system (13 wells), the Real Acequia de Carcaixent irrigation system (3) and the Acequia de Escalona irrigation system (4). However, the wells belonged to the CHJ.

The adoption of the Júcar Basin Water Plan in 1999 paved the way for these transfers (art. 32) provided that they did not infringe on the rights of the USUJ to use the regulated resources in Alarcón reservoir. Nevertheless, the transfers were subject to the approval of a specific agreement between the USUJ (legal owners of this reservoir) and the Spanish Ministry of the Environment, which would grant the State the ownership of the Alarcón Reservoir.

A transfer agreement approved by the CHJ stipulated the payment of compensation for the costs of conservation, exploitation and use of the Alarcón reservoir infrastructure and the possible inconvenience to users, which was established as €0.02/m^3. However, this figure was subject to review in the event that the USUJ and the Spanish Ministry of the Environment signed the above-mentioned ownership agreement. Under the transfer agreement, the CAMB was responsible for paying the costs incurred for transport via the afore-mentioned aqueducts and it was required to present a surety of €2,103,542.37. In addition, the CHJ would also be responsible for the payment of undefined compensation to industrial and agricultural users for any possible losses in energy production or irrigation capacity, or due to resource substitution. However, the CHJ used legal loopholes to avoid the payment of compensation to irrigators. The WUAs pursued the CHJ through judicial channels, but were unsuccessful.

Due to the persistence of drought in Alicante river basins, the operation had to be repeated within the year, and a new transfer of 3.6 Mm^3 was approved in November 1999. Rainfall over the following two years was insufficient to restore the Guadalest and Amadorio reservoirs to optimum levels, and it was therefore necessary to approve a third transfer of 7.5 Mm^3 in May 2000 and yet another of 10 Mm^3 in February 2001. No further transfers have been sent to the CAMB system.

Between 2001 and 2005, other water transfers through the substitution of surface for groundwater resources (51 Mm^3) were approved, in order to meet demand for water in the metropolitan area of Alicante and Elche, served by the Taibilla Canals Association.

In this case, given the difficulty of calculating the exact cost of extraction, it was decided to calculate it by applying a correction coefficient, representative of the indirect costs arising from the expenses incurred by irrigators' associations, to the direct cost of energy per m^3 of water extracted. Using this criterion, in 2002 the cost was established as €0.042070/m^3.

Between 2005 and 2008, 194 Mm^3 was supplied to Valencia, Albacete and Sagunt cities and 16 Mm^3 to the Taibilla Canals Association. All this was achieved without reducing the supply to USUJ members. In this case, the unit compensation for each user was established according to expected volumes and the legislation (which fixes a rate proportion of 1 to 4 between agricultural users and urban water supply).

In recent years, the State authorities seem to have reversed these policies, putting a brake on water transfers between rural and urban users from different river basins in order to stimulate the use of seawater desalination plants as a substitute for these resources. The main reason for this is that over the past decade, various desalination plants have been built on the Mediterranean coast which are not being exploited to their full potential. Consequently, in the Marina Baixa, the transfer of resources from the Júcar was ruled out in 2015, despite having been requested by urban users, and the desalination plant at Mutxamel was used instead to supply 5 Mm^3 to the CAMB at a price close to €0.70/m^3 (Morote et al., 2017).

3.3. Local water transfer through substitution of surface for groundwater resources in the Júcar river valley

During the last decade, internal water transfers in the Júcar river valley began as a consequence of deteriorating groundwater quality. Intensive irrigation farming in the region has contaminated local aquifers, which now contain high levels of nitrates (between 55 and 110 mg/l) and pesticides, with potentially dangerous concentrations of Terbumeton-desetil in several sources used for urban domestic water supply. Between 2012 and 2013, the presence of this pesticide made it necessary to temporarily suspend water supply in the municipalities of Alzira, Carcaixent, Llaurí, Corbera and Carlet, affecting a population of 100,000 people and prompting a European Commission investigation.

As a solution to these problems, the regional government proposed substituting underground sources intended for human supply with surface water, using a new supply network connected to a recently constructed water treatment plant at La Garrofera (Alzira). The 1998 Júcar Basin Water Plan already provided for the substitution of these resources in the event of loss of quality, and article 24 stipulated that the costs associated with this substitution should be met by the end-users of the water. Consequently, given that USUJ held the rights to use these surface waters, it was considered necessary to establish economic compensation for the costs of extraction and substitution of the resource. However, local councils of all political persuasions were opposed to contributing financially to the substitution of resources. Their main arguments were based on the priority given to urban over agricultural uses in water legislation and the unfair treatment that would benefit cities located in surrounding basins, such as Valencia (Turia), Sagunto (Palancia) and Albacete (endorheic zones of La Mancha), which would obtain river resources without paying the traditional users of the Júcar River.

Environmental organisations supported the local councils' position, blaming farmers for polluting the aquifer.

Nevertheless, an agreement was reached between the parties in June 2013, and on the 10 October 2013, the Júcar River Valley Users' Association was created in order to facilitate water transfers. The association initially consisted of the local councils of Alzira, Carcaixent, Cullera, Favara and Llaurí. The agreement to create the association stipulated the payment to be made to the Júcar, Carcaixent and Escalona irrigators' associations: €0.02/m^3 for the allocated transfer volume and €0.05/m^3 for the volume requested annually. The estimated volume for resource substitution in 2014 was 4.3 Mm^3, an amount that had to be increased to 6.8 Mm^3 in 2015 when two other municipalities, Corbera and Algemesí, joined the users' association. Algemesí was obliged to join urgently in April 2015, when levels of Terbumeton-desetil and Terbuthylazine-desetil were detected in wells supplying the town.

The launch of the new Júcar Water Plan in January 2016 halted users' association activity and water transfers. This new water planning framework obliged the CHJ to take over management of the drought wells. Since March 2016, the basin authority has assumed the operation and maintenance works of these wells and charges their economic costs to the end-users through a levy, without the intervention of irrigators.

4. Discussion

Despite the global trend toward the commodification of water (Bakker, 2005; Swyngedouw, 2005; Arrojo, 2008; Scott and Raschid-Sally, 2012), Spain maintains a rigid allocation system of water rights and a limited legal framework for formal water markets (since 2000). The rigidity of the formal framework has favored the emergence of flexible informal exchange practices between agricultural and urban users, often with the active participation of the local, regional or basin authorities. The cases analyzed in the Valencia Region show a significant success in practical terms, solving contextual or local water crises. However, these cases also uncover the formulation of agreements based on an incomplete consideration of the water resources system and reveal weaknesses and flaws in the institutional framework, and an unequal distribution of burdens and benefits among urban and rural users.

In the Marina Baixa district, coastal-inland competition arose over available water resources due to the booming tourism in the littoral fringe. Water transfer from agricultural to urban users in return for using treated wastewater appeared as a pioneering solution at the end of the 1970. What are the advantages of the agreements between farmers and the CAMB? For the CAMB, it has been much faster and more flexible to have guaranteed access to more water than its allowance when necessary, without having to resort to procedures that are more costly in time and resources (Torregrosa, 2009). For the irrigators, they are guaranteed an uninterrupted supply of water for crop irrigation at more than reasonable prices, as well as very attractive regular payments to offset association costs and therefore members' costs, without losing hectares of crops, simply by partially changing the source of the water used. Besides the above reasons, the maintenance of infrastructures, cleaning of irrigation channels and the availability of good quality water more than suffice to preserve the spirit of collaboration between the two groups of users. Undoubtedly, the CAMB can be considered a successful example of

rural-urban cooperation, because it has managed to cope with an impressive growth in urban water demand without significant social conflicts or "water wars", which unfortunately have been frequent in the recent history of regional water management in Spain and in some neighboring districts.

The integrated exchange and use of different water resources is a desirable formula, however some basic rules for water governance and integrated water resources management were absent in the configuration of the CAMB and in the institutional architecture of this resources system. First, the CAMB acts from a position of advantage negotiating individually with some WUAs, leaving the rest of the WUAs outside of the strategies and the decision-making processes of the resources system. The lack of participation of the WUAs in the consortium board could be justifiable in the origin of the institution and determinant in its initial success, because it was probably strategic (and pioneering) to break water rights rigidity in an unfavorable legal context. But in the current context, and particularly after the acknowledgement of the Water Framework Directive and the generalization of participatory water management, the institutional system should be updated.

In this new legal context, transparency should be also improved. Contracts among the CAMB and the WUAs should be published. All water exchanges between farmers and CAMB should publically agree on water costs, prices and tariffs, to avoid the prisoners' dilemma in negotiations and to protect the interests of both public contributors and farmers' associations.

The most significant imperfection of these institutional arrangements is the failure to include all the users of the resources system. Limiting the contracts to a reduced number of WUAs creates a group of outsiders. Many irrigation communities have been completely excluded from water governance, although they are adversely affected by the decisions taken by the CAMB, due to the fact that the aquifer cannot be compartmentalized in isolated pieces. The unity of the resources systems is a basic principal of common-pool resources management (Ostrom, 1990), and no user can be excluded in a sound governance system for integrated water resources management. All the agricultural users of the aquifer should take part of the decisions taken in the collective management of these public resources. The 1985 Water Law clearly sets out an institution for the management of local resources systems shared by agricultural, urban or other users, the *general community of users*.

In the Jucar valley, two characteristics of the resources system facilitated the implementation of water transfer in a favorable political climate for water exchanges (materialized in the reform of the Water Law). First, the existence of WUAs (USUJ) which has an advantageous position in the distribution of water rights in the river basin, as happen in numerous cases worldwide (Molle and Berkoff, 2006, 2009). Secondly, in a river basin where the total water rights exceed water resources availability, the existence of an aquifer with a positive balance between rights, extractions and annual recharge, located underneath the irrigated areas, provided an excellent opportunity to modify the accounting of water allocation introducing exchange operations. When these characteristics have been altered, these sort of water transfers have been difficult to continue.

In recent years, the basin authority (CHJ) is reviewing and adjusting the water volumes allocated to the WUAs (García Mollá et al., 2019), preventing the creation of a group of "waterowners" among the holders of water rights for agricultural users. Moreover, the construction of large desalination plants along the Mediterranean coast under the AGUA Plan (Swyngedouw, 2013) has expanded the boundary of the resources system. In this new resources context, the administration aims to promote the use of desalinated water, consolidating the institutional model of water allocation and limiting the margin to develop new water transfers among rural (inner) and urban (coastal) areas.

The exchanges that took place at the beginning of the 21st century provided an effective solution for some urban systems during drought periods, such as the metropolitan areas of Valencia and Alicante-Elche. A priori, the administration could meet the urban demand without additional costs to traditional users. Compensation was calculated fairly, because the cost of obtaining groundwater was calculated taking into account both the costs arising from pumping and conveyance expenses. However, no estimation was calculated for the environmental costs related to these operations, and no control devices were stablished to check if the substitution of resources was really carried out (WUAs could obtain additional benefits if they finally did not need to use the pumping systems to irrigate).

In the Ribera del Xúquer district, the recent transfers between WUAs and urban supply systems through the substitution of groundwater resources also reveals an inadequate consideration of the resources system and common pool resources management. It could be considered fair that farmers receive some compensation for the maintenance of the wells used in the operation, but the economic compensation clearly disregarded the polluter pays principle, since agricultural users were the ones who had contaminated the resource used by urban dwellers. The application of the polluter pays principle would also involve the inclusion, in the solution of this problem, of other adjacent irrigated areas not belonging to USUJ.

The urgent need for damage control could be used to justify the role played here by the basin authority and the WUAs during the 2013-2015 contamination crisis and subsequent exchanges, but this would imply the recognition of an opportunity cost paid by the city councils and the political pressure of supplying water to urban dwellers. The closure of this informal water market after 2016 has introduced more fairness in the allocation of resources, and deprived farmers of economic compensations. However, urban users still have to pay the full cost of the impact of these agricultural pollutants, while neither the farmers nor the State (as vicariously liable) assume their economic responsibilities.

5. Conclusions

The Spanish legal framework provides specific instruments for the regulation of formal water markets, but leaves a door open to different formulae of informal water exchanges, some of which were established prior to the 1985 Water Law. These water exchanges have the potential to successfully solve temporary or structural local water deficits, but without proper and coherent regulation they can weaken water governance.

In the two cases based on the Ribera Baixa groundwater resources, water exchanges were backed by the basin authority and took place during a limited period of time. After solving the crisis, the administration has chosen to meet water demands by mobilizing other water

resources (desalination) and preserving the institutional allocation system (keeping groundwater under public control).

However, in the Marina Baixa, the public administration has created an institution that effectively solves the problem of urban water supply, but fails to properly fulfil some essential water governance principles. There is a lack of consideration for the integrity of water resources systems and common-pool management rules.

In all the analyzed cases, environmental effects and costs have not been estimated and many agricultural users of the affected resources systems have been marginalized, whilst being disadvantaged as a direct outcome of the actions of other WUAs with whom they share a common water resource. These third-party effects should not be perceived as a reason to impede water exchanges (Heaney et al., 2006), but should form part of any agreement and must be taken into account to calculate compensations. In order to correctly make the institutional allocation system compatible with the existence of transfers, exchanges and markets, a more holistic, transparent, fairer and coherent approach is required.

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