International Journal of Water Governance 1 (2013) 13–40
DOI: 10.7564/12-IJWG8

The Spanish water "pressure cooker": Threading the interplay between resource resilient water governance outcomes by strengthening the robustness of water governance processes

Elena López-Gunn*, Bárbara Willaarts, Marta Rica, Joan Corominas and Ramón Llamas

Water Observatory, Fundación Botin, Departamento de Geodinámica Universidad Complutense de Madrid, Spain
E-mail: elopezgunn@gmail.com

This paper uses the metaphor of a pressure cooker to highlight how water problems in Spain are highly geographical and sectorial in nature, with some specific hotspots which raise the temperature of the whole water complex system, turning many potentially solvable water problems into 'wicked problems'. The paper discusses the tendency for water governance to be hydrocentric, when often the drivers and in turn the "solutions" to Spanish water problems lie outside the water sphere. The paper analyzes of the current water governance system by looking at water governance as both a *process*, and its key attributes like participation, transparency, equity and rule of law, as well as an analysis of water governance as an *outcome* by looking at efficiency and sustainability of water use in Spain. It concludes on the need to have a deeper knowledge on the interactions of water governance as a process and as an outcome and potential synergies and arguing that water governance is an inherently political process which calls for strengthening the capacity of the system by looking at the interactions of these different governance attributes.

Keywords: water governance, institutional reform, water resources, water scarcity, water framework directive.

1. Introduction

Spain made the headlines in 2008 when a drought exposed the vulnerability of Spanish cities due to an apparent lack of water resources widely portrayed in the media. Yet the present paper argues that it was a classic case of "smoke without fire", where in fact water scarcity in Spain is a normal climatic feature of most of the Spanish territory due to its geographical location. This "natural" water scarcity has been constructed as a "problem" to be solved due to the intensive use of naturally scarce water resources (Mehta, 2007). The paper argues that contrary to popular perceptions, this manufac-

* Corresponding author.

Figure 1. The Spanish water pressure cooker. (Courtesy of J. Cañada)

tured "water scarcity" can be re-balanced if adequate relatively painless key measures are adopted and which pivot on a deeper engagement with the concept of water governance.

The *simile* of a pressure cooker is used here to highlight how "physical" water problems in Spain are highly spatial in nature, understood as context specific, and are not necessarily a generalized *malaise* (see Figure 1). Rather, there are some specific hotspots which raise the temperature of the whole complex water system turning many potentially solvable water problems into 'wicked problems' (Rittel & Webber, 1973). The main reason, we claim lies in the hydrocentric approach to water, when in fact often the drivers and in turn the "solutions" to Spanish water problems lie outside the water sphere. As will be discussed, this is related to a deeper understanding on water governance and its disconnection with decisions being taken in other key policy arenas like agriculture and irrigation, or more recently energy liberalization, or trade policies related to agricultural products and virtual water (Allan, 2011). The problem lies in re-allocating some water from the dominant use to other growing sectors. Like in many countries across the world, agriculture is the largest water consumption sector of blue and green water, capturing almost 80% of the total Spanish water footprint. Yet agriculture has a relatively minor direct importance for the economy (2.3% of GDP in 2009) and employment (4.3% of the workforce in 2009). Meanwhile urban water supply accounts for 8% of water consumed, contribute 14% to Spain's Gross Domestic Product and employs 16% of the population (Aldaya et al., 2012). Furthermore, as shown in Garrido et al. (2010) 80% of value from the agricultural sector is generated by 20% of water use. The paper does not position itself against irrigation in what is largely a semi-arid country, where the high productivity of key export-led agriculture relies in irrigation. It will however discuss the potential to re-allocate a small percentage of the 70% con-

sumptive use to give it back to the environment, and thus a deeper look at existing water governance which can help release the existing pressure on Spanish rivers and aquifers and also free up some resources for other high value-added uses like renewable energy or the tourism sector.

It is the opportunity cost of water used for irrigation that is highlighted, providing some examples of hotspots where small re-allocations could act like a lever that unravels a whole, locked in system full of inertias. Furthermore, releasing a small percentage away from irrigation of say, low-value crops, while providing additional incentives to put into value, say, high-value dryland farming systems like the *dehesa*, adapted to optimize natural resources in Mediterranean conditions, can provide a win-win scenario (Willaarts, Volk, & Aguilera, 2012). In a context of high public debt, it can help to reconsider large public investments to meet an ever increasing demand, to focus instead on demand management which opens a whole range of opportunities for restoring fully functioning ecosystem services.

The paper is thus structured in two main sections on the basis of Lautze et al. (2011), who differentiate between water governance *as a process* and water governance *as an outcome*. In the Spanish case in the first instance of "water governance processes" it equates this to the cooker itself in terms of institutional robustness (Anderies, Janssen, & Ostrom, 2004). It thus undertakes a critical analysis of the institutional scaffolding which might be needed to introduce deep reforms to take pressure off the cooker. It argues however that contrary to a dichotomy or choice between water governance as a process and water governance as an outcome, both have to be analyzed. Therefore the diagnosis of water governance is combined as both an outcome (the physical *resilience*) through good governance (outcome) principles like sustainability and efficiency, and water governance (process) principles (i.e. the *robustness* of the system) (Janssen & Anderies, 2007) more focused in alignment with principles like participation, accountability, equity and the rule of law (see Figure 2). Indeed there might be tensions and contradictions between water governance as a process and water governance as outcomes which becomes a fertile area for future water governance research. The paper argues for moving beyond panaceas (Ostrom, 2007; Ostrom, Janssen, & Anderies, 2007) to engage on a deeper level of understanding of water governance which go one step beyond easy options like prescribing "good water governance", without engaging on what it actually means, what it is and what it is not. Water governance is quickly achieving an iconic status as a silver bullet to solve all water problems, yet it often falls short of practical or deep analysis in terms of how to get there. In the case of Spain this remains the main challenge: not whether Spain has good or bad water governance (as a diagnosis) but once the diagnosis is undertaken explain the drivers and the main potential levers for change. That is, if water governance is *both* a process and an outcome, a deeper understanding is needed on the differential strategies required, as well as the potential synergies and the sequential steps to get there.

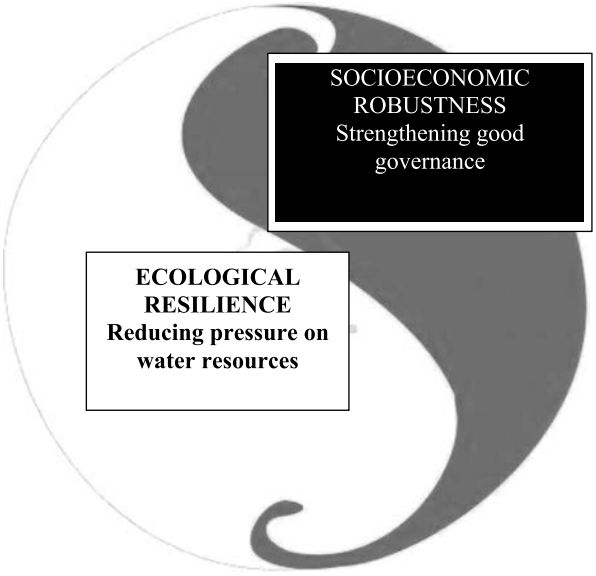

Figure 2. The interconnections between socioeconomic robustness and ecological resilience. (Source: Own elaboration)

2. Spanish water governance and governmentality[1]: An overview and diagnostic frame for the analysis of water governance in Spain

It is frequently stated that the current 'water crisis' is a crisis of water governance and not due to water scarcity (GWP, 2002). Water governance is defined by the GWP as "the range of political, social, economic and administrative systems that are in place to develop and manage water resources, and the delivery of water services, at different levels of society". The Global Water Partnership (GWP) identified ten criteria for "effective" water governance (Rogers & Hall, 2003) (see Table 2). This section will try to move this argument forward and provide a more nuanced debate on a diagnosis of water governance. This is because quite often, in the case of the Spanish pressure cooker, the diagnosis of the physical problem is well characterized whereas reference to "good water governance" is mentioned but not analyzed. Thus many of the corrective measures introduced are based on technical solutions like desalination or modernization and little headway is made on identifying (non-technical) steps that could be taken to develop a more robust water governance system, looking at issues around water rights, water pricing, accountability mechanisms or the existence or creation of collaborative spaces between e.g. agriculture and water administrations, across scales like regions and

[1] Governmentality denotes the " 'conduct of conducts' of men and women, working through their autonomy rather than through coercion even of a subtle kind." (Donzelot & Gordon, 2008). See also Jessop (2006); Foucault (2004a, 2004b).

central government or between e.g. users and the water authorities. The paper however looks at water governance in a sequential manner: it first briefly reviews existing water governance definitions and criteria identified to characterize "good water governance"; second, the paper undertakes a quick diagnosis on these criteria applied to Spain at the macro scale, and third, on the basis of these criteria it revisits the concept of water governance as a process or an outcome as outlined in the paper by Lautze et al. (2011). It helps to reflect on lessons learnt from the Spanish case and what it can add towards a deeper understanding on the challenges of water governance for other areas facing similar pressures on their water resources, particularly other semi-arid regions across the world. The section below analyzes these key governance principles at the macro level for Spain, using available data and information. The evaluation mainly pinpoints general qualitative trends.

2.1. Water governance as a process: Assessing the 'Commandments' on water governance in Spain

The presumed shift from government to governance has been widely documented and analyzed in the academic literature as a potential fracture in government capacity, which is increasingly dependent on a wide range of policy networks (Marinetto, 2003). It refers to the "hollowing out of the state". This was partly the result of the Washington Consensus which gave an ideological and political framework for neoliberal reforms in virtually all fields of activity. This perceived state failure extended to the management of basic services due to the presumed lack of efficiency in the public sector from an "overloaded" state (Esteban Castro, 2011; Skelcher, 2000). This often translated into a push towards a greater role for markets and market based instruments. In relation specifically to water governance, the UN and the World Water Assessment Program (2003) identified ten principles which made up the basic characteristics of "good governance" (see Table 2 below). However, as outlined by Lautze et al. (2011), it is fundamental to make a distinction between water governance *as a process* and water governance *as an outcome*. In the latter case the goal or objective is already fixed, often synonym with the achievement of the nirvana of integrated water resources management (Molle, 2008). Thus of the principles identified by the GWP only the ones concerned with water governance *as a process* are discussed below, in particular those referring to participation, transparency and accountability, equity and the rule of law.

Participation has been defined "as concerned with informing, consulting and involving the public in planning and other decision making activities (...) to give confidence that due consideration has been given to public values and preferences when decisions are made" (Webler & Renn, 1995). The common element in most definitions is the involvement of the public in decision-making. Thus, public participation processes link directly with democratic ideas on governance and the possible desires and expectations of citizens (Rogers & Hall, 2003). The emphasis on participation links with an idealized

democratic model based on a more direct, discursive and deliberative democratic model. In Spain at present a number of participation models co-exist and vie for dominance, participative models that in many ways can be in contradiction with each other. The three main models of participation refer to the corporatist (and neo-corporatist) model, the bureaucratic and the deliberative model.

Spanish water governance (process) has been dominated by a mixture of corporatist and bureaucratic interests. The origin of corporatism dates back to the liberal period and to fascist movements that incorporated groups into policy making as a mode of overcoming conflicts of interest, through captured institutions. It is therefore defined as a political system of interest mediation and negotiation. In effect, it pursues an 'associative' or 'interest-based' form of governance. In the case of water, the corporatist model is marked by the domination by water users, which is very marked in Spain, attributable to a long history of user participation in water management, dating at least to the thirteenth century, with examples like Irrigation Communities in Murcia or the Valencia Water Jury. An example of path dependence, water users were crucial in the creation of River Basin Authorities in 1926. The dominance of Water Users Associations and also of hydroelectric interests and their representation in River Basin Authorities underline the strong influence and weight water users have had in Spain. This defines the corporatist model of participation. Meanwhile positive elements of the corporatist model have been eroded, like the potential for co-management, and of investing directly in future infrastructure (del Saz, 1990; Delgado Piqueras, 1992; Mezo, 2000). As Hernández-Mora (1998, p. 354) explains "The majority of members that are part of the User board are water users. In addition, to the administration and public-sector servants of the River basin Authority, water users are understood as those users having registered rights at the Water Register".

Under a governance mode which assumes the need for all actors to participate in decision-making processes, the question increasingly arises whether these User Boards should be opened up to non-conjunctive uses, like the environment. That is to open up representative institutions to diverse interests and groups, not only for those that have established water rights, but also for those that represent the public interest. In the period 2006–2007 a draft water law was circulated which would have dramatically changed the representation rights, with the balance tipping away from those with established water rights like farmers or hydroelectric companies, opening it up to non-consumptive uses like the environment. However this reform never took place, mainly due to pressure from existing water users with established water rights. Also there was a high political price to the party then in government for following through with deep reforms in water, in terms of potential loss of votes at election times in key regions (López-Gunn, 2009). This corporatist model outlined above, however, coexists with the bureaucratic model of participation. This latter model can be summarized as characterized by the predominance in most decision-making bodies of civil servants and political appointees in the voting patterns, etc. due to their representative majority vis-à-vis e.g. users and/or

non-consumptive uses, which are not included. Both the corporatist and the bureaucratic models of participation arise from representative views on democracy. This mode is based on delegated responsibility to political representatives, and a mode of administrative rationalism. Thus participation becomes instrumental, highly technocratic, with a virtual de-politicization and dominance of bureaucratic rationalism (Esteban Castro, 2011).

Meanwhile as stated earlier, a new third model has been on the table as an alternative for participation and aligned with the requirement under the EU Water Framework Directive for active participation in river basin planning. The model emerges from the change in paradigm towards demand management and a more deliberative style of policy-making. This discursive model of participation, embedded in deliberative ideals of democracy, has not fulfilled its potential. Deliberative democracy is distinct to the model of bureaucratic participation as *an aggregation of preferences* or the corporatist model as a *process of negotiation between different interests*. It is based on "arriving at a common judgment on common interests founded on reasons and arguments" (O'Neill, 2001). By definition it is an inclusionary process and "the primary purpose of access is not to allow each group to get a piece of the action... but instead to ensure that the process of deliberation is not distorted by a mistaken view of a common set of interests" (O'Neill, 2001). Under this model space has been created for the effective participation of citizens, towards substantive democracy (Esteban Castro, 2011), and thus less dominated by professional politicians and scientific experts. It becomes a more open process of knowledge co-production and inclusion. This is the model that in many ways has been pushed by the adoption of the EU Water Framework Directive, however as Hernández-Mora and Ballester (2010) explain it has been a very patchy application throughout the river basin planning process which has been unfolding since 2000 with the approval of the WFD. The incorporation of this new participative model has really been an emergent feature in some regions or basins like the Ebro or in the region of Catalonia, whereas in other cases changes to the fundamental way of decision making to more open, participative and deliberative modes has been more cosmetic than real. Thus from the point of view of helping to release pressure from the pressure cooker, in terms of characterizing an element of water governance like participation, existing participation models along corporatist and bureaucratic traditions, make it unlikely to help shift the power balance towards a re-allocation of existing (captured) water resources. The analysis thus highlights that a gradual shift towards a deliberative mode of governance could empower new actors and thus might help change or diversify the existing balance of power towards new sectors and interests. In summary, in the Spanish water pressure cooker one of the problems has been the inability to integrate new participation models into existing decision making. This is crucial, because if releasing pressure on resources and thus on the water pressure cooker passes through re-allocation, it is probably the deliberative model that would bring new actors into the decision making arena, and a re-balancing of power through a disruption in existing patterns and path dependencies.

Another key 'good governance' principle refers to *transparency* and *access to information*. Advances in information technology, open government and e-government provide a great potential for a new level playing field in terms of data transparency. It offers the potential to open up decision making processes and thus increase accountability from all stakeholders: users, water authorities, and businesses based on new accessible data related e.g. to resource use, allocation of contracts, etc. Transparency is a core component of the so called second generation institutional reform, and it is associated with better socioeconomic development, as well as with higher competitiveness and lower corruption, which ultimately can improve policy outcomes (Bellver & Kaufmann, 2005). In 2008 Transparency International (2008) chose water as the focus for its annual global study. It highlights that water as a sector needs a strong dose of transparency. Transparency is at the heart of water governance because it sheds light on allocation to users and existing incentives. Linking it to the previous section on participation, transparency could facilitate participation and collective action not only by established stakeholders but also for other emerging interests and actors. However, as will be described below, despite its potential to help strengthen water governance, the current diagnosis of water transparency in Spain scores relatively poorly. This conclusion comes from the evidence provided by an initiative from Transparency International (Spanish chapter) (TI Spain, 2012) to develop transparency indicators on water management applied to all river basins (De Stefano et al., 2012). The initiative consisted on the development of a "Water Transparency Index" (WTI), which was applied to all water authorities in Spain for those under the axis of the Ministry of Environment through river basin authorities for shared basins between regions, and for the regional water agencies of specific regions. All river basin authorities were thus assessed for transparency on the basis of 80 indicators developed in collaboration with experts representing all interests (public, NGOs, private, academic) and with different disciplinary backgrounds.

The WTI has been applied for two years running and has provided a first glimpse in relation to information available through e-governance. Probably the two main results refer, on the one hand to the overall low level of transparency of water agencies in Spain. There was no difference between water authorities which depend on the Ministry of Environment, by nature more centralized and in charge of shared rivers between regions and regional water agencies responsible for rivers within their boundaries. This is indicative of a common malaise on lack of transparency. The second main result identified two clear information "black holes". These refer, on the one hand, to aspects related to water rights and on the other aspects related to the economic and financial aspects on water management. This is highly relevant because this information in many ways would provide the support base for two key elements of a robust water governance frame: first, knowing who uses water, for what and who is entitled to this use, and second, who pays for what in the case of water, including novel aspects brought about by the WFD on cost recovery and the inclusion of resource and externality costs. These "black holes" are symptomatic and coincide with some of the main challenges and most

Table 1
Summary of water rights in current river basin draft plans.

Management unit	Available/natural resources in million m^3	Current demand (consumption) in million m^3	Volume in 'Paper rights' or in Process in million m^3	Source
Upper	275	601	990	(Martínez-Cortina et al., 2011); (PHG, 2009)
Adra river basin and Campo de Dalías aquifer	151.11	223.74	126.33	(Proyecto PHCMA, 2010)
Southern andalucian basins	1078.6	1367.94	840.41	(Proyecto PHCMA, 2010)
Vinalopó-Alacantí (CHJ)	69.3	123.6	191.5	(EpTI Júcar Basin, 2008)

intractable issues for water governance in Spain, related to informal use of water and on the other to cost recovery of water services that incorporate environmental and external costs.

In Spain, the water governance "commandments" of *equity and rule of law* in many areas do not fully apply for the case of access to water. The process of registering water rights, started in 1986 after the Water Act became effective. It has "shown up" a complex situation where water use, water rights, and available water resources do not always match (see Table 1). The legal system for water property rights is complex. One of the most interesting and unusual aspects of the Spanish legislative framework is its diversity. This diversity refers on the one hand to a multilevel legal framework, from the supranational level (EU Water Directive) through to national laws, regional laws and local byelaws, and on the other hand to water rights, covering the span from fully private to state concessions, and all types of water encompassing not just surface and groundwater but also new regimes for desalinated, reclaimed or artificially recharged waters. The evolution of the legal system shows a gradual shift towards a governance approach, away from pure command and control, with major changes in the 1999 reform which paved the way for water trading and the establishment of public corporations to act as investment agencies.

In terms of water governance however, if it is accepted inherently as a deeply political process, the question of who has access to water is crucial. Under this scenario monitoring and compliance becomes pivotal, since only a strong and yet flexible water rights system, with a strong monitoring and sanctioning regime, will allow for adaptation to new demands or reforms when facing supply pressures. This is possibly Spain's Achilles heel in terms of water governance. The monitoring and implementation of water rights is again weak, which show up an existing hierarchical and excessively rigid government structure that might benefit from a more network oriented, adaptive gover-

nance approach e.g. making users co-responsible or strengthening the linkages between regions and water authorities.

For example, in the case of water rights there are hotspot regions like the Upper Guadiana (in the Guadiana basin) and the Vinalopó-Alacantí (in the Júcar basin), where the water rights already registered and those in process notably exceed the estimated available water resources (Table 1). Examples like the Special Upper Guadiana Plan have been designed exclusively to address this highly intractable problem, by buying back water to regularize widespread informal use and to give water back to the environment. In the case of the Jucar basin by "expropriating" water rights in the Vinalopó-Alacantí water users by investing on the infrastructure of a transfer from the Jucar river to this region.

Both these examples exemplify the "water supply" policies that have dominated water management in Spain and have an implicit underestimation on the central importance on the control or detailed knowledge on uses made. Although the official discourse refers to water as an essential public resource, there are many inertias in the old paradigm, and fairly opaque water rights systems reflected in the lack of a detailed water resource inventory for water rights in Spain. This in turn has allowed the uncontrolled growth of new (informal) groundwater fed irrigated areas in the Guadalquivir basin, as seen in the irrigation of olives in Jaén, Granada and Cordoba (Corominas, 2009), see below Box 1. In the case of the Southern Andalusian basins, in the groundwater body of Campo de Dalías-Sierra de Gádor, the gap between granted rights and available resources is noticeable, with water use higher than the authorized use by the water authority, which reveals a situation of informal water use. Thus in relation to the rule of law and equitable use, a key starting point for the sequencing of reforms is the need to strengthen water governance processes through a clear focus on the issue of property rights for the use, access and exchange of water.

In terms of *accountability*, water policy in Spain has traditionally been seen as autonomous and self-sufficient, with set goals, taking decisions in a hierarchical manner with well-trodden formal consultation processes with existing water rights users yet fairly hermetic to new uses, demands or more collaborative styles of governance. There are limited horizontal processes of consultation or coordination with other institutional actors, or the necessary coordination with other key policies like agriculture or energy. This lack of adaptation and the failure to develop more complex and flexible governance structures has been exacerbated by political decentralization in Spain. Yet this is a missed opportunity to slowly accommodate the participation of regions in water management. In the last five years there have been reforms to regional Statutes of Autonomy in many Spanish regions, where most have introduced clauses directly related to water management, many to ring-fence use and access to resources to their own region. In some cases like the Guadalquivir in Andalusia and the Douro and Castile Leon, these reforms have been annulled by the Constitutional Court. Yet this is just a symptom of a deeper problem, the lack of an adequate framework for effective coordination and concertation between policies and across different administrations and clear accountability mechanisms.

What the current structure highlights is the lack of horizontal links, and the need to develop a robust networked style of water governance, more suited to the complexity of water problems and which can develop shared spaces across scales and sectors. As outlined above, many of the challenges in Spain might be solved through water governance approach which makes space or room for providing collaborative arenas s for what is ultimately a tough political process of re-allocation. At the moment some key issues linked to the governance principle like the rule of law and equity, like the assignment of rights, risks and responsibilities, the following through on the implementation of laws and rules, and the distribution of cost and benefits, plus issues related to transaction costs are not even on the agenda.

Box 1: Water governance: internal locks and external keys in the Spanish water pressure cooker

• *Governance and administrative coordination*: a "*sine qua non*" condition to advance sustainable water management is centered on good coordination in a multilevel governance system. The Spanish government aims to achieve a National Water Pact, however in reality this often seems limited to getting territorial agreements with all regional governments to allow a water transfer to the Spanish Mediterranean coast. Instead the goal and vision could be a more ambitious, transformative National Water Pact focused on increased governance, administrative coordination and public participation.

• *The 2020 CAP Reform*: Irrigation will be somewhat impaired in the redistribution of decoupled payments. The reformed CAP should introduce less polluting agricultural practices in line with the greening of the CAP. It is very likely that this will overall lead to a decrease in the demand for water resources in continental productions and olive groves, disincentivising the further transformation of dryland farming into irrigation. This highlights how the main key to release pressure in the Spanish water cooker from the resource perspective is out of the water box and hydrocentricity, and instead is dependent on decisions in parallel policy arenas of agricultural trade and policy, and also a new type of a diversified rural development model.

• *Modernization of irrigation*: more than a third of Spanish irrigation systems have been modernized in the last decade, with significant savings in gross water demand (estimated at 20–25%), but together with decreasing returns due to modernization, the net irrigation demand has reduced by 10–15%. Continuing this process of improving the efficiency of irrigation is necessary. However tracking systems on the investments made and objectives pursued should be much more present, e.g. by incorporating compliance with the application of energy efficiency and water pricing principles.

• *Cost recovery of water-related services, including environmental externalities* is an unavoidable task that governments are reluctant to implement because of the impact on influential groups of irrigators. The European Commission recently requested Spain to apply the principle of cost recovery, reminding Spain that water rates are the lowest in the EU. This offers farmers little incentive to reduce water use in irrigation. However, this principle could be implemented gradually, designing a system of fees paid in installments which increase proportionally to the amount of water used.

• *Changing the water rights and licensing model to achieve greater flexibility in water demands, enhancing trading mechanisms and public water banks.* The Commission also reminded Spain that "although some areas of Spain are suffering from water shortages, there are insufficient incentives for efficient use of water, leading to unsustainable use of this resource. In particular, the Spanish Government has not made a clear commitment to reform market concessions in the water sector in order to address specific clear inefficiencies." (EC, 2010)

3. Water governance as an outcome: The Spanish pressure cooker and how to lower the pressure by overcoming the utilitarian view on water

Water governance as an outcome is analyzed mainly in relation to two criteria: sustainability and efficiency. The paper however does not discuss however the fact that these two objectives might on occasion enter into conflict. As will be seen in Spain understanding possible trade-offs between efficiency and sustainability is very much on the agenda. Spain is a quasi-federal country, with 500,000 km^2 for a population of 46 million inhabitants, and a mean rainfall of about 670 mm/year, which disguises wide differences between so- called *wet* North, more akin to countries like France, UK or Central Europe, *dry* Spain in the interior, with a harsh continental weather, and the Mediterranean coast and the archipelagos, where much of the population is concentrated. In terms of regulation Spain is the fourth country in the world in number of reservoirs per capita with 1300 dams. It is also considered a pioneer in the development of non-conventional water resources under the Plan AGUA, an ambitious plan to build desalination capacity for over 700 Mm^3 (or mcm, million cubic meters) to deal with water scarcity and drought (Downward & Taylor, 2007). Water resources are evaluated at 114,000 Mm^3 of which 47,000 Million m^3 are used (level of abstractions). While there apparently are conflicts over water in Spain, these conflicts are very marked in geographical terms and concentrate mostly on the areas where water is more physically scarce, and is more intensively used (Fig. 3a). This is mainly the case in Spanish Mediterranean basins and the Tagus, Guadiana and Guadalquivir rivers where there is an intensive use of water resources, compared to the natural inflows in rivers, which has led gradually, over a number of decades, to a high level of water stress on water ecosystems and their associated water bodies, as defined under the EU Water Framework Directive.

In this context most of the pressure in the Spanish "water pressure cooker" comes from irrigation. Irrigation as a consumptive use of water, captures most of the resources of these basins, is often directly or indirectly related, in large part for the poor quantitative status of water bodies, as well as the cause, along with dry farming and livestock, of diffuse pollution particularly due to nitrates in both surface and groundwater bodies (see Figure 3a and 3b). The need to ensure crops in low rainfall regions like the south and Mediterranean belt, and the uncertain rainfall regime, has internalized an utopia, a

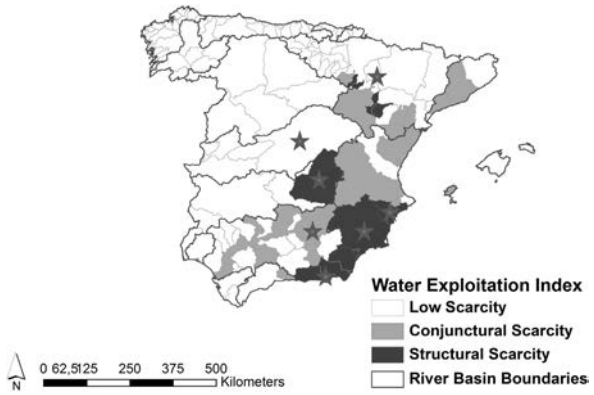

Figure 3a. Distribution of Water pressure hotspots in Spain. (Source: Own elaboration with data from MIMAM (1998))

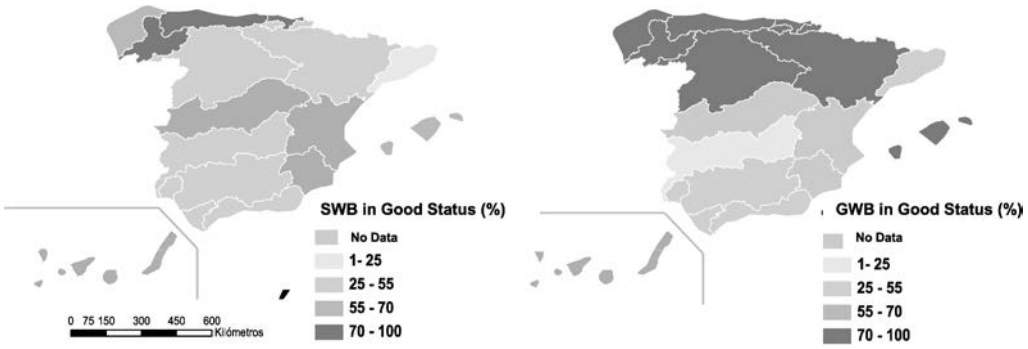

Figure 3b. Current status of surface water bodies (left) and ground (right) in the Peninsula and Balearic Islands. (Source: Compiled from data obtained from the drafts and plans of the 18 river basin districts)

dream for farmers who view irrigation as a lifeline for their crops and a guarantee for a stable income. Thus the Spanish water policy of the twentieth century contributed to the steady supply of new water resources, originally through the development of reservoirs, and more recently via additional investment into desalination, recycling or irrigation efficiency, which has made additional resources available.

However, the drought of 1992–1995 broke the "irrigation myth": over four seasons the larger irrigation schemes had no water, but more seriously in terms of the country's psyche and perception, it jeopardized the supply of water for a large part of the population. For example, two thirds of the population suffered significant periods of restricted supply with many cities in Southern and Mediterranean Spain and a total of 12 million Spaniards experiencing water service interruptions, whilst fields continued to be irrigated. These years marked the beginning of a new paradigm for managing water resources in Spain, which currently co-exists with the old supply-based paradigm (del

Plate 1. Olive groves in Jaen. (Source: Corominas, 2011)

Moral & Saurí, 1999; Saurí & del Moral, 2001). For an analysis of the history and role of irrigation in Spain and recent emphasis on irrigation modernization please refer to López-Gunn et al. (2012).

Different administrations at national and regional level, and also irrigators themselves promoted the modernization of old irrigation infrastructure, partially slowing the spread of new transformation of dryland farming into irrigation. The water savings gained by improving the efficiency of irrigation networks through the modernization of irrigation were expected to increase the security of supply for existing irrigation projects. Actions taken under a National Irrigation Plan Horizon-1998, together with parallel regional government initiatives all in all sought to modernize 1,135 million hectares out of a total of around 3.4 million hectares by the end the end of the first period, and a similar amount for the next period, with an investment of around €3000 per hectare, which would result in a net saving of water of around 22% of that initially consumed by irrigation.

However, the weakness in the governance of river basin organizations (to be discussed below) has allowed an increase in intensive groundwater irrigation during this same period in many river basins. One of the most remarkable examples is the approximately 260 thousand hectares of olive groves in the Guadalquivir basin (Plate 1). This in effect "used up" the savings made in the process of modernization. Meanwhile, in line with the arguments on the apparent paradox of an excessive hydrocentricity of water policies, changes from an unexpected direction, in the EU's Common Agricultural Policy (CAP) were in fact the main determining factor as a driver for water management

decisions at the micro user scale in many areas of Spain and, in some ways well under the radar of the water administration, which remained focused on the management of water and water related infrastructure, explained because agriculture (and irrigation) are beyond their remit of action since it is the competence of regional governments. The introduction of decoupled single payment schemes in agricultural subsidies in effect resulted in reduced pressure on water resources. The change in the EU Common Agricultural Policy meant a decrease in the profitability of many irrigated crops once the farmer started to receive most of their income from single payments, independent of the production levels achieved. In the water management domain this translated into a reduced demand for water by eliminating the need to irrigate in order to increase the productivity per hectare.

In a Mediterranean climate, with rainfall around 500–600 mm per year, mainly concentrated in the autumn and winter months, and with high irregularity, the widespread use of water resources requires the availability of large reservoirs with a storage capacity more than three times the volume used. At the same time, many aquifers are exploited beyond their recharge rate, which leads to a gradual process of decline in the piezometric levels. With this altered functioning of the hydrological system, only large flood events can reach the sea. To meet the environmental objectives of the Water Framework Directive, a system of minimum instream flows have been designed. This however implies strong restrictions and clashes with the current aim under Spanish hydrological planning to ensure that existing water users in each basin have a guaranteed supply. It means that the flows allowed during most of the year are very small and insufficient to recover the good status of water bodies. There is an inverse relationship between level of use and environmental flows.

Thus the issue of *sustainability* of ecosystems as an outcome-based indicator of robust water governance again takes center stage in the Spanish pressure cooker. The Spanish peninsula as highlighted by a number of authors as the most semi-arid country in the European Union. It is also is well recognized worldwide for a long tradition and history in water management, nestled in the Mediterranean basin and an area marked throughout history by its climate. In terms of resource use, the preparation of the river basin plans in compliance with the European Union's Water Framework Directive (WFD), has provided a good diagnosis on the state of the resource and the level of pressure in the system, understood as 'water bodies' in the terminology of the WFD. The WFD has as a central aim to balance water demand with water resources in order to guarantee the ecological functions of river basins. If necessary, it prescribes a series of compulsory and voluntary measures that river basin authorities ought to pursue to recover water bodies to a sound ecological status. With this aim in mind, the elaboration of river basin plans has included a detailed study on the ecological status of all bodies of surface water and groundwater for each basin. The novelty with respect to previous years is that, in addition to analyzing the chemical status and potential pollution problems, it has also assessed the quantitative status, quality of biological communities and in some cases the hydromorphological regime of surface water bodies. The inclusion of a diverse set of cri-

teria enables a more complete view on the functions of aquatic systems and has helped to identify the environmental objectives and a program of measures for their improvement.

According to information gathered from the various drafts of basin plans available, 50% of the surface water bodies do not reach good ecological status (see Figure 3). This deterioration affects both surface and groundwater, and is particularly important in the southern part of Spain. The basins in the north of the peninsula which are located in the naturally more water resource rich part of Spain, have a better situation, with more than 50% of surface water bodies in good condition and over 75% for groundwater. These results show clearly that the current ecological status of water bodies is closely related to the pattern of water stress in different boundaries. In the southern basin where there is intensive water use, only half of the rivers, lakes, wetlands and aquifers achieve Good Status (see Figure 3b). In the basins of the north where there are fewer shortages, water bodies are in better condition. This is probably a combination of virtuous factors: a) the pressure is less because there is less demand for irrigation and b) because the high rainfall contributes to the maintenance of a higher flow, which promotes oxygenation and renewal of water and thus the development of biological communities of better quality. For the nation as a whole less than 48% of total surface water bodies are in good condition based on 2011 data from river basin draft plans. The situation is slightly better in the case of groundwater, where 67% of aquifers are in good condition. Beyond the problems of over abstraction, pollution is the most important factor responsible for the poor state of aquifers in Spain. In the case of surface water, the problems are mainly related to poor biological conditions, the result mainly of over-regulation to which most of the major rivers are exposed. As discussed by Pittock and Finlayson (2011), high regulation of rivers can reduce the adaptive capacity of natural systems making them more fragile to extreme events, particularly droughts.

This means that an overall analysis on the status of water bodies in Spain allows zooming into the Spanish pressure cooker and where the pressure area is located. The main pressure is localized in some hotspots, namely in the Ebro, the Upper Tagus and Upper Guadiana basins, the Segura basin, the Jucar basin and in Andalusia, the Guadalquivir basin and parts of the Mediterranean basin, mainly in the area around Almeria. Some of these hotspots are also defined not just by the pressure on their physical water resources, and imbalance between demand and supply, but also from a governance perspective where there are ongoing regional disputes over access and control to water resources, as well as conflicts between upstream and downstream uses or transboundary conflict between regions either due to shared resources or due to interconnections due to existing infrastructure like the case of the Tagus-Segura transfer. The highly localized pressure in specific areas raises the "temperature" for the whole complex water system, but equally also provides a window of opportunity for targeted action in specific locations.

An example that summarizes a pressure point in the Spanish pressure cooker is the Guadalquivir basin (see Box 2 at end of section). The Guadalquivir basin has an area

of around 57,000 km^2. In terms of natural water resources it has a natural regime of 7,073 Mm^3/yr, based on recorded rainfall for the period from 1940 to 2005. The rainfall series of the past 30 years has been lower than the previous series, thus the contributions of this period have only reached 5,754 Mm^3/yr (i.e. 18% less). Meanwhile aquifers provide a 385 Mm^3/yr of the total resources in the basin. In terms of use, the current surface and groundwater resources reach 2943 Mm^3/yr, but the consolidated demand far exceeds this figure with 3852 Mm^3/yr of which 80% is captured by irrigation, which involves an overexploitation of aquifers and the impossibility to meet the demands from irrigation in drought years due to restrictions, which give preferential use to public water supply. The Guadalquivir Water Plan sets a minimum in-stream flow which represents only 4.6% of mean flows of the natural regime. It is therefore very difficult to achieve good status in almost 45% of the water bodies which currently do not reach good ecological status in the Guadalquivir with this reduced instream flows. To zoom in, 80% is used for irrigated agriculture in the Guadalquivir river (Salmoral et al., 2011; CHG, 2010), and it is only through the re-allocation of some 10% of existing water used for irrigation that the pressure on water resources would be released.

Efficiency in resource use is at the forefront of current debates on the 'green economy' and on hitting resource boundaries (see UNEP, 2012). As discussed earlier under the section on the Spanish water pressure cooker, the main element introduced in the dominant water discourse in Spain has been a move from "structural water deficits", which perceive unmet demand as a problem rather than as an imbalance between available resources and rational use. There has been a shift in discourse to meet the unbalance between current supply and existing demands to a renewed interest in water efficiency. In most cases this has been focused on a sectorial focus on resource efficiency. In the first instance however the focus on "efficiency" has been rather myopic not extending the analysis to resource efficiency by e.g. not including energy and other resources and not looking explicitly at economic efficiency and going up the value chain in water use.

Spain has traditionally pursued a model based on supply management, with very limited initiatives on demand management. The early 2000s saw a policy shift from supply (more dams, more transfers) to a policy of demand management based on initiatives to push irrigation modernization and efficient water use. As highlighted earlier for the case of the Guadalquivir basin, this example of a demand-led policy was centered on the modernization of irrigation which has been pursued over the last decade, at national level through the National Irrigation Plan Horizon 2008 (MAPA, 2001) and the Emergency Shock Plan 2006 (SP, 2006). As discussed earlier, it aimed at modernizing some 1,130 000 hectares, with the stated goal of saving around 3,100 million m^3 of water, with a budget of around €7 billion for the past 10 years (López-Gunn et al., 2012). After the implementation of modernization policies it has succeeded in a gradual but sustained change in the predominant irrigation techniques. For example before 2002, 700,000 ha were irrigated through flood irrigation, often through a network of concrete channels, more than 60 years old, and where large water losses were reported.

In terms of resource efficiency, however, and given that data are incomplete, the analysis of these plans suggests that there are pluses and minuses on public investments in modernization. The main criticism from a water governance point of view is that a major investment in irrigation modernization plans has not been accompanied by a systematic analysis at basin level. This makes it impossible to draw firm conclusions which help to evaluate the efficiency and effectiveness of investments. Despite the lack of detailed data, it seems that part of the water saved has been used to expand the irrigated area or water-intensive crops (Lecina et al., 2010), which in many ways indicates weak water governance at basin level. In terms of economic efficiency the distribution of support for modernization projects suggests that there has been no clear or explicit prioritization of investments to achieve maximum water savings with minimum expense, based on information from the initial efficiency of the systems to be upgraded. Therefore in relation to water efficiency, Spanish water policy offers a puzzling example of seeing the trees but not the forest. As discussed earlier, the central state (and some regional governments like Aragon or Andalusia), have made a huge effort through public investment programmes to increase water efficiency through the modernization or irrigation infrastructure via public investment companies and agencies (Consejería de Agricultura y Pesca, 2010, 2011). However as also discussed earlier, due to weak river basin organizations, where both bureaucratic and corporatist decision making models predominate, potential water savings which often are fictitious have not necessarily translated into increased efficiency at basin level. In fact in a number of documented cases investment to modernize irrigation infrastructure has led to cases where the system has been made hyper efficient and thus more fragile and vulnerable e.g. to extreme events like droughts, since there is no redundancy built into the system. The irony, then, is that a programme designed to make the system more efficient in terms of water resource use, has in effect ultimately raised the "pressure" in the pressure cooker and made it more vulnerable while it has failed to release resources back to the environment to lower the pressure on the resource base. The end result however has been a gradual change in vision towards resource efficiency that looks at other resources in the equation (particularly energy) and that looks at economic efficiency understood as productivity (euros/m^3), moving resources up the value chain ("more dosh per drop").

Box 2: How to reduce the pressure of water demands on ecosystems in the Guadalquivir basin and linkages with robust governance structures

The unsustainability of the Guadalquivir management model is clear in view of existing data from the basin. The deterioration of water bodies is a consequence of the old paradigm that views irrigation is as the engine for prosperity in rural areas, still has a large social, political and institutional acceptance. Given this reality, changes in water management should take advantage of both external drivers outside the region, such as changes in the CAP, and internal policies from e.g. regional or local actors, to help the reorientation of water management.

In terms of external drivers, from the onset of Agenda 2000 to present changes in the CAP, the decoupling of agricultural subsidies from production has produced a significant decrease in water demand in major irrigated crops in the Guadalquivir basin. This reduction has been in the order of 20–25% of water used, with the exception of olive, which is based on deficit irrigation. It is foreseeable that the 2014–2020 CAP reform will continue that trend.

In terms of internal policies, the modernization of irrigation in Andalusia under the Andalusian Irrigation Modernization Plan Horizon-2015, estimates that, over the period 2008–2015, 284,000 ha will be modernized in the Guadalquivir basin, which could produce gross savings of around 262 Mm^3/year. A grant from the European Union, for around 50% of the investment, will be subject to the performance on water savings.

The confluence of these two policies provides a window of opportunity to reduce the allocations of water in terms of water actually consumed by irrigated crops, to ensure modernization of irrigation performance adapts to improved efficiency in water use. Modernization together with changes in European subsidies could represent a decrease in demand of around 600 Mm^3, where half could be devoted to double the Guadalquivir environmental flows to bring them closer to the 10% of natural input, which would represent a major breakthrough in improving the status of water bodies. The remaining half could be devoted to improving the security of all uses, reducing the impacts of socioeconomic droughts while meeting demand from some high value added uses such as solar thermal cooling.

The implementation of these changes and the mechanisms for allocating water resources however can only occur if there are robust governance mechanisms in place to overcome the strong resistance from established interests in Andalusian agriculture and past political clientelism. The strategies that can help change the current status of forced correlation in water management models and actors, should support the strengthening of a number of specific governance attributes:

• *Effectiveness, accountability and policy coherence*: A useful element is the pressure coming from EU on environmental compliance of their agricultural policies.

• *Organizational and accountability strengthening*: Adopt an active role in energizing the decision making of the Committee of Competent Authorities which links regional government and water authorities.

• *Transparency*: The transparency of information on the current state of the Guadalquivir, interests that have led to their deterioration, and the identification of the real benefits produced (and beneficiaries) from its current operating mode are essential. A more inclusive development of the water plan would allow a wider knowledge base which also includes society and an open debate on the management of the Guadalquivir.

• *Participation:* Participation in governance by a wider and more diverse range of civil society sectors. In many respects, it is a prerequisite for the provision of other values which could contribute to a new paradigm of water management in the Guadalquivir.

• *Political representation, governmentality and wider demoscratization of decision making*: All political parties currently support the old paradigm with few cracks: it is essential to open the debate and discussion beyond political parties and established users to discuss on the future of Andalusia which could also be based on urban layers of society, while protecting the rural environment.

4. Conclusion: The "water pressure cooker"

In a case of going 'back to the future', a return from governance to government, it is now widely accepted that Spanish water governance *as a process*, the "cooker" in our simile, is all about robust institutions. The Spanish water pressure cooker at present is not sufficiently robust to sustain the pressures that it would have to sustain from re-allocating naturally scarce 'blue water' resources in hotspots where demand outstrips existing natural supply. This increased awareness on the part of stakeholders and decision-makers that (resource) pressure has to be released from highly regulated supplies, would allow to make space for the river and for the basic recovery of ecosystem functions, building system resilience for e.g. potential increase in extreme events and a new style of management where stationarity is dead (Milly et al., 2008). Yet in the underlying key issue of re-allocations, a number of key basic foundations for robust water governance are missing, like deliberative and diverse participation models, increased transparency and accountability. The case of accountability is particularly pertinent for water governance because the number of actors has increased exponentially, and in the case of Spain this refers to both public actors from the government at different levels, but also in relation to key water users like farmers, hydroelectric companies and other actors who have an increasingly louder voice like environmental NGOs but which remain largely as outsiders to the decision-making arena. Thus the interest is on how to make governance robust in the case of Spain and other countries facing similar issues. It might mean a deeper look at the interface of governance and governmentality in relation to state formation, statecraft and state power at different levels and typify or understand whenever possible situations where governments can steer or cases were rowing and strong government (understood as leadership) is necessary.

The simile of a "water pressure cooker" displays the water stress experienced in many Spanish basins, such as the Guadalquivir, where there are failures in water governance as outcomes, highlighting the difficulties and almost the impossibility to meet all users' demands while also achieving the good status in water dependent ecosystems and rivers. The paper has shown that the challenge for water governance can be framed as a socio-ecological system, in which both the ecological resource aspects have to be considered (i.e. the pressure in the water pressure cooker), but also the social and institutional aspects of strengthening water governance through a series of key elements. Increasing the robustness of the socio-political system would allow to tackle the reforms or political decisions needed which then merge or blends water governance as a process and as an outcome.

The first thing to be done to correct these hazards would be to "put out the fire of demands" that feeds this state of high pressure on the water resource base. It requires good governance as a process and the participation of society in the management of rivers. Reducing the pressure on the water cooker is indispensable in order to improve the ecological status of water bodies, increase the security of different uses, with

maximum priority to the supply of water for the population while enabling new uses to play an important role (like renewable energy). Following the analogy based on the law of thermodynamics, this significant reduction in pressure on water resources can be achieved through efficiency gains by decreasing water consumption in the order of 10–15% compared to today's use, which in turn can help release pressure and shift the system towards a more sustainable level of resource use. This can only be achieved through a solid water governance frame, based on transparency, accountability and rule of law which can implement a consensus between different stakeholders to re-allocate water with due compensation and implemented in a transparent manner.

The combined effects from the application of all these strategies could lower the pressure in the Spanish water pressure cooker allowing to devote around 5% to increasing environmental flows (and restore ecological functionality), which would, for example in the case of the Guadalquivir river, double the existing environmental flow while devoting the remaining 5% to improve users water guarantee meeting the specific demands of high economic value interests or high value social interest. This could be a consensual and gradualist program that could unclog the existing water stress and user dissatisfaction that characterizes the current situation, and it could become the central pillar of the Programs of Measures in the river basin plans to meet the WFD deadline of 2015 for good status of water bodies, the environmental core objectives of the Water Framework Directive that can help finally unlock the Spanish water pressure cooker.

To conclude, water governance is a useful heuristic. The analysis of the "attributes" or criteria analyzed provided a good diagnostic tool on the "health" of the governance system. Yet "water governance attributes" as a concept without differentiating between water governance as a process or as an outcome as discussed by Lautze et al. (2011) is rather limited on the causes of the diagnosis. Research has to be undertaken not only on the specific attributes of water governance as a process (transparency, equity, etc.) and water governance as an outcome (efficiency, sustainability) but also on their interaction and interplay between these different attributes. If water governance, as outlined by Franks (2004) is about power and power sharing, the Spanish case highlights the limits and pressures reflected in the poor status of the resource base consequence of an outdated organizational, hierarchical structure and the difficulties it faces to shift towards a more collaborative networked governance style that is robust enough to navigate political reforms. There are indicators that this new mode of water governance could be based on open government and having a better grasp on the interactions between the state, the private sector and society. This is where a look beyond hydrocentricity can help shift the system by taking opportunities from reforms in other sectors (e.g. in the case of Spain in agriculture), to nudge the system towards a different state, while simultaneously reforms are made to open up the "black box" in terms of decision-making. That is, a twin strategy that looks to reduce the pressure in the water system through a target on water governance outcomes like efficiency as espoused in the new EEA policy on resource efficiency and sustainability under the EU WFD Directive, while giving due attention to the more

Table 2
Water Governance criteria. (Source: modified from IRG, 2010)

Principles	Key governance criteria	Diagnosis for Spain
	Process based criteria	Diagnosis for Spain is mixed in relation to water governance process attributes, where for example headway could be made in relation to accountability and transparency, as well as identifying some contradictions between e.g. the rule of law and equitable use
Participative	The quality, relevance and effectiveness of government policies depend on ensuring wide participation throughout the policy chain – from conception to implementation. Improved participation is likely to create more confidence in the end result and in the institutions which deliver policies	Decision making dominated by corporatist and bureaucratic styles, little space or institutional structures for deliberative processes
Transparent	Good governance requires that all policy decisions are transparent so that both insiders and outsiders can easily follow the steps taken in the policy formulation	Gradual increase in transparency, but with two key areas which show a high degree of opacity related to water rights and to the economic, financial and budgetary aspects
Equitable	Equity between and among various interest groups, stakeholders, and consumer-voters needs to be carefully monitored throughout the process of policy development and implementation. It is essential that penalties for malfeasance be, and be seen to be, equitably applied	High capture of all water resources by two main sectors, in terms of consumptive use, by irrigation and from hydroelectric demand in terms of impact on flows, restrictions to meet ecological flows
Accountable	Roles in the legislative and executive processes need to be clear. Each of the institutions must explain and take responsibility for what it does. But there is also a need for clarity and responsibility from all those involved in developing and implementing policy at whatever level. The "rules of the game" need to be clearly spelled out	Currently there are tensions between different levels of government in Spain due to the ongoing decentralization process (not discussed in this paper) which are ultimately being resolved by recourse to the constitutional court. This is partly explained by weak cooperation and collaboration spaces and procedures between the different levels of government and elements of policy capture. Monitoring and control have to be strengthened

Table 2
(*Continued*.)

Principles	Key governance criteria	Diagnosis for Spain
	Process based criteria	Diagnosis for Spain is mixed in relation to water governance process attributes, where for example headway could be made in relation to accountability and transparency, as well as identifying some contradictions between e.g. the rule of law and equitable use
Communicative	Governance institutions and systems need to communicate among the actors and stakeholders in very different ways. This will lead to civil society being socialized into governance over a wide range of issues	There has been some progress in the current planning cycle which under the European Union WFD requires public participation as part of River basin planning, however only some basins have made an additional effort for so called active participation (e.g. Ebro and Catalonia)
Coherent	Policies and action must be coherent and easily understood. The need for coherence in governance is increasing: the range of tasks has grown; and so has diversity; challenges such as climate and demographic change cross the boundaries of the sectorial policies on which the government has been built. Consistent approach within a complex system is needed	There is a lack of coherence between key policies like agriculture and water planning, and also between e.g. agriculture and energy or, water and energy planning
Ethical	Water governance should be strongly based on the ethical principles of the society in which it functions. This manifests itself most strongly in the issue of property rights for use, access, and ownership of water	As discussed in the paper utilitarian values are given precedence and there are some important pending issues related to existing water property rights, informal use and rigidity in water allocation to face new societal demands

Table 2
(*Continued*.)

Principles	Key governance criteria	Diagnosis for Spain
	Outcome based criteria	Much headway undertaken on efficiency criteria but poor progress made on sustainability outcomes
Effective	Policies must be effective and timely, delivering what is needed on the basis of clear objectives, and evaluation of future impact, and, where available, of past experience. Effectiveness also depends on implementing policies in a proportionate manner and on taking decisions at the most appropriate level. Most importantly, the policies should be incentive-based	The example discussed in the paper e.g. in relation to irrigation modernization, highlights the example of lack of a culture of policy evaluation, which impinges on lesson drawing from past experience. Other examples relate to e.g. new directions like e.g. investment on desalination and planned objectives which have not been realized
Efficient	Economic efficiency, but also political, social and environmental efficiency which should be balanced against economic efficiency. Minimizing transaction costs, for example, is important for political efficiency	As discussed in the paper, a large effort has been placed on water efficiency, for agriculture and to an extent also in public water supply. This however has not necessarily been directly linked to economic efficiency
Integrative	Water governance should enhance the effectiveness of IWRM. Institutions should consider all uses and users and also their interconnections with and impacts upon all other potential users and sectors	As discussed in the paper, there are some important questions pending in relation to commitment to irrigation and available resources. In relation to energy, recent investment in irrigation modernization and desalination and water re-use have consequences on increased energy demand (and also for parallel efforts related to climate change and mitigation and adaptation)
Sustainable	Water governance must serve future as well as present users of water services	As highlighted current water bodies in Spain as defined under EU law are under a lot of pressure

difficult issues around strengthening the water governance process attributes like transparency and accountability to be able to enter the allocation contestations domain. Yet as a concept water governance in itself is an empty vessel ready to be filled, analyzed and defined to make headway on the typologies and characteristics of different co-existing water governance models. The present contribution has shown how in the case of Spain taking pressure off the water pressure cooker are inherently political decisions on water allocation, thus process based dynamics on 'who gets what'. It is also a socio-technical system where, as discussed by van der Valk & Keenan (2011), water as a development issue sits uneasily in the border between social and technical systems. Attention is now turning to issues on adaptive capacity which offer some potential for linking process based criteria with output oriented goals, and towards identifying the gaps in the water governance system, as well as the levers for change. By being more "hydro-eccentric", it becomes more comfortable to accepting water scarcity is not a simple problem to be "solved" but rather a complex problem that has to look for process based solutions geared towards outcome based criteria towards desired societal goals which look for for levers both within and outside of the water domain.

References

Aldaya, M. M., Cabrera, E., Custodio, E., De Stefano, L., Garrido, A., López-Gunn, E., Llamas, M. R., Villarroya, F., & Willaarts, B. (2012). *El Agua en España: Bases para un pacto de futuro*. Madrid: Fundación Botín. http://www.fundacionbotin.org/monografias_observatorio-del-agua_publicaciones.htm.

Allan, T. (2011). *Virtual water: Tackling the threat to our Planet's most precious resource*. I.B. Tauris.

Anderies, J. M., Janssen, M. A., & Ostrom, E. (2004). A framework to analyze the robustness of social ecological systems from an institutional perspective. *Ecology And Society*, *9*(1).

Bellver, A. & Kaufmann, D. (2005). *Transparenting Transparency. Initial Empirics and Policy Applications*. The World Bank.

CHG (2010). Draft water plan of the Guadalquivir River Basin. Seville: Guadalquivir River Basin.

Consejería de Agricultura y Pesca (2010). *Irrigation Inventory 2008 and its evolution over the last decade*. Seville: Ministry of Agriculture and Fisheries, Government of Andalusia.

Consejería de Agricultura y Pesca (2011). *Irrigation Agenda Andaluza H-201*. Seville: Ministry of Agriculture and Fisheries.

Corominas, J. (2009). Irrigation in olive: An opportunity and a risk. In *Meeting "Integrated olive production to new environmental challenges in agriculture"*. Summer Courses 2010 – UNIA.

Corominas, J. (2010). *The new basin water plans Andalusian in national seminar "New basin plans under the WFD"*. Madrid: Water Observatory, Botin Foundation.

Corominas, J. (2011). The uses of groundwater in Andalucía Iberian Congress on Groundwater management challenges for the XXI Century, Zaragoza. *International Association of Hydrogeologists-Spanish Group*, 174–189.

De Stefano, L., Hernández-Mora, N., López-Gunn, E., Willaarts, B., & Zorrilla, P. (2012). Public participation and transparency in water management in Spain. In de Stefano & Llamas (Eds.), *Water, agriculture and the environment in Spain: Can we square the circle?* Leiden: Taylor & Francis. http://www.fundacionbotin.org/fb-water-agriculture-and-the-environment-in-spain-can-we-square-the-circle-seminarios-internaci-787798051267687.htm.

del Moral, L. & Saurí, D. (1999). Changing course. Water policy in Spain. *Environment*, *41*(6), 12–36. doi: 10.1080/00139159909604640.

del Saz, S. (1990). Las Corporaciones publicas. De las Comunidades de Regantes a las Comunidades de usuarios. *Aguas subterráneas, aguas publicas (El nuevo derecho de Aguas)* (pp. 143–158). Madrid: Marcial Pons. Ediciones Jurídicas S.A.

Delgado Piqueras, F. (1992). Capitulo 4 Sección V: Solidaridad y cogestion de los usuarios como base del nuevo gobierno de las aguas publicas. *Derecho de Aguas y Medio Ambiente*. Madrid: Tecnos.

Donzelot, J. & Gordon, C. (2008). Governing liberal societies – the Foucault effect in the English-speaking world. *Foucault Studies*, *5*, 48–62.

Downward, S. R. & Taylor, R. (2007). An assessment of Spain's Programa AGUA and its implications for sustainable water management in the province of Almería, Southeast Spain. *Journal of Environmental Management*, *82*, 277–289.

Esteban Castro, J. (2011). El proceso de democratización de la gestión de servicios públicos esenciales en agua y saneamiento. *Habitat y Sociedad*, *2*, 49–85.

EC (2010). Sustainable growth means building a resource efficient, sustainable and competitive economy, exploiting Europe's leadership in the race to develop new processes and technologies. In: *Communication from the Commission EUROPE 2020: A strategy for smart, sustainable and inclusive growth (COM (2010) 2020 final)*.

European Commission (2012). *Evaluation of the national reform program and the stability program of Spain* 2012 {COM (2012) 310 final}. European Commission. Brussels.

Foucault, M. (2003) *Society must be defended. Lectures at the Collège de France 1975–1976*. New York: Picador.

Foucault, M. (2004a). *Securité, territoire, population. Cours au Collège de France, 1977–1978*. Paris: Seuil/Gallimard.

Foucault, M. (2004b). *Naissance de la biopolitique. Cours au Collège de France, 1978–1979*. Paris: Seuil/Gallimard.

Franks, T. (2004). *Water Governance – What is the consensus?* Paper prepared for the ESRC-funded seminar on *The Water Consensus – Identifying the Gaps*, Bradford Centre for International Development, Bradford University, 18–19 November 2004.

Garrido, A., Llamas, M. R., Varela-Ortega, C., Novo, P., Rodríguez-Casado, R., & Aldaya, M. M. (2010). *Water footprint and virtual water trade in Spain. Policy implications*. New York, USA.: Springer. doi: 10.1007/978-1-4419-5741-2.

Global Water Partnership (2002). *Introducing effective water governance*. Stockholm.

Hernández-Mora, N. (1998). *El papel de los usuarios en la gestión del agua en el acuífero de la Mancha Occidental: Oportunidades ante una situación de conflicto y carestia*. El agua a debate desde la universidad: hacia una nueva cultura del agua, Zaragoza, Spain.

Hernández-Mora, N. & Ballester, A. (2010). Public participation and the role of social networks in the implementation of the Water Framework Directive in Spain. *Ambientalia*. Special Issue: Ten years of the Water Framework Directive: An Overview from Multiple Disciplines. http://www.ambientalia.org.

IRG (2010). *MENA regional water Governance benchmarking project* in collaboration with United States Agency for International Development (USAID), International Resources Group (IRG) in association with International Water Management Institute, Institute of Water and Watersheds at Oregon State University, Computer Assisted Development Incorporated, Nile Consultants, and ECO Consult. October.

Janssen, M. & Anderies, J. (2007). Robustness of social-ecological systems to spatial and temporal variability. *Society and Natural Resources*, *20*, 1–16. doi: 10.1080/08941920600981264.

Jessop, B. (2006). From micro-powers to governmentality: Foucault's work on statehood, state formation, statecraft and state power. *Political Geography*, *26*(1), 34–40. doi: 10.1016/j.polgeo.2006.08.002.

Kaufmann, D. & Kraay, A. (2008). *Governance indicators: Where are we, where should we be going?* Oxford University Press on behalf of the World Bank.

Lautze, J., de Silva, S., Giordano, M., & Sanford, L. (2011). Putting the cart before the horse: Water governance and IWRM. *Natural Resources Forum*, *35*, 1–8. doi: 10.1111/j.1477-8947.2010.01339.x.

Lecina, S., Isidoro, D., Playán, E., & Aragüés, R. (2010). Irrigation modernization and water conservation in Spain: The case of Riegos del Alto Aragón. *Agricultural Water Management*, *97*, 1663–1675. doi: 10.1016/j.agwat.2010.05.023.

López-Gunn, E. (2009). El agua es nuestra: The New 'regionalist' twist in the Spanish hydraulic paradigm. *Water Alternatives*, *2*(3), 370–394.

López-Gunn, E., Zorrilla, P., Prieto, F., & Llamas, M. R. (2012). Lost in translation? Water efficiency in Spanish agriculture. *Journal of Agricultural Water Management*, *108*, 83–95. doi: 10.1016/j.agwat.2012.01.005.

MAPA (Ministerio de Agricultura, Pesca y Alimentación) (2001). *Plan Nacional de Regadíos Horizonte 2008* [National Irrigation Plan Horizon 2008]. Madrid: Ministry of Agriculture, Fisheries and Food.

Marinetto, M. (2003). Governing beyond the centre: A critique of the Anglo-governance school. *Political Studies*, *51*(3), 592–608. doi: 10.1111/1467-9248.00443.

Mehta, L. (2007). *Contexts and Constructions of Scarcity*. Draft. http://splash.bradford.ac.uk/files/PDF%20Alternative%20Water%20Forum%20Mehta.pdf. Last accessed 17 July 2012.

Mezo, J. (2000). *Ciudadanos, agentes concernidos y usuarios: Tres dimensiones de la participacion publica an la gestión del agua*. Conferencia europea con la nueva cultura del agua, Oporto, Portugal, Prensas Universitarias de Zaragoza.

Milly, P., Betancourt, J., Falkenmark, M., Hirsch, R., Kundzewicz, Z., Lettenmaier, D., & Stouffer, R. (2008). Stationarity is dead: Whither water management? *Science*, *319*, 573–574. doi: 10.1126/science.1151915.

MIMAM (1998). *Libro Blanco del Agua en España*. Madrid.

Molle, F. (2008). Nirvana concepts, narratives and policy models: Insight from the water sector. *Water Alternatives*, *1*(1), 131–156.

Ostrom, E. (2007). A diagnostic approach for going beyond panaceas. *PNAS (Proceedings of the National Academy of Science)*, *104*(39), 15181–15187. doi: 10.1073/pnas.0702288104.

Ostrom, E., Janssen, M., & Anderies, J. M. (2007). Going beyond panaceas. *PNAS*, *104*(39), 15176–15178. September 25. doi: 10.1073/pnas.0701886104.

O'Neill, J. (2001). Representing people, representing nature, representing the world. *Environment and Planning C: Government and Policy*, *19*(4), 483–500. doi: 10.1068/c12s.

Pittock, J. & Finlayson, C. M. (2011). Australia's Murray Darling Basin: Freshwater ecosystem conservation options in an era of climate change. *Marine and Freshwater Research*, *62*, 232–243. doi: 10.1071/MF09319.

Rittel, H. & Webber, M. (1973). Dilemmas in a general theory of planning. *Policy Sciences*, *4*, 155–169. doi: 10.1007/BF01405730.

Rogers, P. & Hall, A. (2003). *Effective water governance* (TEC Report No. 7). Stockholm: Global Water Partnership.

Salmoral, G., Dumont, A., Aldaya, M. M., Rodríguez-Casado, R., Garrido, A., & Llamas, M. R. (2011). *Análisis de la huella hídrica extendida de la cuenca del Guadalquivir [Analysis of the Water Footprint of the Guadalquivir Basin]*. SHAN Series: Vol. 1. Botín Foundation. http://www.fundacionbotin.org/monografias_observatorio-del-agua_publicaciones.htm. Accessed 25 April 2012.

Saurí, D. & del Moral, L. (2001). Recent developments in Spanish Water Policy. Alternatives and conflicts at the end of the hydraulic age. *Geoforum*, *32*, 351–362. doi: 10.1016/S0016-7185(00)00048-8.

Skelcher, C. (2000). Changing images of the state: Overloaded, hollowed-out, congested. *Public Policy and Administration*, *15*(3), 3–19. doi: 10.1177/095207670001500302.

SP (2006). Plan de Choque de Modernización de Regadíos 2006 (BOE 11703/2006).

TI Spain (Transparency International Spain) (2012). El Índice de Transparencia en la Gestión del Agua. www.transparencia.org.es.

Transparency International (2008). *Global corruption report: Corruption in the water sector*. Cambridge, UK: Cambridge University Press.

UNEP (2012). *Measuring water use in a green economy*. A Report of the Working Group on Water Efficiency to the International Resource Panel.

UN-WWAP (World Water Assessment Programme) (2003). *World water development report: Water for people water for life*. Paris, UNESCO and New York: Berghahn Books.

van der Valk, M. R. & Keenan, P. (2011). *Principles of good governance at different water governance levels*. Papers presented at a Workshop 22 March 2011, Delft, The Netherlands.

Webler, T. & Renn, O. (1995). A brief primer on participation: Philosophy and practice. *Fairness and competence in citizen participation* (pp. 17–33). London: Kluwer Academic Publishers. doi: 10.1007/978-94-011-0131-8_2.

Willaarts, B. A., Volk, M., & Aguilera, P. (2012). Assessing the ecosystem services supplied by freshwater flows in Mediterranean Agroecosystems. *Journal of Agricultural Water Management*, *105*, 21–31. doi: 10.1016/j.agwat.2011.12.019.