

Drought risk management in transboundary river basins: a Mediterranean feasibility assessment

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Abstract

This paper proposes a methodology to assess the potential and constraints for an effective drought risk reduction in Mediterranean transboundary river basins. Shared river basins of the Iberian Peninsula, and particularly the Guadiana, are of major interest for Mediterranean Europe, because of its significant dimension, aridity, water scarcity, and drought risk.

The assessment is driven by a SWOT analysis conducted on each country's drought management policy, based on 24 criteria grouped into four major categories: Institutional Cooperation, Environmental Protection, Social and Economic Dimensions, and Planning System. Secondly, ten key decision-makers were interviewed in both countries, allowing to: i) validate the preliminary SWOT analysis; ii) identify competences to be shared for mutual benefice (win-win situations); iii) define the best scale to implement such competences; and iv) identify risks associated to transboundary competences, thus setting a business model framework to be used on a joint process of river basin planning.

General results show that the Portuguese situation is quite fragile when compared to Spain's, because of its downstream position, weaker social, economic and negotiating capacity, and poorer governance conditions. On the other hand, Spain faces greater internal challenges, due to an excessive irrigation demand, and increasing political power fragmentation. Interviews point to a "depoliticised" transboundary model of river basin management, mostly restricted to technical competences, and identify several risks related to the implementation of such competences at the transboundary level – namely loss of



sovereignty, excessive costs, poor communication, and mismatching planning structures between riparian countries.

Keywords: drought risk, river basin, planning, transboundary, Portugal, Spain, Guadiana, Mediterranean.

1 Introduction

Most of the research on transboundary water governance has focused on formal legal instruments, conflicts and conflict resolution mechanisms at the national scale (Zeitoun and Warner [1]), but little emphasis has been put into strategies and methodologies addressing an effective shared governance – namely in critical situations such as droughts or other water-related risks and disasters (Videira [2]).

Drought events, which seem to occur with increasing frequency and intensity over the Mediterranean Region, exacerbate water stress and scarcity, as well as water management and planning challenges (Roose [3]). In fact, there is poor knowledge and experience to overcome gaps and differences arising between different countries drought responses.

Contrarily to what might be expected from its geographic position, the Iberian Peninsula's Southwest (where the Guadiana river basin is located) presents particularly enhanced Mediterranean climatic features, with little Atlantic influence, and a strong continental component (Figure 1). As pointed out by Rivas-Martínez [4], in spite of its closeness to the Atlantic Ocean, the Iberian SW rainfall is markedly Mediterranean, even more so than in the Spanish territories on the Mediterranean Sea coast (García-Barrón *et al.* [5]).

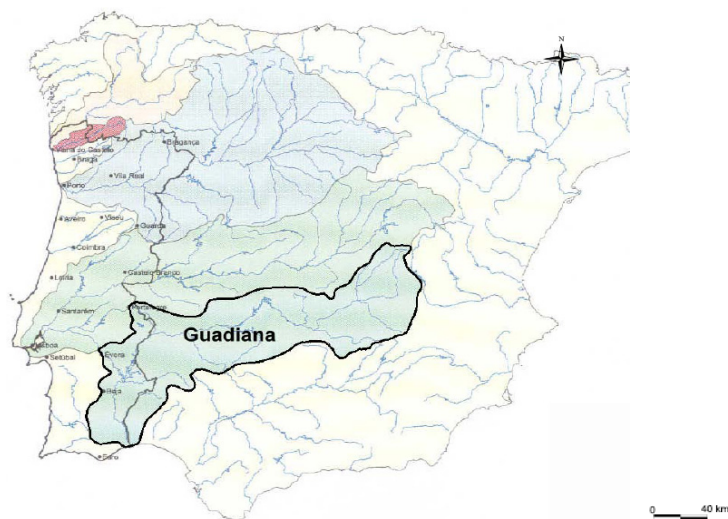


Figure 1: Location of the Guadiana and other transboundary river basins in the Iberian Peninsula (source: www.inag.pt).

In fact, the Guadiana is one of the most water stressed European basins, mostly subject to semi-arid environmental conditions. In the shade of the sub-tropical high pressure systems, this region presents the highest values of summer temperatures, annual solar radiation, and potential evapotranspiration, and the longest dry season average records in the whole Europe. More importantly, it also presents the highest values of rainfall variability, which are only surpassed, at the global scale, by arid climates (Do Ó [6]). Such extreme variations in rainfall – from season to season, year to year, and region to region – aggravate scarcity in water flows, particularly in the drier south.

Agricultural irrigation is the main source of consumption for both states, which is also a typical Mediterranean feature, because of the need to supply crops with water in their growing season. Although water use in the Iberian Southwest has traditionally been frugal, learning both from scarcity and variability, the last decades have witnessed a major shift. Modern technologies and infrastructures (such as dams, boreholes, pumping stations and irrigation channels), mainly developed after the 1950's, have made water readily available in many areas, while state initiative and subsidies have kept water prices artificially low, and unequal among different users (Monteiro and Costa [7]). This has resulted in overabstraction, overuse, and poor efficiency – even if some efforts have been made in the last years, in terms of increasing water conservation and efficiency. These problems are aggravated by the historical focus of both countries, and particularly Spain, on large hydraulic projects featuring not only the construction of local and regional infrastructures, but also large-scale water transfers from wetter to drier regions (Maia [8]; Lopez-Gunn [9]).

Given this natural and economic context, the Guadiana is, amidst transboundary river basins in Europe, a particular interesting case study for the research and shared management of scarce water resources, due to:

- high rainfall variability and aridity conditions over large parts of the basin;
- the importance of transboundary water resources for Iberian countries, particularly in the drier Southern regions;
- water scarcity resulting from a relatively high demand and intensive water use;
- climate change scenarios pointing to reduced flows and increasing drought risk.

Although framed by an important and diplomatically effective bilateral agreement on the use and protection of shared water resources (the Albufeira Convention), drought situations still pose an increasing threat to both countries' water security. Droughts have already proven to cause the conflict potential to become higher, the flow regime to fall into an exception category, and the mechanisms to solve disputes to lose strength (Do Ó [10]). Therefore, both countries clearly need a systematic approach in order to identify planning gaps and to find ways to bridge the differences between their national planning processes, particularly during such water-stressed situations as droughts.

2 Assessment

In order to assess the potential and constraints for an effective drought risk reduction in Mediterranean transboundary river basins, the author conducted a previous analysis of riparian relations and drought risk management, using the Guadiana as case study (Do Ó [10]). The research work was based on a thorough comparative analysis of both national frameworks, using a SWOT matrix (adapted from Mitsiani and Tsakiris [11]) to identify not only the Strengths, Weaknesses, Opportunities and Threats of each framework, but also to allow comparison between them. Furthermore, it can be deployed as a quantitative tool for adaptive water management (Raadgever *et al.* [12]).

The 24 variables used for this assessment were selected and adapted from the works of Mitsiani and Tsakiris [11], Do Ó [6], and Boterill [13]. Results show that Portugal's situation is worse than Spain's, with Weaknesses clearly overcoming Strengths, while in Spain the outcome is the opposite. Both countries present more variables scored as Opportunities than Threats, but its projective dimension is less relying, and probably reflects some natural optimism towards the future. Still, Spain presents a more favourable scenario.

In terms of variables, attention should be drawn to the low classification of both countries in terms of environmental issues, to the globally positive assessment of the "Planning System" and "Institutional Cooperation" sets, to the better planning system of Spain as compared to Portugal, and to the far better assessment of social and economic issues in Spain, where Portugal shows significant fragilities.

Given the subjective nature of the assessment previously conducted, there is a clear need to validate these results through a participatory approach. The participation of stakeholders in public policy and decision-making processes has long been recognised as a key element for its successful implementation. In the current research, applied to a specific geographic (the Guadiana basin), thematic (drought risk management) and political context (the implementation of the WFD), it is considered fundamental to validate the qualitative analysis previously conducted, through target interviews with key stakeholders from both sides of the border. These include (one from each country):

- Central Administration in charge of water management and bilateral relations (in the frame of the Albufeira Convention);
- Guadiana River Basin Authority;
- Independent scientific expert;
- Environmental NGO with experienced knowledge on the Guadiana;
- Regional irrigation farmers' representative.

Furthermore, the input from these key stakeholders is vital to assess the level of agreement and willingness to cope on an eventual shared planning and management structure for drought risk, specifically for the Guadiana river basin.

Besides integrating and learning from the stakeholders' points of view, and validating the previous SWOT analysis work, these interviews allowed to:

- identify the goals of a joint drought planning process, and what are the possible win-win situations and positive sum outcomes (benefit sharing);
- identify an appropriate common business model, namely at what level of competence (transboundary/national/regional/local) should drought response measures be undertaken;
- determine possible risks associated with the transboundary competences identified.

2.1 Validation of SWOT analysis

The first qualitative assessment that was asked from interviewed stakeholders was to validate the research previously conducted, based on a SWOT analysis of 24 variables that conform the risk management and response to droughts in both riparian countries.

Interviewed stakeholders were asked to fill a similar SWOT matrix for both countries, regardless of their origin, and without access to the preliminary research results. Some did not fill the table for all variables, particularly regarding the other riparian country. Therefore, results are not homogeneous – i.e., there is not the same number of answers for each variable, and only a few have all replies. The fact that Portugal has more full results per variable seems to reflect a stronger willingness and/or knowledge from Spanish stakeholders on Portugal, than the other way around.

Significant similarities and differences were identified, namely the following:

- overall results are much more positive from interviewed stakeholders, showing optimism but also a professional commitment that is not necessarily exempt;
- this is particularly the case for environmental issues, the set of variables where both countries perform better (contrary to the research results). This is mainly explained by a strong feeling of opportunity and optimism arising from the implementation of the WFD – indeed, few find strengths in the current environmental situation and framework for drought management;
- the globally positive assessment of institutional cooperation is validated, and is the only set of variables where Portugal performs better than Spain, mainly because of its internal conflicts between national and regional administrations;
- the same positive validation is done for both planning system and social and economic issues, where Spain performs far better than Portugal, that presents significant fragilities. Negative variable assessments can only be found in these two sets, particularly for Portugal: economic adaptive capacity of stakeholders, citizens awareness and participation, drought definition and declaration objectiveness, and response measures costs – the only variable where Spain also has an overall negative

assessment, but also the one that received less responses (only 50% for each country), which does not contribute to a significant validation.

2.2 Goals of a joint drought planning process

Interviewed stakeholders were asked to identify state competences that could benefit from being shared between the two countries, through a joint drought planning process that could generate win-win situations and positive sum outcomes. Given a long list of theoretical competences compiled from numerous reference sources, the interviewed were asked to number their top four priorities. Each competence was classified accordingly (first rank with 4 points, second with 3, third with 2, and fourth with 1), and the overall results were the following:

- 1st – Coordinate the system of survey, measures and impact assessment (23 points)
- 2nd – Integrate management of supply and demand (22)
- 3rd – Increase technical and decrease political relevance on decisions (21)
- 4th – Integrate monitoring and data sharing (19)
- 5th – Increase sense of river basin identity (10)
- 6th – Increase political, cultural and institutional integration (9)
- 7th – Increase resilience of supply systems (9)
- 8th – Comply with international agreements (7)
- 9th – Ensure joint positions in face of EU legislation and pressures (4)

This evaluation shows a clear gap between the first four competences and the remaining ones. The former are basically related to technical competences, while the latter are mostly political – except for “Increase resilience of supply systems”, which may be considered as a consequence of the 2nd one in ranking, “Integrate management of supply and demand”, but not as clear in terms of feasibility.

Nevertheless, it is interesting to notice that implementing all top three competences (and particularly the 2nd and 3rd) at the transboundary level would mean a major policy shift, with great political meaning. The de-politicization of decision-making has been the focus of recent studies (Swyngedouw [14]), and is clearly present in this ranking. It is also and controversially shown with the low (6th) ranking of “Increase political, cultural and institutional integration”. Still, most stakeholders didn’t hesitate to consider that both countries would win from implementing the top four competences at the transboundary level, without increasing the political integration between the two countries.

2.3 Common business model and best level of competence

Previous research works conducted by the author (Do Ó [10, 15]) allowed to identify the most significant drought responses implemented by both public authorities and private users in both countries. These responses were classified into three sets of measures (administrative, structural/preventive, contingency /reactive), and interviewed stakeholders were asked to classify such measures in terms of what level of competence would be more effective and efficient in

Table 1: Identification of risks associated with transboundary competences.

Transboundary competences	Risks
International Law Compliance	Loss of sovereignty and national control Loss of competitive initiative in productive sectors Non-compliance through informal agreements
Drought Management Plans	Loss of competitive initiative in productive sectors Lack of financial background “Lost in paper”
R&D Studies	Excessive costs Scientific noise Increased complexity for management
Drought Expert Boards	Excessive costs Poor representation/share of Portugal Increased complexity for management
Early Warning Systems	Misunderstanding of risk associated uncertainty Response measures incompatibility Scale incompatibility Excessive costs
Basin and System Transfers	Environmental protests Loss of sovereignty Impacts on environmental flows

implementing them: international/transboundary, national, regional/basin, local/municipal (Table 1).

Some did not reply to all measures, and many have chosen more than one level for several measures. Results are quite diverse and not clear in pointing the best level of competence to implement drought response measures. There are some exceptions though, where one level is clearly chosen by the majority of stakeholders:

- International law compliance (57%) – transboundary
- Research & Development Studies (50%) – transboundary
- Implement cost recovery mechanisms (54%) – national
- Increase irrigation water use efficiency (54%) – regional
- Desalination (70%) – regional
- Wastewater reuse (57%) – local
- Financial incentives to water savings (50%) – national
- Water saving campaigns (54%) – national
- Removal of excessive biomass from reservoirs (54%) – regional

Other measures are concentrated and closely divided between two levels (e.g. revision and update of water concessions – 100% national/regional; Drought Management Plans – 75% transboundary/regional; creation of drought expert boards – 93% transboundary/national). The majority though, present quite unclear results. Some are particularly scattered among all levels, indicating a

vertical nature of application (e.g. public participation, joint management of surface and groundwater).

Looking specifically at the transboundary level of competence, this assessment shows that only two measures are clearly accepted and have the general agreement of key stakeholders:

- International law compliance – this is less of a measure than a framework; anyway, it is already in place (through UN Conventions, Albufeira Agreement, EU legislation, and other legal tools), and already provides an umbrella for bilateral relations on water and drought policy.
- Research & Development studies – it is quite interesting that this measure has been the only that is not yet implemented but receives the agreement of the majority of stakeholders: it's the recognition of the need to merge (or at least coordinate) methodologies, databases and assessments, in order to approach the river basin as a single unified management unit.

Other measures that could be implemented at the transboundary level, although sharing competences with national and/or regional authorities, are the following:

- Drought Management Plans – this may be an umbrella for all other measures, i.e., it is not a measure in itself unless it clearly identifies joint thresholds and triggers, impacts and actions, funding and responsibilities, regarding all other measures herein referred to. But there is still a long way to go – Spanish Plans need major improvements, Portuguese Plans are nonexistent, and specific joint plans can only be envisaged in the frame of a coordinated River Basin Plan for the Guadiana (expected for 2015).
- Creation of drought expert boards – if R&D studies are conducted at the transboundary level, then experts could have scientific grounds for advising the administration properly; in the present, joint boards of drought experts risk to lack the expected effectiveness.
- Early Warning Systems – this measure needs a lot of background work before being implemented at any level. Significantly, it still does not exist in Portugal, and it still needs quite some tuning in Spain. If “indicators, thresholds and alert levels” mainly depend on agreement and coordination of technical information and methodologies, “triggers of measures and responses” are basically dependent on a political agreement, reflected in a joint or coordinated RBMP.
- Basin or supply system transfers – there is already an obligation of both parts to inform the other of such initiatives in shared river basins, in the frame of the Albufeira Convention. But decision-making will hardly be planned and informed by transboundary interests, and most likely remain as a strategic national decision.

Finally, concerning measures that are shared among all levels of competences, or have no clear agreement on which should be the priority one, the following comments ought to be outlined:

- For “Joint management of surface and groundwater” and “Restriction of low-priority public uses”, management is likely to remain at the local/regional levels, since these are measures directly related to supply systems. However, it may well attain a transboundary dimension whenever covering cross-border supply systems or water masses.
- “Ecosystem conservation and resilience increase” recognises the need to target ecological units regardless of political boundaries, and therefore it is clear that it can occur at any level, depending on the scale of intervention.
- Finally, for “Public participation” and “New updated public information schemes”, it is clear that all levels ought to be used; there are already some initiatives at the transboundary level, such as the meetings held in Évora and Mérida for the new Guadiana RBMP’s (in 2009 and 2011), the Albufeira Convention website, the Spanish Guadiana River Basin Authority newsletter from June 2011, and the increasing number of weblinks from several stakeholders’ webpages to their neighbour’s counterpart.

2.4 Risks associated with identified transboundary competences

Stakeholders were asked to identify possible risks associated with the implementation of drought response measures at the transboundary level, according to their options in the previous section. Results for selected measures are presented in Table 1, showing that most risks identified refer to: i) loss of sovereignty, ii) excessive costs, iii) planning incompatibilities, and iv) poor communication.

Loss of sovereignty has been a crucial issue between all EU Member States, with an increasing conflictuality over the last years (Grisolia [16]). Even between neighbouring and increasingly integrated countries (economically, culturally, and socially) such as Portugal and Spain, historical mistrust is often present at the table when is time to take decisions.

Excessive costs are a current concern in our market-driven society, and have increased substantially with the current financial, economic and social crisis that peripheral Euro zone countries (as the two Iberian) are experiencing.

Planning incompatibilities are part of the national sovereignty issue, with a strong juridical independence on one hand, and increased demand for political integration from EU institutions. Nevertheless, many steps could be taken at the political level to facilitate the technical and operational compatibility in transboundary river basin management.

Finally, poor communication also refers to a cultural difference, based on distinguishing languages and social backgrounds. Still, if Spain allowed the full (although conflictive) integration of its culturally and linguistic separated regions, like Catalonia, the Basque Country, or Galicia, it shouldn’t look unfeasible to improve communication between the two Iberian neighbours.

3 Final remarks

The research work herein presented combines different analytical tools, namely an open SWOT matrix analysis and selected stakeholder interviews. These tools provided some insight into the potential and constraints for a shared and effective drought risk management policy between the two riparian countries of the Guadiana river basin – Portugal and Spain.

General results show that the Portuguese situation is quite fragile when compared to Spain's, because of its downstream position, weaker social, economic and negotiating capacity, and poorer governance conditions. On the other hand, Spain faces greater internal challenges, due to an excessive irrigation demand, and increasing political power fragmentation. Interviews point to a “depoliticised” transboundary model of river basin management, mostly restricted to technical competences, and identify several risks related to the implementation of such competences at the transboundary level – namely loss of sovereignty, excessive costs, poor communication, and mismatching planning structures between riparian countries.

These results also point to the need of a transboundary drought policy based on active international agreements, grounded on a shared process of public participation, identifying an appropriate business model that includes water and benefits sharing, and relying on the principles of adaptive and integrated water management. For both Iberian countries, these conditions define a significant roadmap for drought management policy.

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