

# **Making inroads towards adaptive water management through stakeholder involvement, the NeWater experience in the Upper Guadiana basin, Spain.**

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## **Abstract**

Conflicts between intensive groundwater use and wetland conservation are widespread throughout arid and semiarid regions worldwide. These have become more significant wherever there has been a synchronism between groundwater-based human development and the awakening of an environmental awareness in society. The Upper Guadiana basin provides an example of such an occurrence, which has given rise to noteworthy social conflicts over the years. Uncertainty features high in the basin's water management practices, not only as to what the future may entail but also in relation to basic water management data. Adaptive water management is often advocated as means to deal with the uncertainties inherent to the management process. From a conceptual standpoint, adaptive management may constitute a potentially adequate approach to the Guadiana setting, providing a series of basic principles that are largely

implicit within the demands of the EU Water Framework Directive. This paper dwells on explaining the experience in the basin of the NeWater project, an EU-funded initiative that aims at developing new approaches to adaptive water management under uncertainty. NeWater work essentially comprises the implementation of an informal public participation forum that among other initiatives includes participatory modelling approaches. These have served the purpose of identifying the key drivers for change in the basin and developing coherent scenarios to be tested by the models.

## 1 Introduction

Over the last thirty years, rapid change and adaptation have been key to water resources management in the Upper Guadiana basin. Much like in other semiarid regions of the world, the generalization of intensive groundwater use has virtually offset the effects of the region's endemic drought problems, thus supporting irrigation-based social and economic welfare and acting as the main driver for prosperity (Garrido et al 2006, Llamas and Martinez-Santos 2005). On the other hand, pumping has been the catalyst for unwanted environmental effects such as wetland degradation (Llamas 1988, Fornes et al 2001). The clash between human development and environmental protection is currently at the heart of widely voiced water conflicts, both at the inter and intra-basin scale, and calls for further adaptation in the dawn of the Water Framework Directive (WFD).

Since adaptive water management relies heavily on public participation, one of the main objectives of NeWater work in the Upper Guadiana basin is to support the transition to inclusive public participation processes. This is largely an achievement in itself, given the climate of conflict that exists among the main water actors, the lack of a participatory tradition in water management and the demands established by the WFD.

The main objective of this paper is to analyse the stakeholder involvement framework developed within the project, exploring its potential contribution to adaptive management at the basin scale. The paper provides an overview of the participation process, examining each of the different stages involved. The focus then shifts to discussing the contents of each of the five stakeholder meetings, all of which were held between spring 2005 and the beginning of 2007.

Meetings contributed to identify the main stakeholder and policy-driven aspects of water management. Key drivers were in turn used to devise a series of vulnerability scenarios to be tested by means of hydrological and agro-economic models. In addition, stakeholder meetings served the purpose of facilitating a non-binding social learning forum for the key stakeholders. This is perceived as a timely addition to the basin's water management framework, particularly since the NeWater stakeholder process has run parallel to the development of the recently approved Upper Guadiana Water Plan (UGWP).

## **2 Adaptive water management and its potential application to the Guadiana setting**

The adaptive management concept is not specific to the water policy framework. It was first introduced to scientific literature by Holling (1978), and originally focused on the use of system models to underpin management decision-making for harvesting fisheries and forests. Since the 1970s, adaptive management has become widespread, and is currently applied to natural resources so diverse as grasslands, waterfowl or national parks. Nevertheless, adaptive management is still referred to as a relatively new concept, often more influential as an idea or as a fashionable word for managers than as a practical tool per se (Lee 1999, Allan and Curtis 2003).

The adaptive management concept is manifold and difficult to capture in a few words (Downs and Kondolf 2002). In general terms, it could be said that adaptive management is a learning approach to handle ecosystems and natural resources under uncertainty. In other words, it is a flexible form of management, akin to a scientific experiment, which operates on a typically iterative fashion while relying heavily on stakeholder input.

The adaptive approach does make some interesting points in regard to natural resources and ecosystems management. Since rapid change has become an inherent feature of the modern era, vulnerability and resilience assessments are increasingly acquiring significance as indicators of risk and of a system's capacity to cope with uncertainty (Holling 2001). Thus, adaptive capacity is often perceived as a key issue within current and future water policy frameworks, not only in regard to potential climate hazards, but also to political and legal constraints. From a conceptual standpoint, adaptive management looks as though it may provide a

potentially adequate approach to the Guadiana setting, providing a series of basic principles that are largely implicit within the demands of the EU Water Framework Directive.

Adaptive management is participatory per se, as it advocates stakeholder-manager interactions as a way to attain better understanding of the system and a broader sectoral integration. In addition, the iterative nature of adaptive management places a significant emphasis on empirical evidence, which may constitute an important step towards transparency in water management regimes. Adaptive management requires a periodic evaluation of decision outcomes, and thus also encourages accountability. Furthermore, by embracing uncertainty as an inherent part of the management process, the adaptive approach may yield decision-making more flexible, enabling systems to be better prepared to cope with external hazards.

On the other hand, the adaptive approach is not free of the burden of experience. Despite its potential appeal, the adaptive management concept does not often translate well into practice (WWPRAC 1998, Lee 1999, Stankey et al 2003), largely due to its requirement for a long-term commitment as well as to commonplace stiff legal and institutional frameworks. In particular, adaptive management attempts have seemingly struggled in instances similar to the Guadiana, where socio-environmental conflict often polarizes the water policy debate (Gunderson 1999).

This leads to a first issue of concern. Is adaptive water management feasible in a world where political terms span only four to six years? Contrary to other natural resources, water affects one hundred percent of the population, and provides a key element in the livelihoods of strong social lobbies, notably farmers. Thus, water often presents an emotional dimension that other resources simply do not have, particularly in arid and semiarid settings such as the Guadiana. In these regions, water easily becomes a pivotal element in election campaigns, which may in turn make it difficult to sustain an adaptive management programme over time. This can pose a significant drawback to the concept, since adaptive management typically requires long periods of time to yield results (Lee 1999).

On the other hand, the Guadiana setting presents a series of peculiarities that currently pose a challenge to any type of management. As stated in the introduction, illegal drilling and pumping is widespread, metering devices are generally lacking, and uncertainties in regard to irrigation data are

significant. In such a situation, where conflict among stakeholders and water authorities is also significant, attaining greater transparency in water data is a paramount step before the adaptive approach can be implemented.

Furthermore, there is a considerable lack of experience on the participation front. The Guadiana Water Authority has recently made significant inroads in order to involve stakeholder collectives and has started to work on a public participation plan to comply with the participation requirements of the Water Framework Directive (WFD). However, aforementioned conflicts may pose an additional difficulty in the first steps of the basin's public participation fora.

Last but not least, the Guadiana case shows how water policy may at times become a direct function of agricultural policy. Given Spain's current institutional framework, water is dealt with through basin agencies (Water Authorities), who in turn depend directly on Madrid's central government. On the other hand, agricultural and environmental policies are drafted by autonomous regional governments. This mismatch essentially entails that cooperation between basin agencies and autonomous governments does not always flow adequately, since it is at times hampered by competing political interests. Potential adaptive management approaches should therefore allow for a cross-institutional dimension which is yet to be explored.

Despite its limitations, adaptive management may prove an interesting approach to handling the multifunctionality of water resources within the Guadiana basin in the future. However, it does not seem realistic to pretend that it can be implemented in the short term. On the other hand, the rationale behind NeWater research is that inroads can be made towards a more adaptive conception of water management (Pahl-Wostl et al 2005). Thus, the NeWater project has focused on a two-fold objective, namely fostering cross-sectoral integration and developing site-specific adaptive management tools. These are further explained in the following sections.

## **2 Stakeholder involvement in the Upper Guadiana basin**

As explained in the previous section, adaptive management embraces uncertainty as part of the management process. Involving stakeholders is a

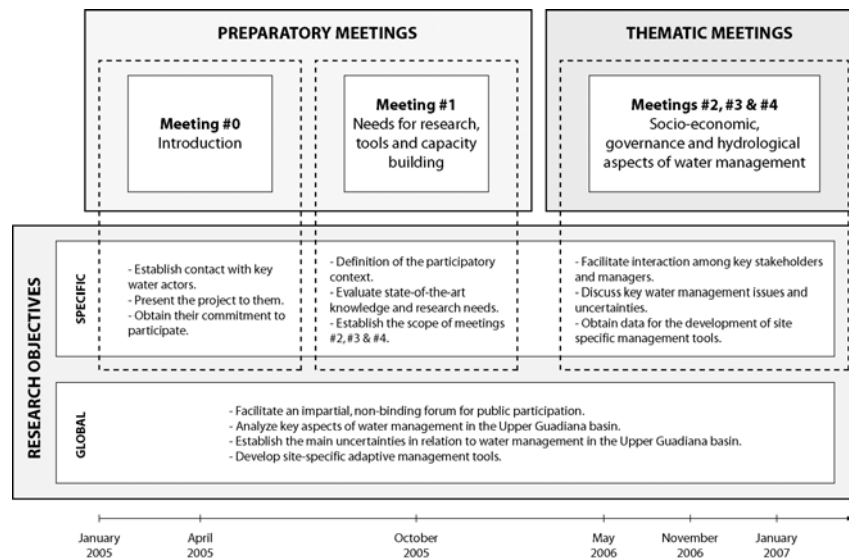
way to narrow down management uncertainties, and it also helps to identify the key drivers for change and the most vulnerable units. Therefore it is a feature of adaptive management regimes.

The participatory process in the Upper Guadiana basin was designed to make sure that all relevant stakeholders took part in the discussions. This was important given the climate of conflict that traditionally exists among the main water actors in the area and the fact that participation in water management has traditionally been limited to permitted water users, with other stakeholders and the public at large excluded from formal participation settings. Therefore there had been little opportunity for conflicting views to be shared in a neutral and constructive setting.

Since most of the area's current conflicts seem to arise from the overall lack of agreement on water data and the related uncertainties (e.g. how much water is available, how much is abstracted, how much can be abstracted in a sustainable way), the seminars were designed to enable managers and stakeholders to sit down together and discuss these issues in an informal, non-binding forum. In order to facilitate participation, it was made clear from the beginning that the role of the research team was to provide an unbiased framework for discussion and social learning, rather than to influence sensitive aspects of decision-making. In fact, according to the external evaluation of the participatory process (Correa 2007a and 2007b) it is precisely the non-binding character of these meetings that allowed for a climate of cooperation and minimal conflict. On the other hand, the active participation of the Guadiana Basin Authority in the project enabled the results of the process to serve as a basis from which to build the official public participation plan.

Figure 1 illustrates the key stages of the participatory process. A first introductory meeting was designed to establish contact with the main actors, present the project to them and obtain their willingness to collaborate. In this initial stage, actors were identified by the research team as representatives of the main stakeholder groups based on over 30 years of research experience in the area. Participants in that first meeting were also invited to identify other stakeholders that should be present, and that were invited to subsequent meetings. Once this was achieved, a second meeting was organized in order to determine needs for research, tools and capacity building, as well as to help determine how to break down and discuss water issues during the participatory process. From these discussions three key issues were identified that were the focus of the next

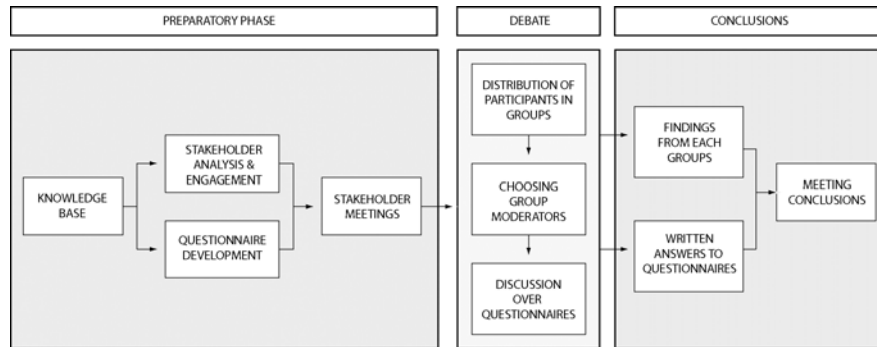
thematic seminars: agro-economic, legal-institutional, and hydrological aspects of the area's water policy.



**Fig 1.** Schematic representation of the case study approach for the first two years of the project (Martínez-Santos 2007).

Figure 2 illustrates the basic structure of each meeting. Meetings were organized around a questionnaire developed by the research team on the basis of their experience in the area and the main issues that emerged in meetings #0 and #1. The questionnaires were divided into thematic blocks that served to break down the day-long meetings into discussion sessions. Between 20 and 30 stakeholders participated in each meeting, representing a wide range of interest groups and management agencies: farmers, national and local environmental groups, Guadiana Basin Authority, regional agricultural regulatory agency, farmer unions, etc. Meeting participants were divided into smaller discussion groups, where an effort was made to guarantee that a diverse set of viewpoints was represented. The break out into smaller groups was key to ensure that everyone had ample opportunity to participate in the discussion. Additionally, the small group format was more conducive to build trust among different stakeholder groups, one of the goals identified by stakeholders in meeting #0. A group moderator/reporter was responsible for guiding the discussion

in each break out group and reporting back to the main group in plenary sessions.



**Fig 2.** Schematic representation of the stakeholder meeting process (Martínez-Santos 2007)

The results of the plenary sessions and the written answers to questionnaires were gathered in meeting reports prepared by the coordinators of each meeting. The reports have been used for several purposes, including driver analysis and scenario design, as well as inputs to build and validate socio-economic and hydrological models, as will be discussed in the following section. They are also being used by the Guadiana Basin Authority as a basis from which to develop the public participation process required by the WFD for the elaboration of the new basin management plans.

Participation throughout the entire process was fairly consistent, with representatives from the main stakeholder groups attending every thematic meeting and participating actively in them. Perhaps it was those groups that do not have a seat at formal participatory structures within the Guadiana Basin Authority that considered they benefited most from this process, since they had access to decision-makers and other interest groups and were able to discuss issues and build alliances that may not have been possible in more formal settings. This observation allows for optimism as water planning and decision-making in the basin becomes more open and participatory in the context of the new WFD regulatory framework.

A few general conclusions can be drawn from the meetings. First, there is a widespread feeling that there need to be more effective and broader information and participation initiatives. These initiatives need to include all relevant stakeholders, not only permitted users, and be based on open and easy access to relevant information.

A second conclusion is that there is more agreement among different groups than is apparent, particularly in what pertains to the main challenges and possible alternatives to tackle them. In fact, many of the conflicts that exist result from a lack of commonly shared information on basic management parameters (recharge rates, total abstractions, economic impacts of different policy scenarios, total number of permitted and illegal water users, etc).

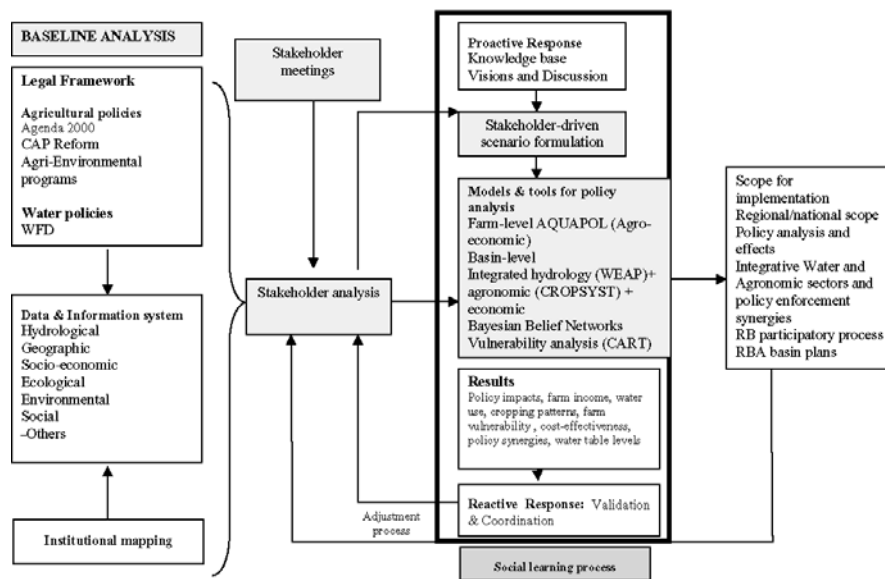
Thirdly, disinformation and lack of participation allows for manipulation of the public opinion in an issue, such as access to water, that is highly emotional in a semi-arid region as is the Upper Guadiana basin. Again, transparency in decision-making could help bring down the level of conflict and facilitate cooperation among different stakeholders and decision-makers. In this sense, the experience of the participatory process in the Upper Guadiana shows that participation in the building of tools and decision-making scenarios can help build consensus as the different management alternatives, and the consequences of those alternatives, are shared and discussed by all.

Finally, it is significant that the concept of management under uncertainty, which is at the core of the adaptive management rationale, is not easily understood by stakeholders. In fact, issues such as the potential impacts of climate change are seen as distant preoccupations in the face of more pressing issues and interests. Once again, information and participatory frameworks can help involve stakeholders and the public at large in this effort.

#### **4 Development of site-specific adaptive management tools**

The other main feature of the project is the development of site-specific tools to make inroads towards a more adaptive water regime. These essentially comprise economic and hydrological models to underpin

participation in decision-making (Figure 3). Both types of models were requested by the stakeholders and developed from scratch in order to facilitate their understanding and foster stakeholder participation (Varela-Ortega et al 2007a and 2007b; Martinez-Santos et al 2007). The stakeholder meetings explained in the previous section contributed to identify the main drivers that are likely to affect present and future water management. These were in turn used to devise a series of plausible scenarios to be tested by the models. Models ultimately aim at identifying the likely impacts of each of the different scenarios on the main stakeholder collectives. In the case of the Guadiana Basin Authority or the environmental conservation groups, these refer to the possibility of recovering the aquifer and its associated wetland ecosystems within the deadlines of the WFD; on the other hand, farmers are more interested on income-related effects or on an eventual exhaustion of the groundwater resources.



**Fig 3.** Methodological framework for stakeholder participation in the development of scenarios and tools for agro-economic modelling (Varela-Ortega et al 2006a)

Given the share of irrigation in the area's water consumption, there is a need to integrate the agricultural and water sectors within the policy context. This implies a recognition of newer developments on the policy front, which include the WFD and the different reforms of the Common Agricultural Policy (CAP). The need for a joint interpretation of water and

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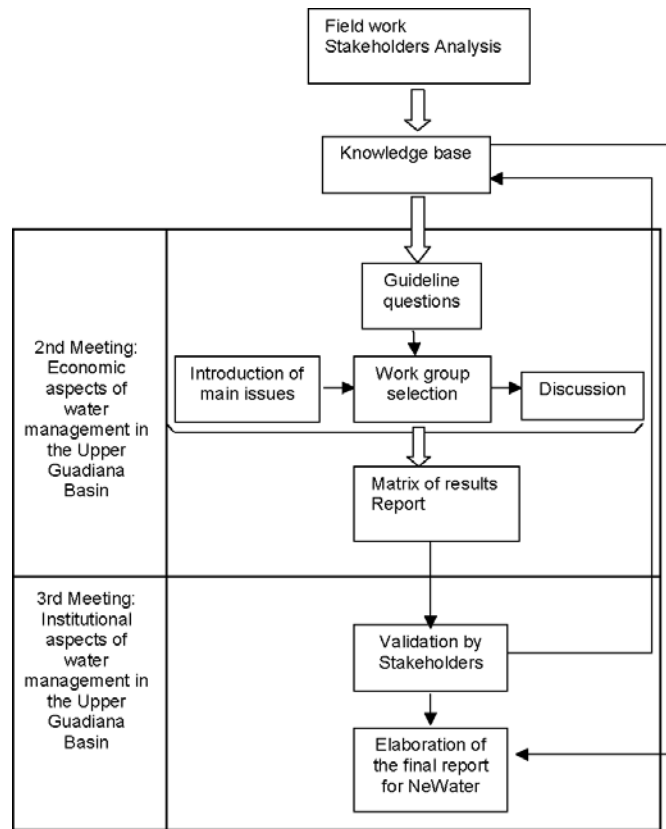
agricultural policies stems from the Guadiana's long-lasting lack of policy integration, which has resulted in disruptive, non-coherent outcomes. These include remarkable ecological impacts on internationally-reputed wetlands, aquifer depletion and social unrest in the rural communities. Within the present social context, adaptive management strategies can be an advantage for selecting efficient and socially-accepted instruments that will seek to assure the environmental requirements of the WFD, while also maintaining the socio-economic viability of the rural livelihoods at tolerable social costs.

Water policies have traditionally been based on the imposition of a strict water quota regime with no compensation to the farmers for their derived income loss. These policies have created long standing social conflicts, while also giving rise to free-riding behaviour among irrigators and uncontrolled well-drilling. The Guadiana Basin Authority has not been capable of enforcing these policies to its full application, due to the large social costs implied. In turn, the new CAP programs have evolved to progressively include environmental regulations into the direct payment scheme. These are cross compliance mechanisms that seek to assure a competitive and environmentally-concerned multifunctional agriculture. Seeking synergies between these two main policies remains crucial and is still not fully explored.

Integration between policy drivers is therefore important (Mejias et al 2004). There are, however, other drivers to take into account in order to devise plausible scenarios. Aside from providing an informal participation framework, stakeholder meetings have prepared the grounds for selecting such policy-relevant drivers. These are based upon the discussions and participation of the key water actors. The scenario-building capacity of the stakeholders' participatory process is one of the clear advantages offered by the adaptive management approach. This is in turn reflected in the modelling tools and outcomes. Active stakeholder involvement has substantially enriched the prediction and simulation potential of the agro-economic and hydrological models.

Policy drivers have been used in the context of the NeWater project to elaborate a set of simulations based on the public policies currently in place in the Upper Guadiana basin. As stated above, these include the WFD or the CAP programs alongside with the national water policies under different types of policy instruments. Take for instance water quotas, agri-environmental programs, CAP subsidies, single-farm payments or cross-compliance schemes (Varela-Ortega 2007).

On the other hand, those drivers identified by the stakeholders have also played a part in the simulations. In the case of agro-economic models these include the establishment of a water rights' markets, legalizing illegal wells (Blanco et al, 2007), selling water rights to a public water distribution agency (Carmona and Varela-Ortega, 2007), the capacity of the water authority to enforce the legally established water quotas and the vulnerability of the different types of farmers (Varela-Ortega et al, 2007b). Hydrological modelling work caters for the most relevant of these for groundwater conservation purposes, while it also includes other potentially important drivers such as climate change or the reallocation of an existing water transfer into the region (Martinez-Santos 2007).



**Figure 4.** Implementation process of the stakeholder meetings for agro-economic modelling (Varela-Ortega et al 2006a).

Figure 4 summarizes the steps involved in the scenario building process. As shown, successive stakeholder meetings allow for an iterative approach. Modelling tools and baseline information were discussed during the initial meetings, while subsequent encounters served the purpose of validating the results of modelling work. Note that stakeholder involvement was not limited to the meetings, but also took place through individual interviews. Thus the scenario-design process comprised several steps. This comprises an initial study of the general framework, including a hydrological, agronomic, socio-economic and political framework analysis. Fieldwork and stakeholder analysis in the study area ensued, providing a knowledge base about characteristics of farms and crops in the Upper Guadiana Basin, and about stakeholder interests and potentials. This knowledge base allowed to develop a series of questionnaires for each of the different thematic meetings, aimed at guiding the discussion on socioeconomic, institutional and hydrological aspects of water management. Discussion outcomes were used to elaborate a matrix of results. Outcomes were put to the stakeholders for validation, and led to the elaboration of a final report for each of the meetings.

While the hydrological and agro-economic models are yet to be coupled, separate simulations already allow to draw a series of meaningful results. These can be summarized as follows:

- (1) Recovering the area's ecosystems within the deadlines established by the Water Framework Directive will be difficult, if possible at all.
- (2) Illegal pumping may offset the effects of water-saving policies even if limitations on water consumption are imposed on legal users.
- (3) If strictly enforced, water-saving policies may also inflict significant farm-income losses. Small farmers, whose ability to diversify the crop is lower, will be the most vulnerable to the Common Agricultural Policy single-farm payment. This is in turn likely to result in farm extensification throughout the study area.
- (4) Farmers located in the western and boundary areas of the aquifer appear the most vulnerable to potential water shortages derived from aquifer exhaustion.

In practice, these essentially mean that win-win solutions for the region are highly unlikely. As a result the group did not reach unanimous policy recommendations. This is by no means perceived as a failure of the group, since solutions looked unlikely from the very outset. Rather, the purpose of the work was to take steps down the right road by letting the stakeholders address their own vulnerability under different scenarios. Moreover, the very implementation of an informal forum for public participation is perceived in itself as an achievement given the basin's conflictive nature and the participatory requirements of the WFD.

## 5 Conclusions

The Upper Guadiana basin provides an example of the conflict between socioeconomic development based on intensive groundwater irrigation and the conservation of valuable wetland ecosystems. This paper exemplifies how adaptive management may, despite its limitations, constitute a potentially adequate approach to deal with these issues.

From the practical viewpoint, the work carried out aims at making inroads towards adaptive water management. A pivotal element in this endeavor is stakeholder involvement, carried out through a series of meetings in which all key players were represented. Stakeholder meetings served a three-fold purpose. First, to provide an informal framework for public participation, which was perceived as an achievement in itself given the area's long-standing conflicts and the lack of a participatory tradition in water management; secondly, stakeholder involvement established the need to develop a series of site-specific tools (namely hydrological and agro-economic models); and thirdly, stakeholder meetings identified the area's key drivers for change, which were in turn put into scenarios to be tested by the models. Modelling work ultimately identified the most vulnerable units of the system in the face of plausible future water management scenarios.

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