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NAture Insurance value: Assessment and Demonstration

NAIAD Case Studies:

Medina del Campo Aquifer Demonstration site

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MEDINA DEL CAMPO AQUIFER DEMONSTRATION SITE

THE DEMO SITE

Medina del Campo Groundwater Body (MCGB) is located in the Duero River Basin, North West central Spain. It covers a surface of 3,700 km2 extending over four provinces that host over 154 municipalities.

Agriculture plays a main role in local economy, particularly in the rural areas, being irrigated agriculture the main water use (96%) followed by urban consumption and industrial uses. The area has a low average precipitation and is prone to periodic drought spells. As a result, surface water resources are scarce, with only three seasonal surface water courses that have limited intermittent flows along the year. Therefore, the water supply and the economy of the region heavily depend on the aquifer. There are currently 5,495 groundwater concessions for agricultural use issued over a surface of 45,115 ha of irrigated area. The intensive exploitation of MCGB over the last decades has put the groundwater body at risk from both the qualitative and quantitative standpoints (Water Framework Directive 2000/60/EC), while seriously impacting the associated surface ecosystems. Meanwhile, droughts also cause serious economic losses in agriculture that are contributing to a severe decrease in rural population.

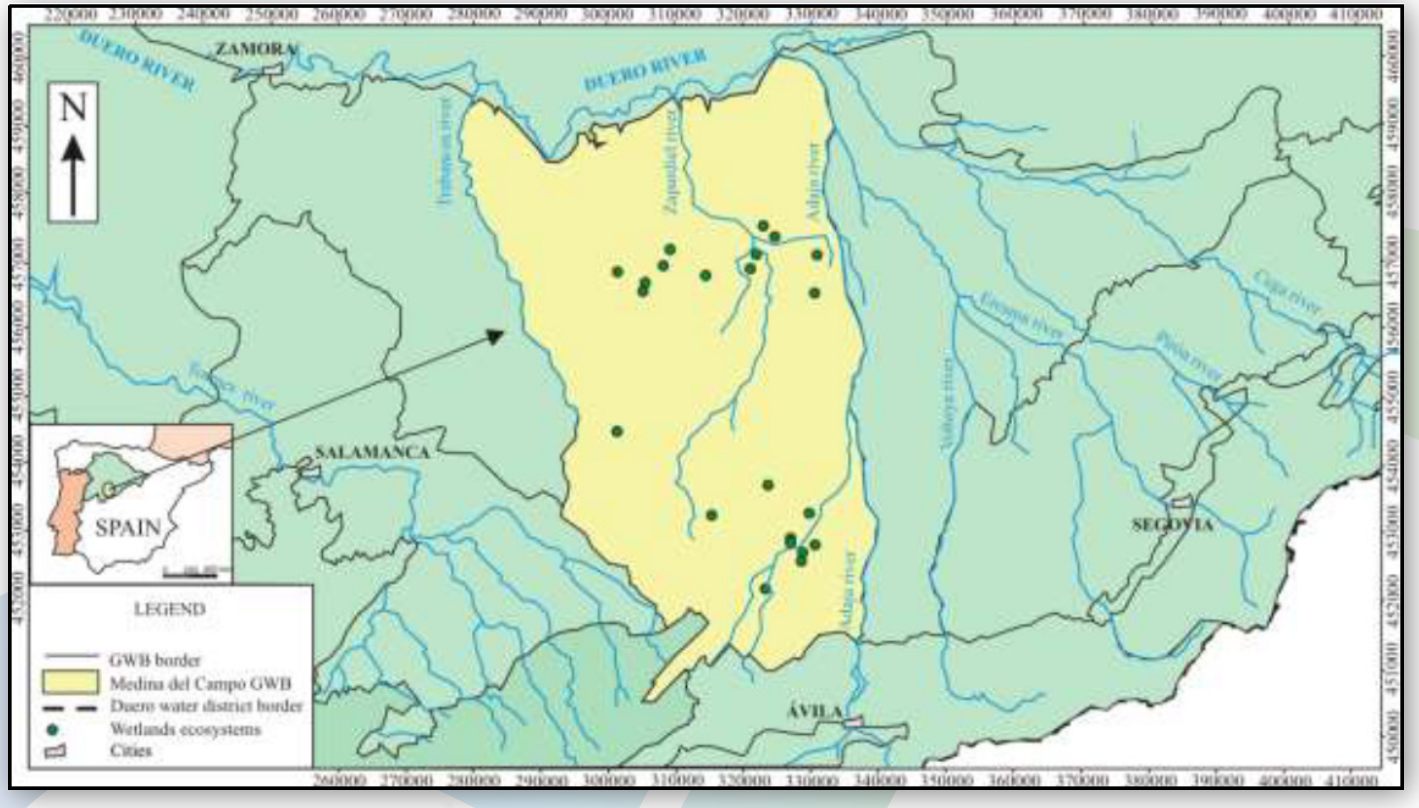

Figure 1. Duero demo site, Medina del Campo Groundwater Body (yellow), in the Duero River basin. Source: Africa de la Hera, IGME.

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Figure 1. Dry riverbed of Arevalillo River.

The objective of the Demo is to assess the potential and impacts of a series of selected Nature Based Solutions (green and blue infrastructure) for the recovery of the groundwater levels and associated ecosystem services, and to generate adaptation capacity for the regional agriculture against more frequent droughts due to climate change.

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NBS BEING TESTED

The demo considers a baseline or business as usual strategy and two alternative strategies combining a different set of NBS with soft measures to test the effect on several impact indicators. The strategies were developed following a stakeholder co-development process combined with a feasibility analysis by technicians from the river basin authority with support of the modelling results. During a series of participatory workshops, a list of NBS, soft, and grey or hybrid measures were selected and ranked by preference by the stakeholders. These were then combined into three different strategies with 4-5 measures per strategy. The resulting set of measures and strategies was assessed by the demo team and the technicians from the Duero RBA in terms of technical and legal feasibility. The resulting final set of strategies combining NBS and soft measures is shown below.

BUSINESS AS USUAL	STRATEGY 1	STRATEGY 2
MEASURES		
No measures are applied	**NBS:** • Crop change towards drought resilient species • Soil and water conservation practices including crop rotation and mulching **Soft:** • Water Users Associations (WUAS) formation • Abstraction monitoring and control (through meters/remote sensing) • Environmental awareness	**NBS:** • Localized aquifer recharge through the Zapardiel river using the Adaja irrigation infrastructure to restore riverine ecosystems associated. **Soft:** • WUAs formation • Abstraction monitoring and control (through meters/remote sensing) • Environmental awareness

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Figure 3. Medina ponds and lagoons

Figure 4. Shrinking Medina wetland

There are seven NAIAD project partners working on the assessment of Medina demo's NBS strategies.

1. **The Duero River Basin Authority (Duero RBA) and ICATALIST** are the demo leaders and have carried out the participatory stakeholder engagement process to identify the NBSs, co-develop the NBS strategies and validate the demo results. NAIAD strategies will be also part of a broader IWRM plan by the Duero RBA aimed to achieve the good status of the aquifer to comply with the DMA, as well as to ensure the water supply and the economic sustainability of the region.

2. **The Spanish Geological Survey (IGME)** has carried out modelling work along three lines in order to assess the current status and potential impact of the aquifer recharge on the groundwater levels and associated surface wetlands.
   - Surface hydrology modelling and flood risk assessment.
   - Detailed regional aquifer modelling focused on the recharge sites and evaluation of impacts from different recharge options.
   - Modelling of regional wetlands and associated ecosystem services and assessments of effects from the aquifer recharge.
3. **Two teams from the Technical University of Cartagena** have worked separately on two lines:
   - Economic assessment of the NBS strategies, including assessment of avoided damage costs after implementation and qualitative valuation of associated co-benefits provided by NBS.
   - Identification and modelling of groundwater-related ecosystem services and the associated changes brought by the implementation of strategy 2.
4. **Deltares** has developed a water allocation model and an aquifer scale groundwater model in order to describe and simulate groundwater flow dynamics with and without the strategies proposed, as well as the effects from spatial water allocation on the aquifer surface. Additionally, they have also developed a metamodel aimed at integrating the different measures considered within the strategies and evaluate their effects individually, by combining results from all the previously described models.
5. **HZG** has developed a Systems Dynamics model that simulates the behaviour of the biophysical, social and economic models in order to connect physical, socioeconomic and climatic data/knowledge. The SD model has been built applying the participatory modelling or group model building approach, in order to integrate key stakeholders in the co-design and co-production of conceptual models of the system.
6. **CNR-IRSA** has developed an Agent Based Model and Social Network Analysis aimed to model and analyse the complex network of interactions among the different decision-agents, and to simulate the way that different decisions and actions interact to each other. This activity allowed to detect policy resistance mechanisms due to the actions and reactions of the different decision-agents, that could hamper and/or slow down the implementation of NBS, and/or negatively affect the NBS effectiveness.

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THE MAIN RESULTS WE EXPECT FROM OUR WORK ON THE DEMO SITE

The achieved and expected results and beneficiaries include the following:

- The modelling teams have developed a set of models that allow a description and follow up of the aquifer dynamics and status through a set of key performance indicators that can be monitored over time. These have been directly linked to the indicators used by the Duero RBA in their planning process. Therefore, the tools created are a result in itself that will be transferred to the Duero RBA for their use in the overall River basin planning process.

The assessment has provided relevant results regarding the foreseeable limited impacts of the aquifer recharge measure as it was designed initially. These results have allowed to re-design the measure in order to maximize the cost/benefit ratio. As a result, the Duero RBA has avoided to invest a considerable sum in a measure that would have no the desirable effects, and will reallocate these funds to other activities within the river basin management plan minimizing the opportunity costs.

- The assessment of the crop change strategy will provide results of the potential effects, both in terms of avoided economic losses and water use, of a partial crop change towards less water consuming crops. Some woody crops such as nut trees and pines were identified as most suitable crop alternatives by technicians. The discussion and validation with stakeholders enabled the identification of possible barriers for implementation, including farm transformation investments (machinery, irrigation system, labour techniques), time to optimal production (3-5 years) and existence of or access to a market locally. Hence, it revealed the need to design accompanying measures that generate the appropriate incentives and conditions to overcome them, such as soft financial packages, pilot test sites and promotion of local value chains for the target products, including associated food processing industries. Meanwhile, some successful cases of business models around other alternative low water consuming crops, such as legumes or aromatic plants, were identified as pioneering experiences of rural development entrepreneurship and innovation. These cases could serve as an inspiration for other already tested viable alternatives. The results will provide farmers with information, data and support on the possibilities to adapt their business to reduced water dependency. In addition, the RBA will obtain a simulation of the cumulative impacts on water abstractions and the local economy, enabling to dimension the amount and type of crop land to be targeted in order to make the measure effective.

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- The organisation of iterative workshops with stakeholders to explain and discuss the problem has increased the awareness and understanding of the need for action. Meanwhile, their involvement in the identification and assessment of solutions has also motivated a positive attitude towards the resulting solutions and an engagement in refining them to become feasible. This has increased the trust and collaboration between the RBA and the farmers, and thus paved the way for active responses and willingness for adoption on both sides. Furthermore, the results of the Agent Based Modelling and Social Network Analysis focusing on the soft measures have particularly contributed to identify the existing barriers and possible levers that will help the RBA design the right incentives to facilitate the implementation and ensure success.

First NAIAD workshop, January 2018

Second NAIAD workshop, December 2018

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THE MAIN MESSAGE OF THE LEZ BASIN DEMONSTRATION SITE

- Drought is a risk difficult to tackle where groundwater resources can play a key role to offset the surface water shortages. However, it is essential to correct the negative trend of the groundwater body and turn it into a positive trend with the aim of reach the good status of the water body. A recovered aquifer will then fulfil this offsetting function and provide all the related ecosystem services that build natural resilience against these situations.
- Groundwater cannot be seen, and thus the perception of "groundwater shortage or overexploitation" by the users is not so evident. Open communication and awareness raising for farmers about the situation, as well as the collaboration between the RBA and all affected stakeholders in an iterative process to find suitable solutions, have all contributed to tore down some of the barriers for the acceptance and adoption of the proposed solutions.
- The proposed NBS alone may not be enough to completely solve the problem. However, when combined with other (mainly soft or management) measures in an integrated plan, they can make the difference to minimize the impacts of a lower water availability on the rural economies. Moreover, their capacity to provide the region with additional natural values (such as wetland recovery, increased bird biodiversity or carbon sequestration), offers enhanced opportunities for alternative business models and rural development options decoupled from intensive water use.

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About the NAIAD Project

'NAIAD' (Nature Insurance Value – Assessment and Demonstration) is an advanced, first of a kind, EU Horizon 2020 applied research programme focused on Nature Based Solutions (NBS) in risk management strategies, with a focus on water. NAIAD aims to operationalize the insurance value of ecosystems to reduce the human and economic cost of risks associated with water (floods and drought) by developing and testing - with key insurers and municipalities - the concepts, tools, applications and instruments (business models) necessary for its mainstreaming.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 730497.

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