Potential impacts of Water Framework Directive on the environmental services associated with historical irrigation systems: A case study from Southern Spain



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Introduction

- Historical irrigation systems at risk: effects on the cultural and environmental heritage -

The 'historical irrigation systems' (HIS) have played a particular role in the ecological history of landscape, not only in southern Europe, but also in very different environmental regions across Europe. These systems, which are still operational in many places, provide important ecosystem services (see Figure 1), especially those that are located in mountain areas. However, the singularities of HIS are not addressed by the Water Framework Directive (WFD). WFD proposes mechanisms for sectorial and territorial integration (principle of subsidiarity), such as the River Basin Management Plans (RBMPs). Unfortunately, the implementation of RBMPs is threatening the HIS located in some river basins across Europe, such as those located in the 'Sierra Nevada' region (Southern Spain), due to the adoption of measures aimed at increasing the water use efficiency of these systems.



Objective

The goal of this work was **to analyze the potential impacts related to the WFD implementation** on the HIS located in 'Sierra Nevada' region (Southern Spain), as well as on the environmental services provided by them.

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an historical approach to cultural heritage based on traditional agrosystems <u>MEMOLA</u>

 Analysis of the environmental services associated with these HIS

 Literature review
 Hydraulic surveys
 Ethnographic studies

 Characterization of crop, soil and water management
 Soil and water management

Identification of potential impacts of WFD implementation on the environmental services of HIS

Assessment of EU water policy and the RBMP

Meetings & workshops with farmers and sectorial organizations

Meetings with local and reginal policy makers

Results and discussion

Historical irrigation schemes of Muslim heritage



Multifunctionality of the HIS

In the RBMP of the study area, the water allocation to HIS is classified only as agricultural water use. Therefore, the non-recognition of the multifunctionality of the HIS (extra-agricultural services) has led to a non-suitable water resources allocation and the lack of assessment of the impacts of these activities.

Water use restrictions - Ecological flows

The implementation of the ecological flow (e-flow) as a tool to avoid the overexploitation of the water resources is a **challenging task** in these systems due to their **complex hydrology**. The oversimplification in the current methodology used for determining e-flows reduces drastically the water allocation to the HIS. Therefore, **the assumed natural flow regime of some rivers in the area is being put at risk since this flow is maintained at certain times of the year by the recharge function of HIS**.

Between conservation and modernization

Driven by the WFD, the RBMPs promote modernization of irrigation systems as a priority action for increasing efficiency of irrigation water use. However, these

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ucts which have been able to survive during centuries, thanks to a relevant realience ify and a sustainable use of the natural resources. These systems, which are still operational ny places, are agroecological systems of great socio-economic, environmental and al interest. They have generated peculiar cultural landcacpes as a result of centurities of inable interactions between people and nature. The water cultural heritage associated use systems relates not only to the technology, terms and architecture developed, but also citices, based on traditional environmental knowledge, which have generated intangible pe values. U the intrinsic values held by the HIS, important ecosystem services are also provided by systems, especially by those which are located in mountain areas. Among these services, it is helphighted: headwater regulation, aquifers recharge, reduction of hillside runoff (erosion On the basis of these results, a **Policy Brief was generated** in order to present suggestions for policy interventions to establish the mechanisms and criteria for the protection of the values of the HIS systems. measures would have significant adverse effects on the environmental services provided by the HIS due to a change in the local hydrology. Currently, irrigation modernization plans are threatening many HIS in the area without an adequate assessment of other alternatives that could provide better environmental, social, employment, and economic options.

Conclusions

Following the WFD guidelines developed to fill the gaps in water quantity and efficiency, most RBMPs that have HIS associated with their water bodies cannot safeguard the ecosystem services provided by these systems and the water management in line with their functions.

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