



Proceedings of the International Conference

Daylighting Rivers: Inquiry Based Learning for Civic Ecology

Florence
1-2 December 2020

Edited by
Ugolini F. & Pearlmutter D.

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Ugolini F., Pearlmutter D., 2020. Proceedings of the International Conference “Daylighting Rivers: Inquiry Based Learning for Civic Ecology”. Florence, 1-2 December 2020.

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P.le Aldo Moro 7

00185 Roma

ISBN 978 88 8080 424 6

DOI: 10.26388/IBE201201

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Organizers:



Consiglio Nazionale delle Ricerche
Istituto per la BioEconomia

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WATER VALUER: PARTICIPATORY ASSESSMENT OF RIVERINE ECOSYSTEM SERVICES FOR SUSTAINABLE WATER MANAGEMENT IN THE ARNO BASIN

Castelli G.¹, Pacetti T.², Bresci E.¹, Caporali E.²

¹ Department of Agriculture, Food, Environment and Forestry (DAGRI), Università degli Studi di Firenze, Firenze, Italy, giulio.castelli@unifi.it, elena.bresci@unifi.it

² Department of Civil and Environmental Engineering (DICEA), Università degli Studi di Firenze, Firenze, Italy, tommaso.pacetti@unifi.it, enrica.caporali@unifi.it

Abstract

Water-related Ecosystem Services (WES), defined as the multiple benefits that society can obtain from water or water-related ecosystems, represent a useful perspective to look at the interrelation between biosphere and anthroposphere in a river environment. Aiming at exploring the ecosystem-water-society nexus to support watershed management through the participatory evaluation of WES, the study considers the specific case of Figline and Incisa Valdarno municipality (Tuscany Region, Italy). The territory, part of the Arno watershed, is situated in an area where water has a strong socio-cultural and economic relevance for the citizens. Starting from the biophysical assessment of the study area, focus groups were organized to allow the participatory evaluation of WES, targeting mainly low impact stakeholders that have often little voice in the management process. Results show that the proposed approach allowed WES mapping and the identification of valuable WES characterised by a critical status. This further allowed the analysis of multiple scenarios and the identification of a shared river management strategy, jointly with local authorities and water management experts. Our analysis demonstrates the potential of WES concept as a suitable common framework for developing participatory processes over integrated water resources management. The study was carried out being fully inserted in an actual legal framework, since it was organised and funded in line with the Tuscany Region Law for Public Participation (L.R.46/2013). The proposed participatory approach can promote the involvement of all interested parties in Water Framework Directive implementation (Art 14) and foster a wider public participation in building river management plans.

Keywords: water resources management, ecosystem services, participatory approach, Water Framework Directive, river basin plan.

Introduction

The concept of Ecosystem Services (ES) represent a useful tool to explore and assess the complexity of natural resources management issues. ES are defined as the conditions and processes through which ecosystems sustain and support human life (MEA, 2005). Water-related Ecosystem Services (WES) are, specifically, the multiple benefits produced by water-related ecosystems (Duku et al., 2015) and therefore the most suitable for river basin management (Brauman et al., 2007). They can be categorized into four classes: supporting WES such as the support of aquatic habitats; provisioning WES, including water supply for the different types of production and for human consumption; regulating WES such as sediment and flow regulation; cultural WES that are related to the provision of cultural, religious, educational and touristic values.

In a watershed, terrestrial ecosystems can affect the attributes of the water (e.g. quantity, quality, spatial and temporal variability) that flows through. WES thus constitute an overlap of the biosphere and the anthroposphere (Spangenberg et al., 2014): spatiotemporal water availability and the presence of recipients (society needs) determine the passage from an ecohydrological process to a WES.

Society, in fact, acts as a driver for the transformation of the water-land system, also reacting with adaptation to its evolution. Due to this, on one hand, it is vital to model and carefully evaluate the human-induced pressured and modification to ecosystems such as human-induced land use change. This latter one impacts the green/blue water partition, strongly influencing the capacity of the territory to provide services (e.g. sediment and flow

regulation, water supply) and determining different kind of risks (hydrogeological risk, water scarcity risk, etc.). On the other hand, it is extremely important to analyse which are the human perceptions of the surrounding environment, in order to highlight the extents to which local citizenship is aware of the WES utilized and their value. Mixing these two perspectives can open the road to a better understanding of the importance of the ecohydrological processes that support WES (Everard et al., 2009).

With these premises, the objectives of this pilot study are (1) to realize an assessment of WES provided by water and land use setting in the territory of Figline and Incisa Valdarno (Figline e Incisa Valdarno) Municipality (FIV), within the Arno river basin in central Italy, based on GIS and participatory mapping analysis; (2) to carry out an analysis of the society perception of the value of water resources in the territory by utilizing a WES framework; and (3) to develop a standard framework for the valuation of such WES by integrating the results of objectives (1) and (2). The present research was realized within the “WaterValues” Project, financed by the Tuscany Region (Italy) in the framework of the Regional Law for Participation 46/2013. This approach aims to provide a sound basis for facilitating a participatory watershed planning process (within the EU Water Framework directive 2000/60/EC – EU WFD) where the instances of population are combined with the expert analysis.

Methodology

The study area included FIV municipality, Tuscany Region, Italy. FIV falls within the Arno river basin, with a rugged territory of 98 km² that include four main small left-bank tributaries (Figure 1).

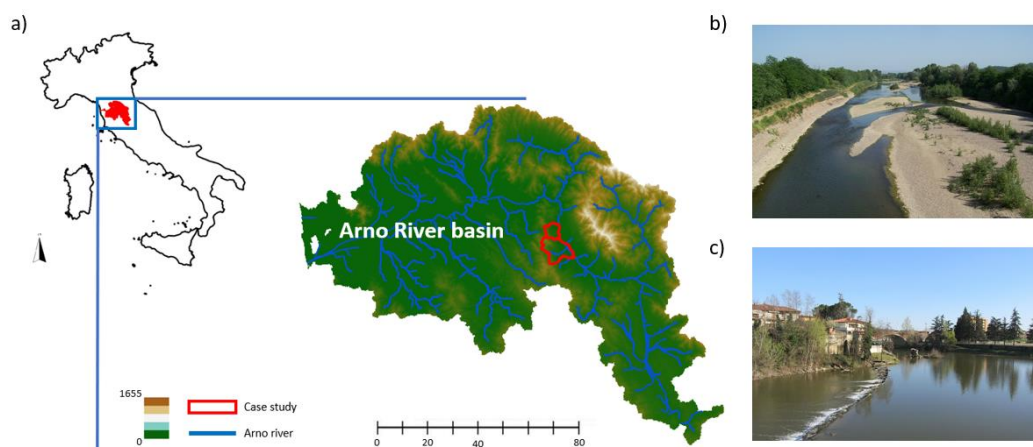


Figure 1. a) The entire Arno river basin with highlighted the municipality of Figline and Incisa Valdarno serving as research area; b) Arno river bars in Figline; c) Weir on Arno river in Incisa

In the area, Arno River and its tributaries, have a strong relevance for local population (e.g. fishing, gardening, recreation) and contribute to the touristic vocation of the area. Moreover, water represents a vital component of the economy of the area: besides the domestic consumption of the 23,000 inhabitants, water is withdrawn for industry and agriculture. At the same time, water can be a threat for the territory due to hydrological extremes. Recent droughts events caused water rationing during summer in FIV. On the other hand, the case study area is characterized by high hydraulic risk as indicated by several past flood events (e.g. the flood event of November 1966) that led to the realization of two retention areas realized upstream of the municipality (Galloway et al., 2017).

The methodology of the study (Figure 2) followed four main phases: (i) the biophysical assessment of the ecosystem capacity to provide WES; (ii) the analysis of the population and identification of stakeholder to be involved in the focus groups; (iii) the organization of focus group, which included: (iii-a) a first sub-phase of participatory identification of WES, (iii-b) a second sub-phase for their mapping in the area of study and (iii-c) a third one for the identification of valuable WES characterised by a critical status; (iv) the participatory scenarios analysis where the trade-offs between different management options are highlighted.

The first phase was carried out taking advantage of the analysis provided by the Northern Apennines River Basin Authority (Northern Apennines Water Management Plan 2015, 2nd cycle of EU WFD implementation), including both quantitative and qualitative indicators, which provided a fundamental basis of knowledge to determine the status of each water body in the area. The second phase was carried out through the analysis of population and associations living in the area of study, in order to identify a representative group of participants. This analysis led to the involvement of several association in the territory which were involved as “community champions” (Lindsay et al. 2019). The third phase was developed by organizing participatory meeting with the identified associations to produce an inventory of the perceived WES. To overcome the frequent problem of limited participation in plenary meetings, a tailor-made set of focus groups was organized with the different association at their own headquarters.

For each focus group, a list of all the WES perceived through participants discussion was elaborated. Then a participatory mapping activity was realised with the support of Google Earth as interactive digital mapping tool. Finally, each focus group evaluate the status of WES present in the municipality, on a 3-level ranking: “good”, “poor” and “critical” status.

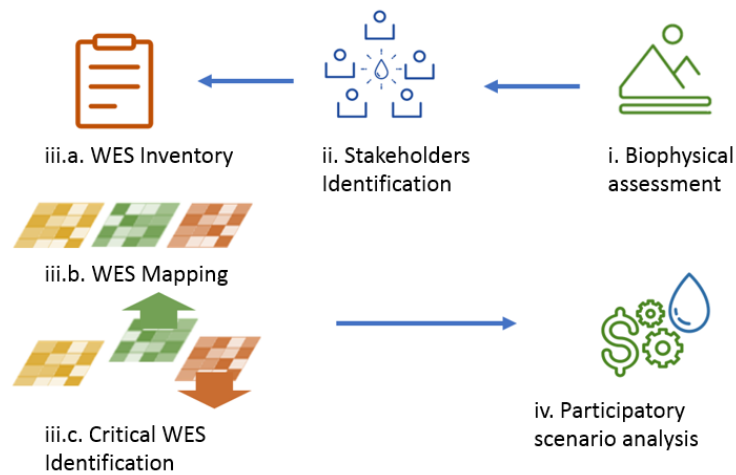


Figure 2. Graphical sketch describing the participatory process methodology

The fourth phase involved the citizens of FIV who already attended the focus groups in a discussion with selected water professionals and representatives of local institutions. This phase was organised as a final meeting where the results of different focus groups were discussed to reach a common evaluation of WES and of their status, and to provide potential strategies to improve the level water and land management in FIV.

Results

The selection of local associations to be involved in the process identified four main subjects: “ProciV - Protezione Civile”, an associations of local civil protection servants; “Il Giardino”, cultural association of retirees; Association “Soci Coop Figline”, including local associated of Italian food cooperative Coop; and “Circolo fotografico Arno”, a photographers club of FIV municipality with a specific interest on river Arno locations. The four focus groups realized with these associations allowed the definition of multiple WES lists, from which it was possible to derive interesting information regarding the different perception citizen have on WES. For each class of services (i.e. regulating, supporting, provisioning, cultural) a list of WES has been elaborated identifying also the area where the service itself was produced its perceived status. The associated mapping allowed also the localization of the main hotspots (i.e. areas of particular importance important for WES production or that have criticism - Figure 3). Supporting WES of “Water quality” and of “Support to water biodiversity”, Cultural WES of “Fishing” and of “Cultural and Aesthetic value”, all considered as produced by the River Arno main stream, were perceived in a “critical status” caused by the low water quality. Such characteristic was also confirmed by Northern Apennines Water Management Plan. This result indicates how citizenship is aware of the problem. In the fourth phase of the

process, Payment for Ecosystem Services (PES) scheme was indicated as suitable solution. The recreational WES localised in the riverside of Arno was also considered in a “critical status” due to the low level of maintenance. For this latter one, a River Basin Contract (RBC) framework was suggested as adequate tool to deal with this issue in the framework of the meeting realised in the fourth phase.

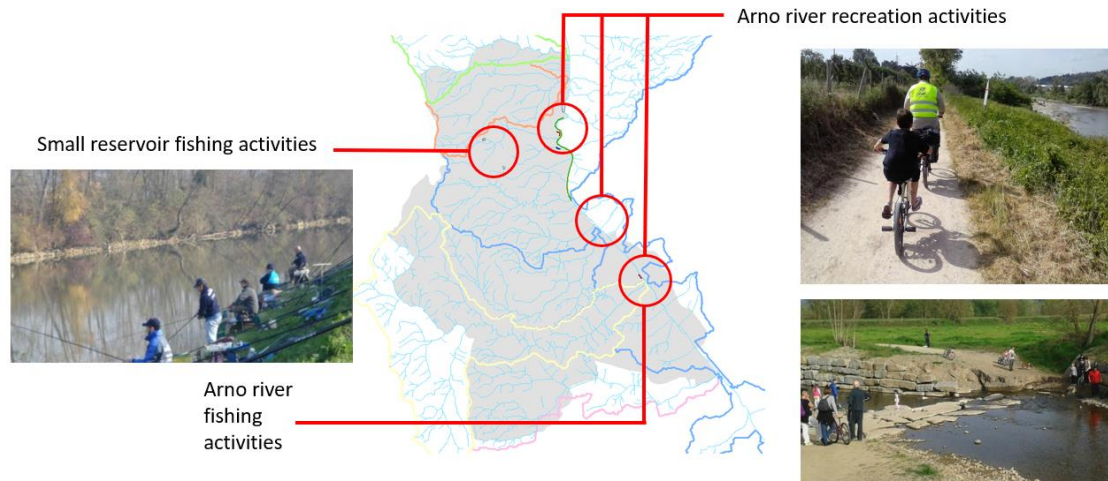


Figure 3. Cultural WES mapping. The Arno river is identified as the main hotspot due to the importance it has support recreation activities and the problem associated to its quality the limited the quantity of cultural WES provision. This figure is a graphic synthesis of the participatory mapping realized with a finer scale of details during the focus groups by digital mapping tools.

Discussion and conclusions

The present study highlighted how WES concept can facilitate an active dialogue between water management institutions and all the other stakeholders. The results of the participatory process allowed the identification of the main WES provided by the Arno river basin to FIV population, their participatory analysis, and the information of future policies for different management scenarios. The inclusive approach adopted in the present project enhanced the clear relationships between the citizens and the resources of the territory, highlighting their limits and potential. Water can be interpreted according to multiple scales of value: only understanding and seeking an ideal convergence between different scale of valuation can lead to an effective watershed management. Moreover, the present work served as a pilot implementation of the Regional Law for Participation 46/2013 of Tuscany Region, and at the same time as a support tool to the watershed development strategy of Arno River in integrating citizenship participation and ecosystem valuation, as prescribed by EU WFD.

Acknowledgements

This study was realized thanks to the funding provided by to Tuscany Region for local participatory processes (Regione Toscana- Delibera n. 36 del 30 agosto 2017). The authors want to thank Lorenzo Tilli and the Municipality of Figline e Incisa Valdarno for their willingness and dedication throughout the entire project implementation, and ReteSviluppo team (Bianca Cinelli, Marco Dugini, Carmelita Breccione Mattucci and Lapo Cecconi) who organized the focus groups and the communication activities.

The full reference of the study can be found at: <https://link.springer.com/article/10.1007/s11269-020-02684-4>

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