



UNIVERSITÀ
DEGLI STUDI
FIRENZE



WATER VALUES: 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)*

² *Department of Civil and Environmental Engineering (DICEA)*

Università degli Studi di Firenze

December 1st, 2020

Water related Ecosystem Services (WES)

- **Ecosystem Services (ES)** are defined as the “*conditions and processes through which ecosystems sustain and fulfill human life*” (MEA, 2005).
- **Water-related Ecosystem Services (WES):** “*the multiple benefits produced by the interactions between terrestrial ecosystems and freshwater as it moves through the landscape*” (Duku et al., 2015).

WES can be categorized into four classes:

- Supporting WES such as the support of vital estuaries and other habitats;
- Provisioning WES that include water supply for the different sectors;
- Regulating WES such as flow and sediment regulation;
- Cultural WES that are related to the provision of religious, educational and tourist values (Brauman, 2007).

Water related Ecosystem Services (WES)

Society produces transformation to the water-land system and reacts with adaptation to its evolution.

Thus, it is fundamental to:

- (1) Model and carefully evaluate the human-induced modification to the system** (land use change that impacts the green/blue water partition, sediment and flow regulation, water supply hydrogeological risk, water scarcity risk, etc.).
- (2) Analyze human perceptions of the surrounding environment** to highlight the extents to which local citizenship is aware of the WES utilized and their value.

Mixing these two perspectives open the road to a better understanding of the importance of the maintenance of the ecohydrological processes that support WES (Everard et al., 2009).

Objectives

The correct **evaluation of the value of WES** is **key to generate water management policies** targeting both ecosystem valuation and the integration of citizens participation within the management framework, as prescribed by **EU Water Framework Directive – Article 14**.

“Member States shall encourage the active involvement of all interested parties in the implementation of this Directive, in particular in the production, review and updating of the river basin management plans. [...]”

Objectives

- (1) to realize an assessment of WES** provided by water and land use setting in the territory of **Figline and Incisa Municipality**, within the river Arno basin in central Italy, based on GIS and participatory mapping analysis;
- (2) to carry out an analysis of the society perception** regarding the **value of water resources** in the territory by utilizing a WES framework; and
- (3) to develop a framework for the valuation of WES**, by integrating the results of objectives (1) and (2).

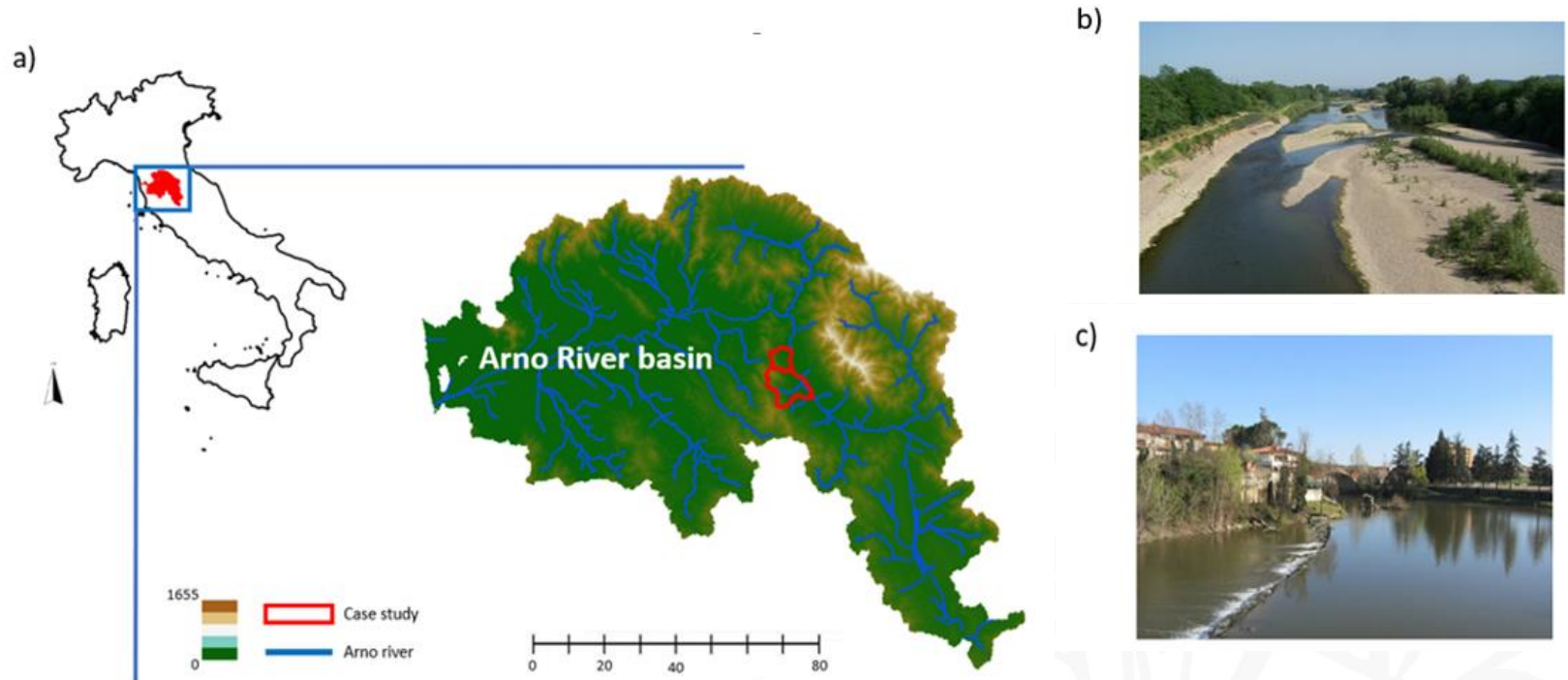


WATER VALUES

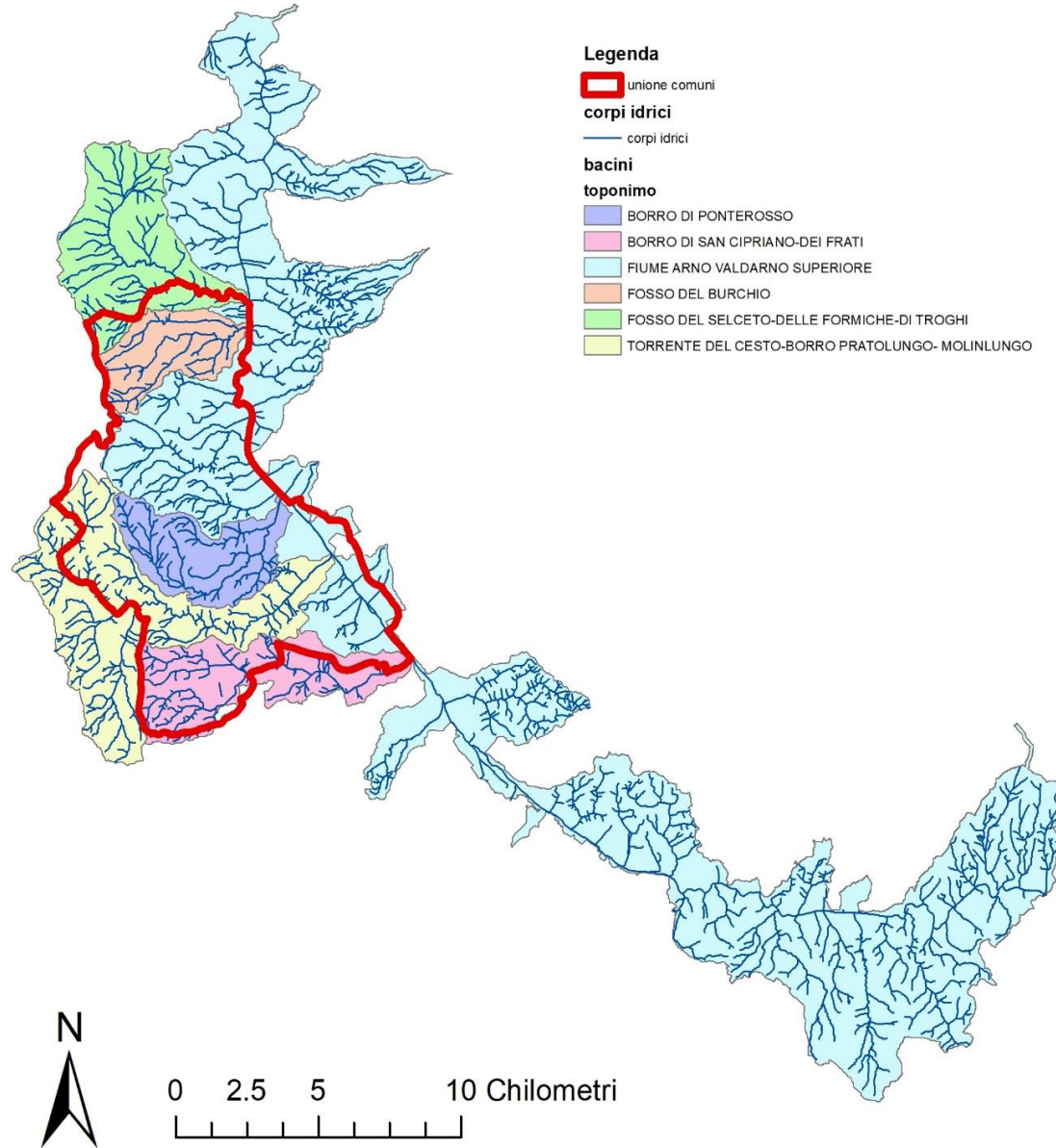
IL VALORE DELL'acqua

The project is financed by the Tuscany Region (Italy) in the framework of the Regional Law for Participation 46/2013 (15,000 E)

Materials and methods – Study area



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



Materials and methods



STEP 1 Preliminary phase

- Biophysical assessment
- Participation guide



STEP 2 Stakeholders identification



STEP 3 Focus groups

- WES inventory
- WES mapping



STEP 4 Participatory scenario analysis

- Critical WES evaluation
- Scenarios definition

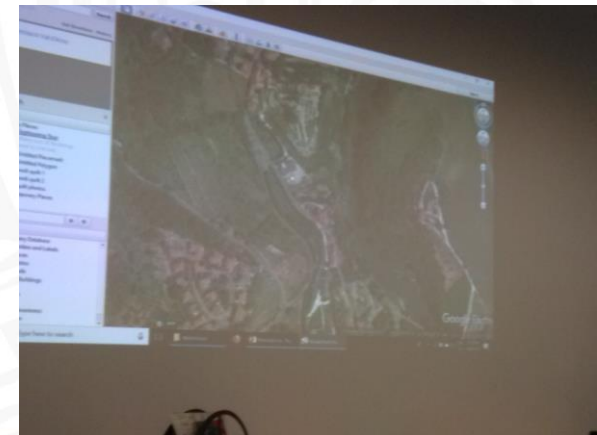
Focus Groups Discussions

Meetings with **key associations** working in the municipality:

- Civil protection
- Photographic club “Arno”
- Assembly of “Coop” members of Figline
- Senior centre “Il Giardino”

Framework of “**Community Champions**”: target those groups that, despite their marginalized role, have the **motivation to trigger a shift in governance starting from at a local level** (Lindsay et al. 2019)

Lindsay J, Rogers BC, Church E, Gunn A, Hammer K, Dean AJ, Fielding K (2019) The role of community champions in long-term sustainable urban water planning. *Water* 11(3):476



WES Inventory

Type of WES	Description	Production	Status	Criticism
Cultural	Recreational (fishery)	Lakes in the municipality	Green	
Cultural	Recreational (fishery)	River Arno	Red	Low quality of water
Cultural	Recreational (riverside)	Tributaries Arno	Green	
Cultural	Recreational (riverside)	River Arno	Red	Partial accessibility to riverside (downstream Incisa Area), Low quality of water
Cultural	Cultural value	River Arno	Red	Low quality of water
Provisioning	Antifire	Lakes in the municipality	Green	
Provisioning	Irrigation for private horticultures	Shallow wells in Arno aquifer	Green	
Provisioning	Irrigation for communal horticultures	Shallow wells in Arno aquifer	Green	
Provisioning	Drinking water supply	River Arno	Yellow	Lack of water during summer
Provisioning	Drinking water supply	Public fountains	Green	
Provisioning	Drinking water supply	Dams in upstream areas (Levane, La Penna)	Green	

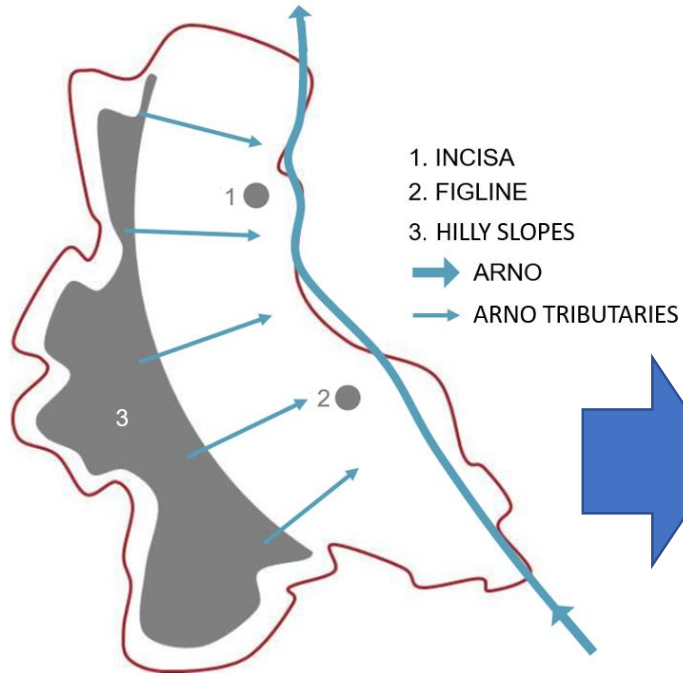
WES Inventory

Type of WES	Description	Production	Status	Criticism
Regulating	Climate regulation	Tributaries Arno		
Regulating	Erosion control	Weirs on tributaries Arno		
Regulating	Flood protection	Weirs on tributaries Arno		
Regulating	Flood protection	Dams in upstream areas (Levane, La Penna)		
Regulating	Flood protection	Drainage network		Low maintenance
Regulating	Flood protection	Land use setting		
Regulating	Flood protection	Tributaries Arno		
Regulating	Flood protection	Flood detention basins		
Regulating	Flood protection	Weir on Arno (Incisa)		
Support	Support to aquatic biodiversity	Weirs on tributaries Arno		
Support	Support to aquatic biodiversity	Arno		Low quality of water
Support	Support to biodiversity	Lakes generated by excavations		
Support	Water quality	River Arno		Low quality of water
Support	Water quality	Tributaries Arno		
Support	Water quality	Wastewater treatment plant		

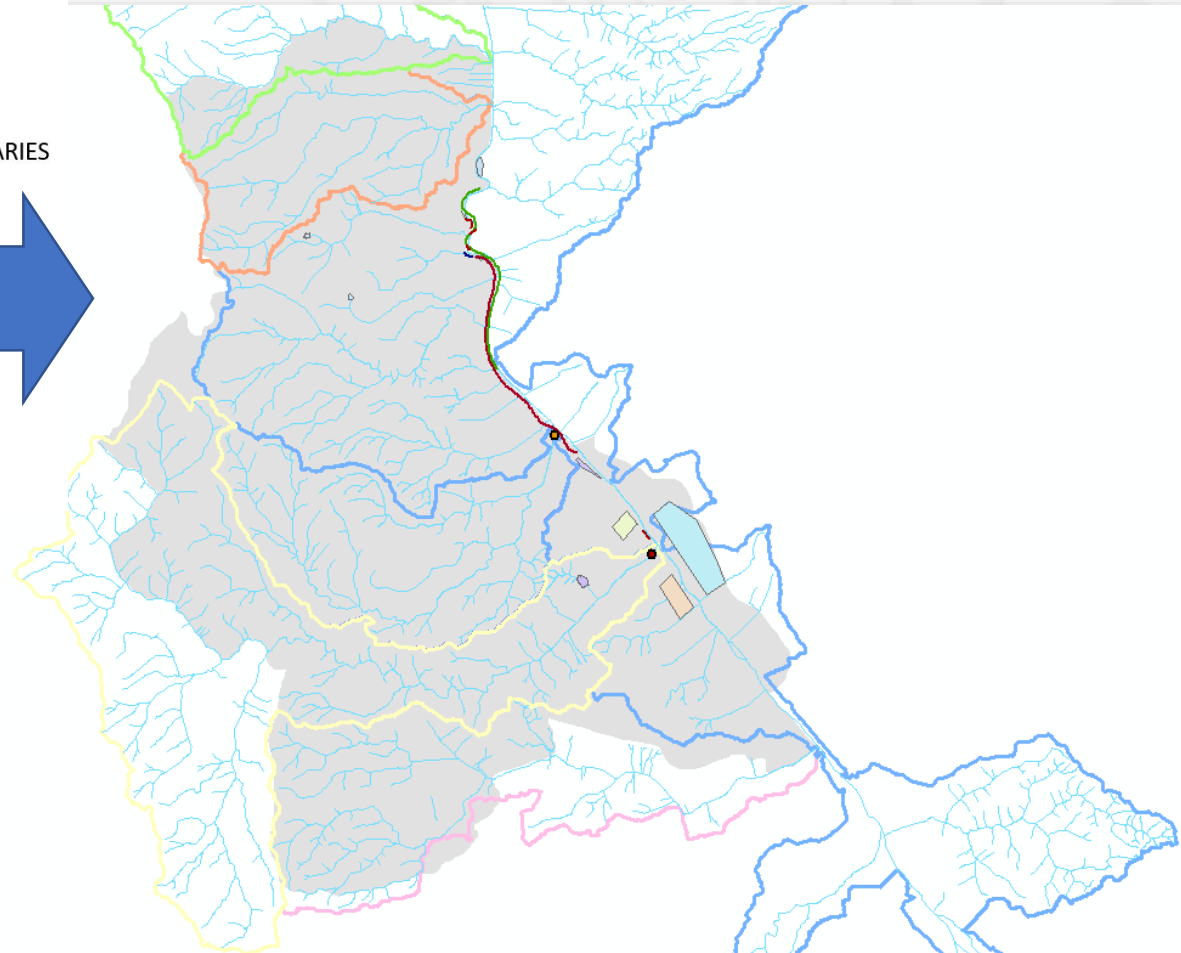
WES Inventory

Type of WES	Description	Production	Status	Criticism
Regulating	Climate regulation	Tributaries Arno		
Regulating	Erosion control	Weirs on tributaries Arno		
Regulating	Flood protection	Weirs on tributaries Arno		
Regulating	Flood protection	Dams in upstream areas (Levane, La Penna)		
Regulating	Flood protection	Drainage network		Low maintenance
Regulating	Flood protection	Land use setting		
Regulating	Flood protection	Tributaries Arno		
Regulating	Flood protection	Flood detention basins		
Regulating	Flood protection	Weir on Arno (Incisa)		
Support	Support to aquatic biodiversity	Weirs on tributaries Arno		
Support	Support to aquatic biodiversity	Arno		Low quality of water
Support	Support to biodiversity	Lakes generated by excavations		
Support	Water quality	River Arno		Low quality of water
Support	Water quality	Tributaries Arno		
Support	Water quality	Wastewater treatment plant		

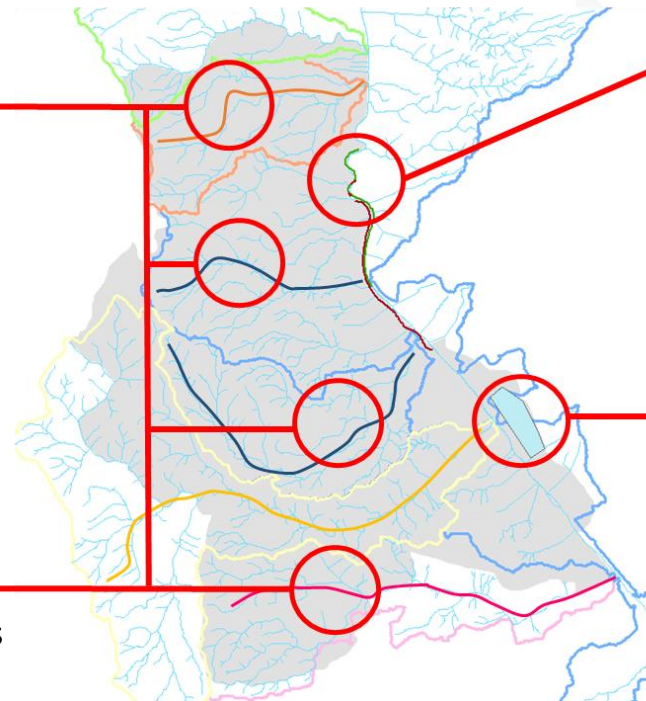
WES Mapping



Participatory mapping



WES Mapping – Regulating services



Check dams on tributaries



Weirs on Arno river



Arno river detention pond



Flow and climate
regulation role
of Arno tributaries

WES Mapping – Supporting services

Aquatic habitat provided
by tributaries

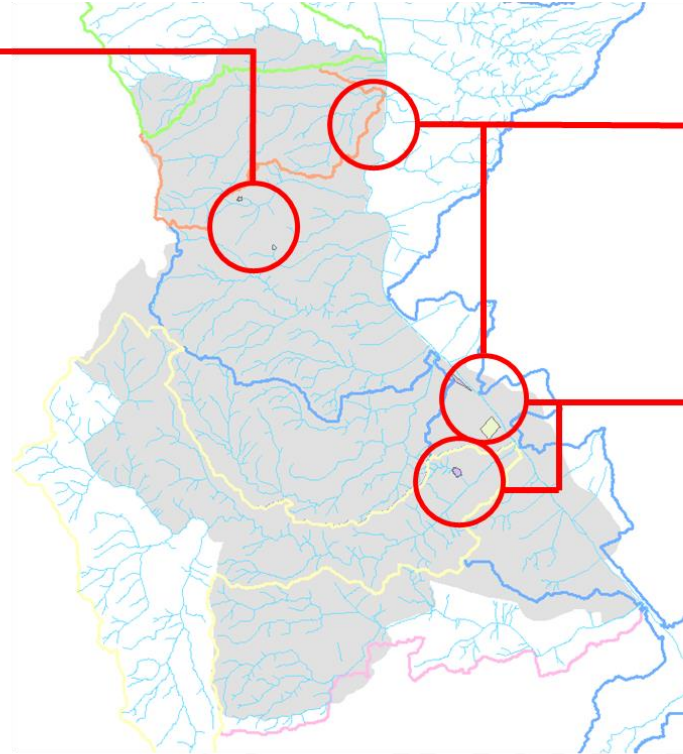


«Garzaia» artificial lakes, now
providing habitat for various species



WES Mapping – Provisioning services

Fire protection lakes



Public water
drinking fountain

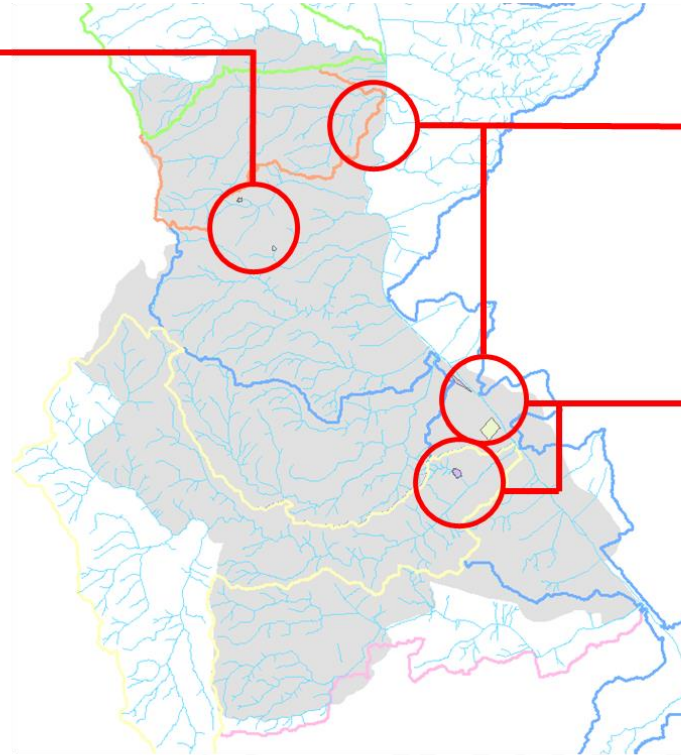


Social horticulture



WES Mapping – Provisioning services

Fire protection lakes



Public water
drinking fountain



Social horticulture

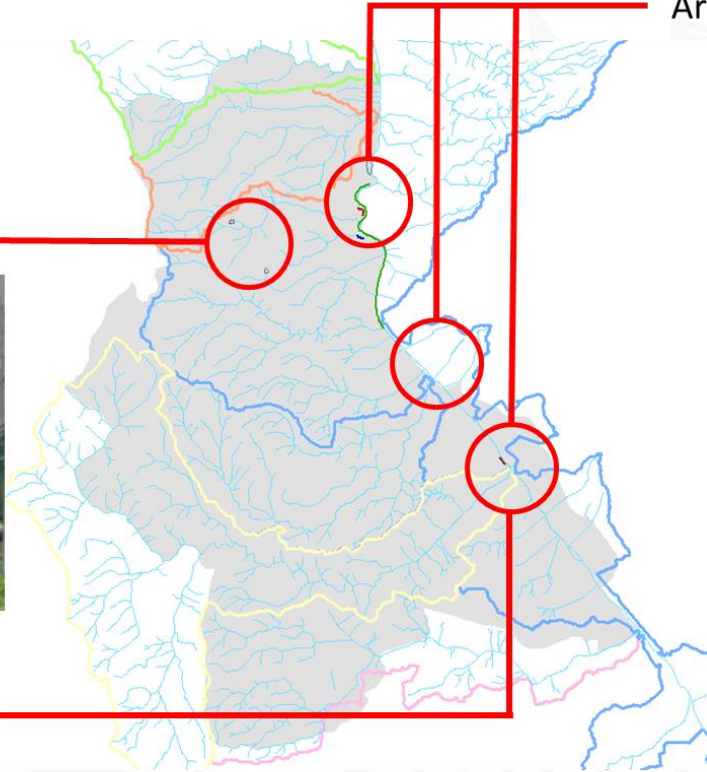


WES Mapping – Cultural services

Small reservoir fishing activities



Arno river
fishing
activities



Arno river recreation activities



Participatory WES Scenario Analysis

Plenary meeting, involving:

- Participants of focus groups (representatives)
- Citizenship (other participants, the meeting has free access)
- Technical experts (University, Environmental Groups/associations, governing bodies)
- Technical personnel from the municipality



WES scenario analysis

Type of WES	Description	Production	Status	Criticism
Cultural	Recreational (fishery)	River Arno		Low quality of water
Cultural	Cultural value	River Arno		Low quality of water
Support	Support to aquatic biodiversity	River Arno		Low quality of water
Support	Water quality	River Arno		Low quality of water
Cultural	Recreational (riverside)	River Arno		Partial accessibility to riverside (downstream Incisa Area), Low quality of water
Provisioning	Drinking water supply	River Arno		Lack of water during summer
Regulating	Flood protection	Drainage network		Low maintenance

WES scenario analysis

Potential management actions to be implemented

Type of WES	Description	Production	Status	Criticism
Cultural	Recreational (fishery)	River Arno		Low quality of water
Cultural	Cultural value	River Arno		Low quality of water
Support	Support to aquatic biodiversity	River Arno		Low quality of water
Support	Water quality	River Arno		Low quality of water
Cultural	Recreational (riverside)	River Arno		Partial accessibility to riverside (downstream Incisa Area), Low quality of water
Provisioning	Drinking water supply	River Arno		Lack of water during summer
Regulating	Flood protection	Drainage network		Low maintenance

Low quality status:

- Already known by River Basin Authority Assessment
- The perception of the problem justifies additional investments and **Payment for ES approach**

Recreational WES on riverside:

- Well developed only in Figline upstream area
- Justifies and **encourage investments**
- **River Basin Contract** suggested

To be verified with additional hydrological and on-field analyses

Discussion and conclusions

There DO IS a request of participation for Natural Resources Management, it has to be channelled:

- Initially we proposed to undertake WES inventory and mapping in **one single meeting at the municipality, with scarce results**
- **By joining local associations' ordinary meetings**, each association per time, we obtained enthusiasm, commitment and average of > 10 people per meeting [9.5 officially registered]

Different groups shows different perceptions:

- Senior club: enhance WES on flood protection (memory of historical 1966 Arno flooding)
- Civil Protection: Antifire function

Discussion and conclusions

Suitability of WES concept

- WES concept was understood with limited efforts by **all the participants to the process**, including also elderly people of people with disabilities
- It allowed an **holistic evaluation** of the water role, providing a sound knowledge base for the integration of **citizenships' perspectives in land and water management planning**


Practical outcomes

- **Low quality status** problems were well-understood by local population, justifying **Payment-for-ES approach**
- Municipality revealed that downstream Incisa riverside was not used by population, but **only by discussing with the population, a strong interest for riverside development was evident. A River Basin Contract scheme** could be put in place for funding the maintenance operation

Project Dissemination and exploitation

Open Access | Published: 12 October 2020

Water Values: Participatory Water Ecosystem Services Assessment in the Arno River Basin, Italy

T. Pacetti , G. Castelli, E. Bresci & E. Caporali

Water Resources Management **34**, 4527–4544(2020) | [Cite this article](#)

731 Accesses | 1 Citations | 2 Altmetric | [Metrics](#)

<https://link.springer.com/article/10.1007/s11269-020-02684-4>

Guidelines for WES participatory analysis



Scientific dissemination

Dissemination through think tanks and foundations

(Fondazione Feltrinelli)

<https://fondazionefeltrinelli.it/schede/10-idee-per-comunita-sostenibili-buone-pratiche-per-una-gestione-intelligente-della-risorsa-acqua/>





UNIVERSITÀ
DEGLI STUDI
FIRENZE



THANK YOU FOR YOUR ATTENTION

CONTACTS

Giulio Castelli

Research Fellow (Ricercatore)

E-Mail: giulio.castelli@unifi.it

TWITTER: @GiulioCst

Water Values Project Information: <http://bit.ly/2FVLm5M>



UNIVERSITÀ
DEGLI STUDI
FIRENZE

DAGRI
DIPARTIMENTO DI SCIENZE
E TECNOLOGIE AGRARIE,
ALIMENTARI, AMBIENTALI E FORESTALI

