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Call for Proposals “Halting Desertification in Europe”

Pilot Arno Water Accounts

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PAWA team

PAWA is a 15-month pilot action (Jan. 2014–Mar. 2015) that aims at improving knowledge on water resources available in the Arno River basin (NW Italy) and their use and assessing the potential impact of management, technological and economical measures to reduce the territory vulnerability against water scarcity and drought.

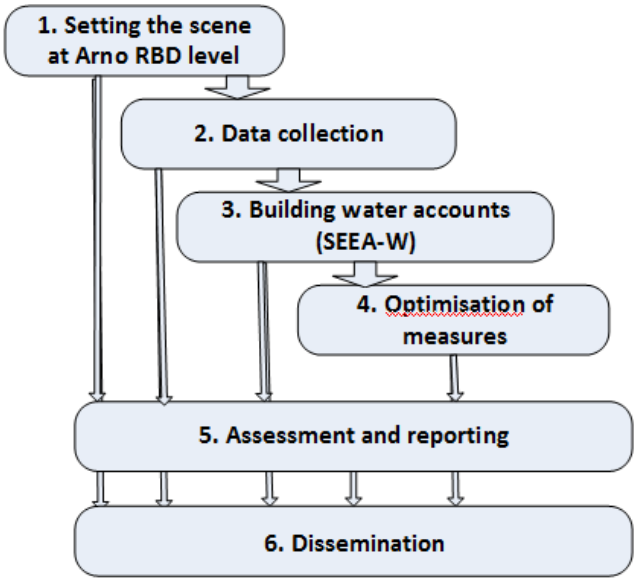
ISPRA is the technical-scientific branch of the Italian Ministry of Environment. It operates within the Environmental Agencies System, composed of 20 Regional and 2 Provincial Agencies according to a federative system combining direct knowledge and experience of local environmental issues with national and European policies (incl. EU WFD 2000/60/EC; EU Floods Dir. 2007/60/EC; WS&D Comm.) for environmental prevention and protection.

Since 1989 the Arno River Basin Authority (one of the six River Basin Authorities of National Relevance Relevance) has been carrying out programming and planning activities on land protection and water resources management. In recent years, ARBA has been entitled, in accordance with the EU WFD, to draft the RBMP for the Northern Apennines River Basin District and to coordinate the implementation activities as regards to the EU Floods Directive.

SEMIDE/EMWIS is an initiative of the Euro-Mediterranean Partnership (EUROMED) that provides a strategic tool – the only one operational nowadays – for exchanging information and knowledge in the water sector between and within the EUROMED countries. In the framework of the WGs of the Mediterranean Joint Process between the EU Water Initiative and the EU WFD, EMWIS is also working on know-how exchange for specific themes selected by the EUROMED water directors.

Project

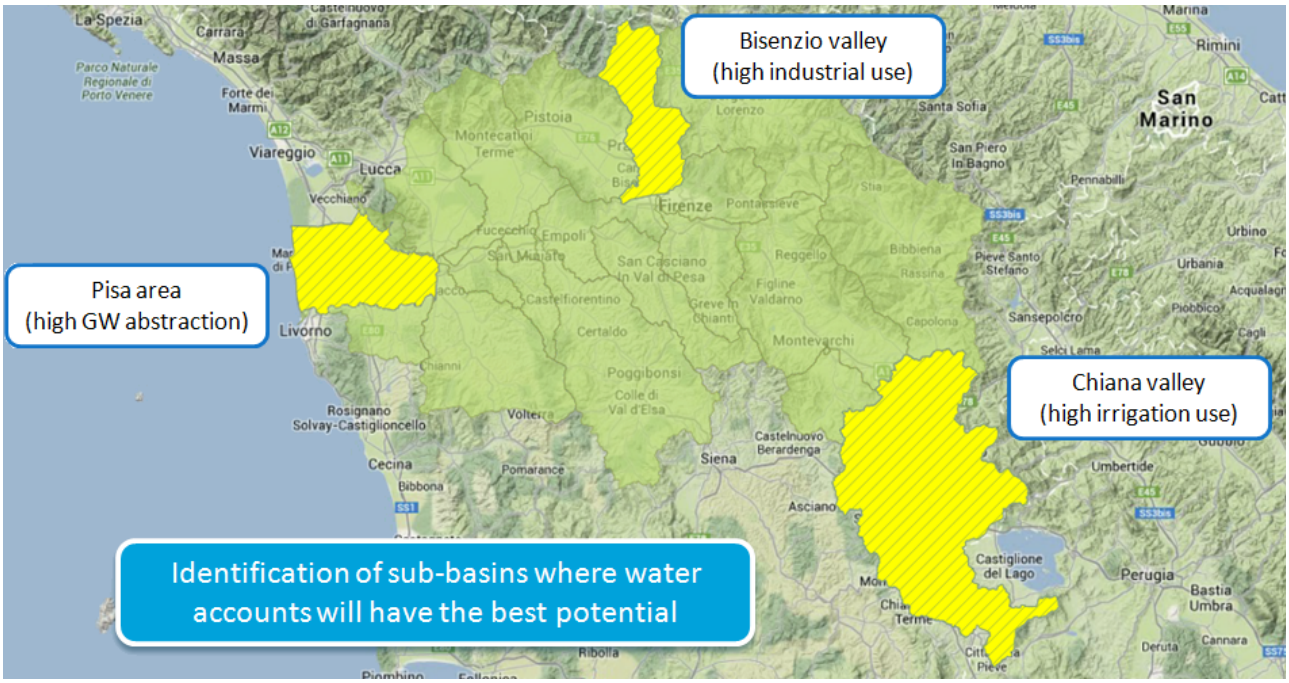
The PAWA project is composed of 4 successive technical activities and 2 horizontal activities as presented in the figure.



The analysis was focused on three specific sub-basins within the larger Arno watershed (8228 sq km), so that the System of Environmental-Economic Accounting for Water (SEEA-Water) could be thoroughly investigated by testing its application on areas characterized by different water exploitation issues:

- Chiana valley (1373 sq. Km)
- Bisenzio valley and Prato plain (hydr. Basin of 320 sq. km + Groundwater 90 qs. km)
- Pisa area (407 sq. km)

These sub-basins have been identified using the following criteria: vulnerability to drought and water scarcity; data availability and water governance structure. Nonetheless, data collection and modelling tools took the whole Arno river basin as reference area.



Aims

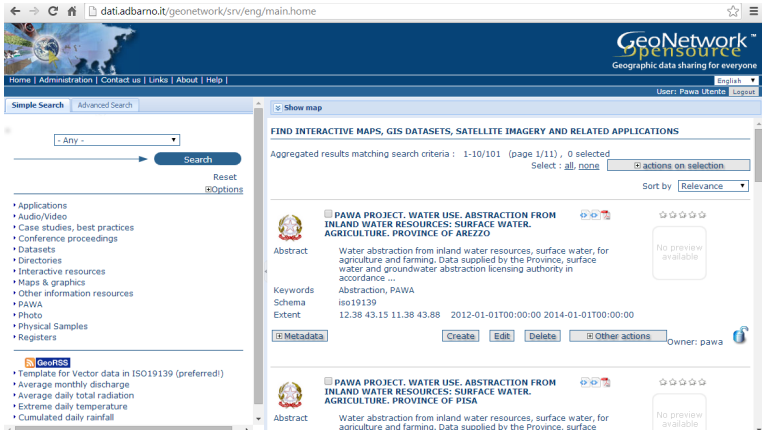
- Production of physical water accounts following the SEEA-W framework using the best available data coming from field measurements or resulting from models when necessary. In order to identify trends water accounts were calculated at monthly scale for several past years. The geographical resolution will be based on the ECRINS reference system. The quality of each dataset will be assessed using a simple scorecard based on the estimated accuracy of the data source.
- Elaboration of visualization products (e.g. graphs and maps) based on the water accounts for decision making and concertation with local stakeholders in the basin, according to international standards applied to spatial data infrastructures.
- Use of water accounts to assess the potential impact of combining various measures related to water resources efficiency in the most vulnerable sub-basins and test their acceptability during a workshop with stakeholders.
- Definition of water efficiency targets for potential future integration into Arno River Basin Management Plan.
- Dissemination of project results and share experiences with other basin organizations and water authorities in Italy as well as in the Euromed area.

Data

For each investigated area the following datasets were gathered: meteorological, hydrological and water abstraction/restitution data. Other information regarded leakages, water supply and abstraction licenses costs.

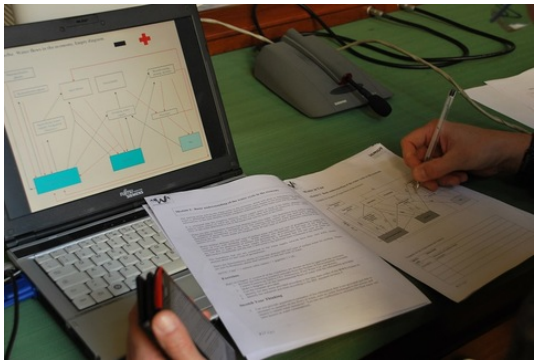
Data were organized in a geo-referenced database; each data set with different accuracy level and spatial-temporal resolution was documented in accordance with INSPIRE requirements.

In order to make the inventory of all relevant datasets available to compile water accounts, the partners proposed to set up an INSPIRE compliant metadata catalogue.



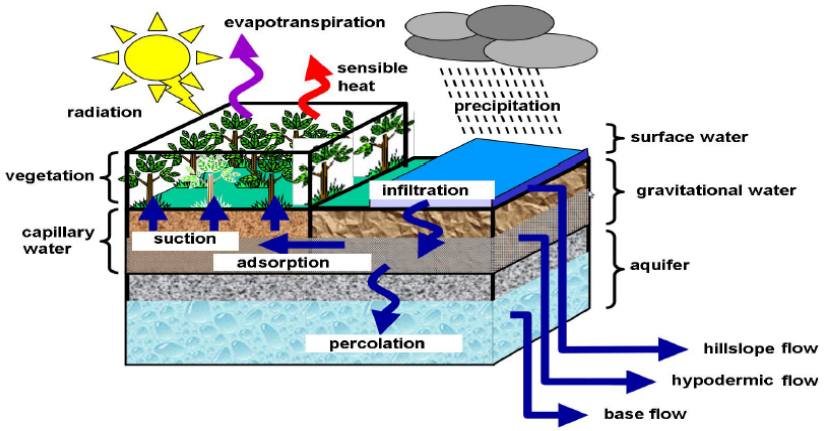
Stakeholder involvement

The participation of the stakeholders of the investigated areas to the different project's phases was pivotal to achieve the implementation aims and the desired outputs. The project saw the large participation of data providers, local water utilities, water associations which all cooperated in an active way. In particular the coooperation with the local Provinces of Arezzo, Florence, Prato and Pisa and the water utilies: Publiacqua, Nuove Acque and Acque Spa in terms of data supply and decision making support was particularly fruitful. Meetings were organized in order to share experiences on water balance issues, to test the potential application of SEEA-W tables and to discuss of project's deliverables at different stages.



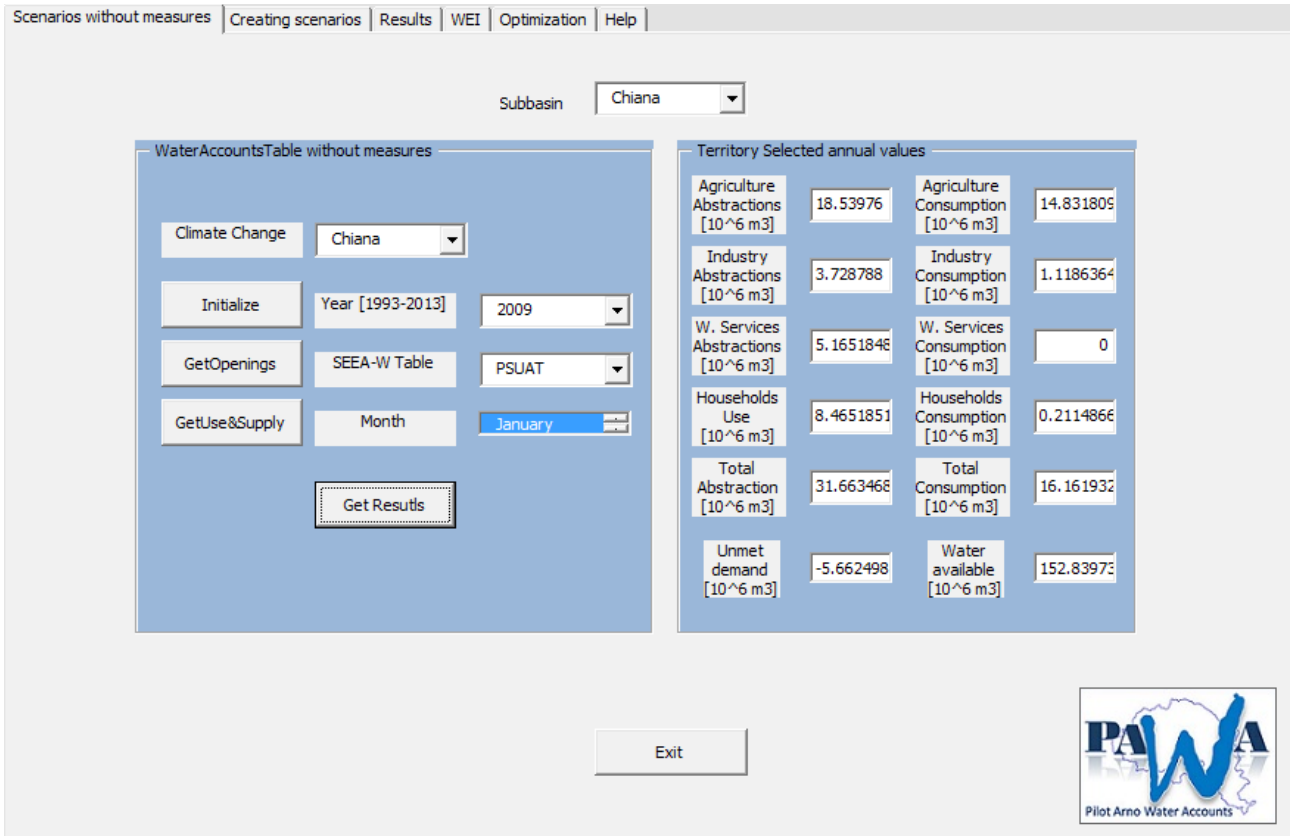
Tools

A distributed hydrological model was used in order to obtain physical water asset accounts values. The MOBIDIC-WRM (Water Resources Management) tool is a physically-based model that allows the estimation of the elements of the hydrological balance in the sub-surface layer, the soil-vegetation system and surface water bodies.



A lumped groundwater model was used in order to obtain monthly data of aquifers' water quantities and exchanges. Both models helped to have detailed information and consistent estimations of the physical quantities.

A VBA tool was produced by the project's partners to automatically compile the SEEA-W PSUAT tables and the Assets accounts tables. Thus, it was possible to perform the tables' compilation and graphs' production in a quick and reliable way directly using the data stored in the geo-database.



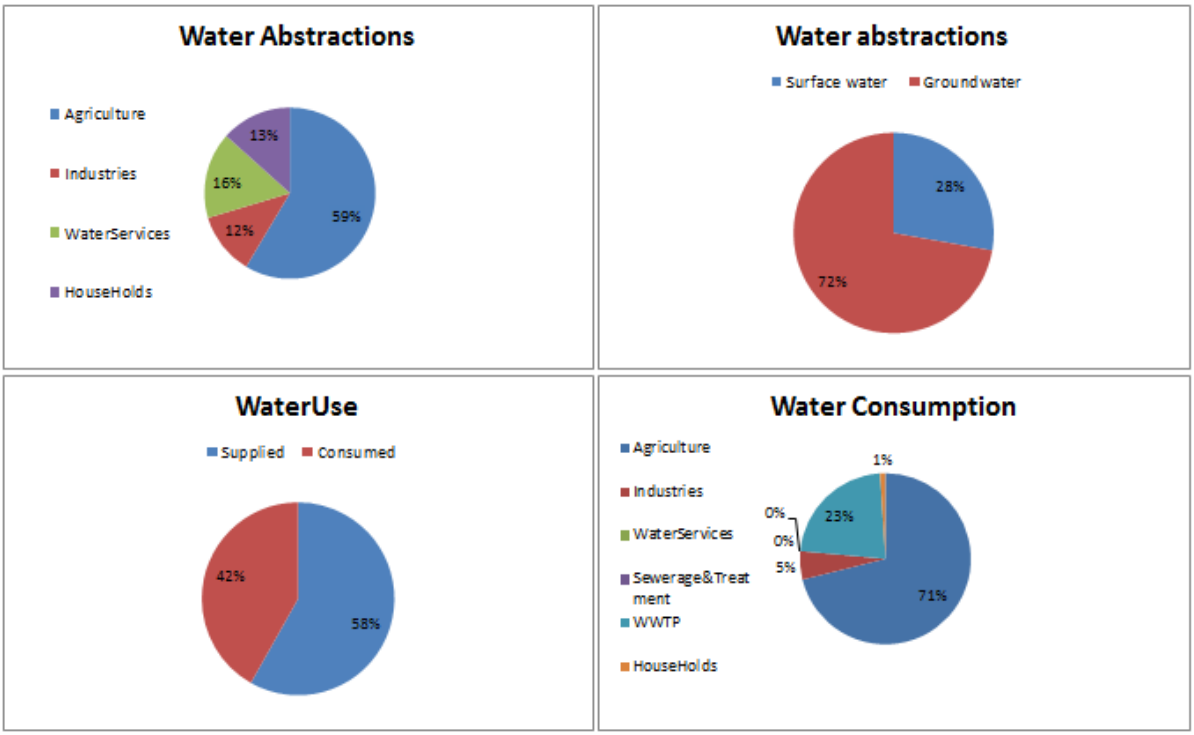
This tool allows a lot of time saving when comparing different scenarios and it helps decision making to find the best set of measures to be implemented in the different territories, in order to reach specific water saving targets.

Results

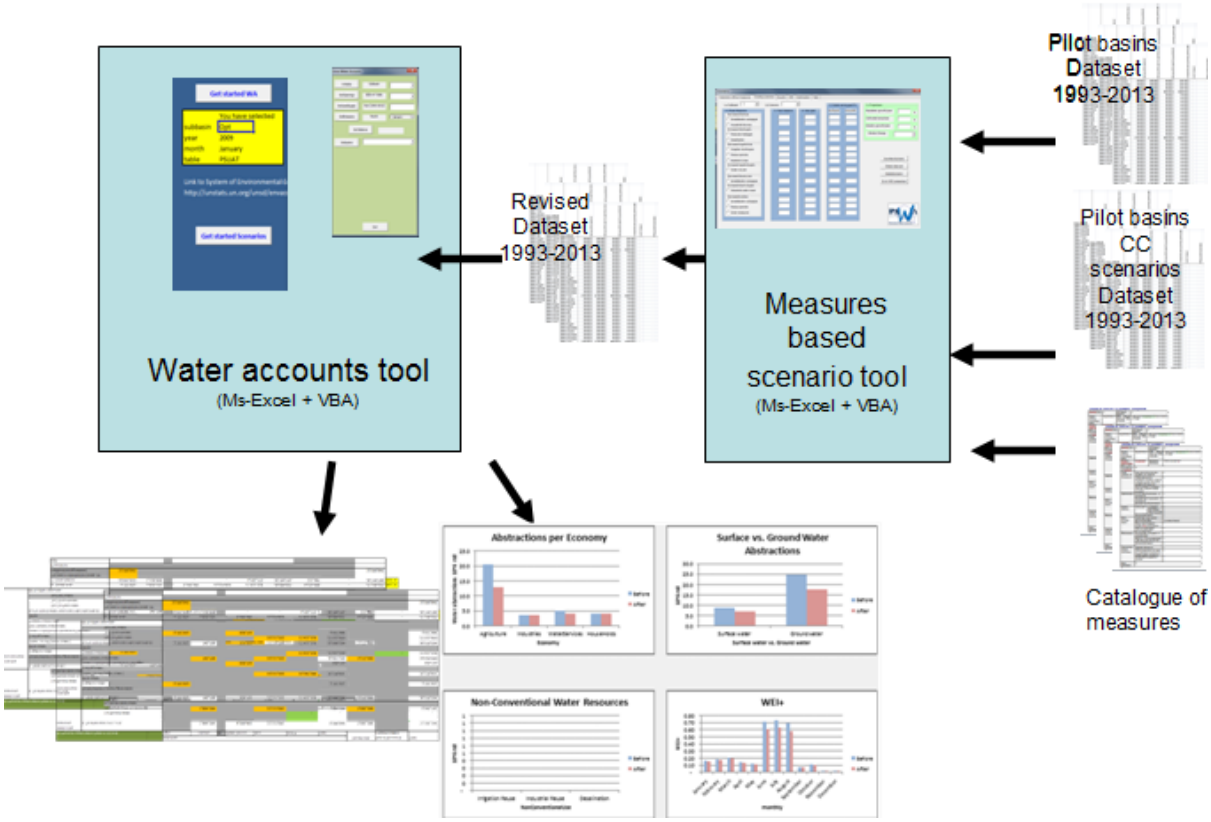
Results are expressed in terms of monthly tables (Physical Supply and Use, Assets Accounts) or graphs (bar plots or pie charts).

Chiana December 2012 Water Asset Accounts Table

Chiana / Asset accounts (Table VI.1) [m3]	EA.131 Surface water: EA.1311 Artificial reservoir	EA.1312 Lakes	EA.1313 Rivers	EA.131 SurfaceWater	EA.132 Groundwater	EA.133 Soil water	Total
1. Opening stocks	-	5,880,000.0	-	-	535,026,564,743.3	-	535,032,444,743.3
Increases in stocks			-	2,368,911.5	4,970,605.8	83,781,801.0	91,121,318.3
2. Returns				2,368,911.5	361,796.6		2,730,708.1
3. Precipitation						83,781,801.0	83,781,801.0
4. Inflows			-	-	4,608,809.2		4,608,809.2
4.a From upstream territories					1,235,000.0		1,235,000.0
4.b From other resources in the territory					3,373,809.2		3,373,809.2
Decreases in stocks		90,140.4	41,457,657.6	612,998.9	2,517,998.9	9,571,216.7	53,637,013.7
5. Abstraction		90,140.4		612,998.9	1,905,000.0		2,608,139.3
6.Evaporation/actual evapotranspiration						6,197,407.5	6,197,407.5
7. Outflows			41,457,657.6		612,998.9	3,373,809.2	45,444,465.8
7.a To dowsntream territories			41,457,657.6				41,457,657.6
7.b To the sea							-
7.c To other resources in the territory					612,998.9	3,373,809.2	3,986,808.2
8. Other changes in volume							325,458.4
9. Closing stocks		5,789,859.6			535,029,017,350.2		535,107,738,811.0
10.Balance	-	5,789,859.6	- 41,457,657.6	1,755,912.5	2,452,606.9	74,210,584.3	75,294,067.7



The production of a list of standard indicators (like WEI+) allows the comparison between different scenarios of measures' implementation in a changing climate, allowing a direct evaluation of their efficiency and robustness.



Different hypotheses of a “Programme of Measures” with the goal of improving the

flow regime were tested. The set of measures was tested by comparing a list of indicators derived from SEEA-W tables ("before/after"), using different climate change scenarios. The choice of the selected measures in the different test areas depended on the needs highlighted as regards to the environmental status of the main water bodies, as reported in the River Basin Management Plan.

Open issues

The Water Accounts System appear to be a good decision support tool to define the most suitable water efficiency measures for a selected area.
In the process of defining the best set of measures to achieve water efficiency targets using the WA tables and the supporting tool developed, some limitations and potential improvements have been identified.

- Part of data are based on approximation or on expert estimations; therefore, a percentage inaccuracy and uncertainty remain.
- The uncertainty is higher for abstraction volumes in agriculture. The total amount of irrigation groundwater losses and evapotranspiration get affected because their value depends on the irrigation use.
- Multi-year trends have not been investigated because of the limited extension of temporal series for abstraction and restitution data.
- The optimization process, implemented through iterative steps with different sets of measures could be automated by means of a new software development to reach an unmet demand equal zero with the best combination of criteria such as cost, water saving and socio-environmental benefits.
- For economic analysis and decision making, the use of the Hybrid Economic Accounts Table could be very valuable. The collection of such economical data should also be analyzed and tested in the future.

More information on: http://pawa.emwis.net