Preparatory Action on Development of Prevention Activities to Halt Desertification in Europe
Halting desertification in Europe – 2012

HALT-JÚCAR-DES

Halting Desertification in the Júcar River Basin

21/12/2011 – 21/03/2013 - www.emwis.net/initiatives/desert-jucar

Background / context of the project

Water accounts (WA) defined by the UN (**SEEA-W**: Systems of Environmental and economic accounting for Water) provide a very valuable tool for quantitative water management, in particular for drought management and to fight desertification. The purpose of the SEEA is to explore how sets of statistical accounts can be compiled which will permit investigation and analysis of the interaction between the economy and the environment. The paramount ambition of the SEEA is to allow links to be made to economic series which impose first and foremost to harmonize the environmental data, with the likely simplifications that are required. The SEEA-W has been designed to link the economic information, that makes explicit how much and by which ways water taken from the environment is being used as economical component, with hydrological information in order to provide the users with a tool for integrated analysis. The SEEA-W takes the perspective of the economy and looks at the interaction of the economy with the hydrological system. Its implementation is educated by manual, the IRWS (International Recommendations for Water Statistics), issued in 2009 and was used as basis for implementing the SEEA-W at the European level. It completes the basic concepts and distinguishes the inland water resource system that mimics the hydrological cycle in the environment and the economy. The economy part relates to the inland water resource systems by abstractions from and returns to the environment. The main interest of SEEA-W is to provide a standard approach and therefore the possibility to compare results between different areas. Thus, the EC together with the European Environment Agency (EEA) have initiated the preparation of physical water accounts (i.e. water balances) at river basin level for all the EU territory, using a systematic approach based on existing datasets collected at EU level. To achieve this objective is was necessary to develop an EU wide homogeneous reference hydrographic network called **ECRINS** (European catchments and RIvers network System). ECRINS is a fully connected system of watersheds, rivers, lakes, monitoring stations, dams at the EU level, made from previous work of the Joint Research Centre (JRC) and validated with Member States. Functional Elementary Catchment areas have been defined to comply with hydrology requirements and possible aggregation with administrative units, thus making possible to link socio-economic information with hydrologic data. Through WISE there are publicly available data sets reported under the WFD and which end host is normally ECRINS.

On the other hand, the communication "**Blueprint to safeguard Europe's water resources**" is a EU policy that outlines actions that concentrate on better implementation of current water legislation, integration of water policy objectives into other policies, and filling the gaps in particular as regards water quantity and efficiency. The objective is to ensure that **a sufficient quantity of good quality water** is available for people's needs, the economy and the environment throughout the EU. The Water Blueprint's time horizon is closely related to the EU's 2020 Strategy and, in particular, to the 2011 Resource Efficiency Roadmap, of which the Blueprint is the water milestone. However, the analysis underpinning the Blueprint covers a longer time span, up to 2050, and is expected to drive EU water policy over the long term.

The Blueprint and related assessments have demonstrated that there are still important knowledge gaps and failures in the dissemination and proper integration into decision making. Hence, one of the building blocks of **the Blueprint follow up activities** was to deal with **the water balances** and its reference situation water availability and demand. In this context, a contract for DG ENV with technical support from EEA was launched, based on UN SEEA-W (nicknamed “European water accounts”) methodology and shift from year /country (being carried out up to now in the reporting processes related to the EU-WFD) to Month /sub-basin levels. Its main objectives were: i) to analyze the regional interdependencies; ii) to support EU policies; and iii) to identify inconsistencies between datasets (across countries, sectors, reporting processes, etc.). The EEA has contributed by providing the reference system ECRINS, climatic data, river run-off (collected data) and a large support in human population and urban / domestic water uses.

Making the water accounts operational require defining the space resolution and the time resolution. Most past applications of the SEEA-W resulted in nation level and year aggregates. In the case of the European implementation, these simplistic resolutions were adjusted, after analyzing the key constraints of water accounting that are summarized as:

- Water is not like money, it can be spared, not loaned; hence the time resolution must be short enough to identify water demand and resource that may temporarily match. The monthly step has been chosen because being the best compromise between soundness and feasibility;
- Water can not be transferred without physical device. Hence the area of accounting must be spall enough to make water needs and water resource adding and subtracting. If special piping is required, it is a transfer, not plus and minus in the I/O table. The sub-basin area (a few 10 000km^2) has been taken as territory of reference & the elementary components of catchments (**FEC**s: Fundamental Elementary Catchments)as “statistical units”.

Different data sources are collected, processed, completed or just modeled to carry out water accounts computation. This computation is the first full scale water balance under the SEAA-W carried out at the EU level. Some data sources have a high level of coverage and reliability, other ones are highly modeled. The purpose of this description is to raise awareness of member States experts on the rationales used for this task.

The current project came up as one of the 3 winning projects of the call for projects launched by the EC DG Environment under the title: “Preparatory action — development of prevention activities to halt desertification in Europe.” This call aimed at addressing and mitigating the most relevant data gaps (as well as methodological gaps induced by the absence of data) so that water balances can be established at sub-catchment level for the whole EU with at least the level of confidence achieved in the group of best documented basins to allow better comparability across Europe. It should as well validate those components of the water balance that could not be finalized because of these data gaps. The present project should also contribute to the efforts of the DG Environment towards the design and prototyping of a permanent and cost-effective process for the production of water balances, improving the interaction between reconstructed and reported data.

This exercise **at the EU level** aims at carrying out **a comparative study between EU river basins** in terms of their **water accounts tables in a monthly basis**, which will facilitate **the WFD reporting data processing**. The concrete objective of the current project is to produce a revised and complete water resource balance with monthly resolution at sub-basin level in the Spanish River basin: the Jucar. Hence, the pilot action developed on the Jucar River Basin District, over 15 months, focused on the preparation of water accounts using data available at local level. Thus, the Halt-Júcar-Des project has provided an opportunity to test and check the feasibility of applying the SEEA-W to produce water accounts in the Júcar River Basin District. While the part of data gathering and processing took time and was more complex than expected, results have shown to be promising and have proven to be quite useful.

Project summary

The Coordinating entity is the Spanish Consulting firm **Evaluación de Recursos Naturales, S.A. (EVREN)**, and the main partner is the **Euro-Mediterranean Information System on know-how in the Water sector (EMWIS/SEMIDE)**. In addition, the **Júcar River Basin Authority (CHJ)** acts as a collaborating entity to ensure the coherence of data compilation and assessment. This action aims at obtaining and assessing socio-economic, environmental and climatic data, develop updated water accounts according to water availability and existing demands in the Júcar River Basin district, all which would allow assessing existing desertification risks. It is intended, through management and water savings recommendations, to contribute to halting water scarcity, drought and desertification in the basin. The specific objectives initially set included:

- Compile & assess data (flows, precipitation, evapotranspiration, climatic, groundwater levels, demands..) and adapt them to ECRINS developed by the EEA; and to the SEEA-W.
- Propose a methodology for the management of data and their integration in the aforementioned systems.
- Obtain updated water accounts and detect desertification risks in the basin.
- Assess results and transmit them to managers & stakeholders through a participative process.
- Establish a series of recommendations for feasible water savings options and management measures targets.
- Transfer and disseminate results to EU and non-EU Mediterranean countries.

Results

The results obtained have helped to assess, in a retrospective way, water availability, abstractions for economic uses, and storage capacity of specific elements within the system (reservoirs, lakes, groundwater bodies) and to analyse the pertinence of water management practices during the last years. By assessing a whole decade, relevant episodes were easily highlighted in the data series and general trends were discerned. For instance, the severity of the drought episode that took place in 2005-2006 is reflected in most variables. The progressive abandonment of rain-fed agricultural areas and the decrease in abstractions for agricultural practices are also palpable.

	Element					
Variable	**1311 Reservoir**	**1312 Lakes**	**1313 Rivers**	**132 Groundwater**	**133 Soil**	**Total**
StateInitial	**942**	**0**	**1 412**	**1 840**	**5 189**	**9 383**
ReturnHydropower			674			674
ReturnIrrigation			28	63		91
ReturnUrbanSupply			44			44
Precipitation	4	0	6		2 047	2 057
FromArtificialReservoirs			140			140
FromGW			202			202
FromRivers	128			53		181
FromSoilWater			44	159		203
Evapotranspiration	-4	0	-6		-1 452	-1 463
AbsHydropower			-674			-674
AbsIrrigation			-131	-155		-286
AbsRainFedAgr					-460	-460
AbsUrbanSupply			-3	-56		-59
ToArtificialReservoirs			-128			-128
ToGW			-53		-159	-212
ToRivers	-140			-202	-44	-386
ToSeaTotal			-122	-56		-178
OtherLosses			-17			-17
Final State	**929**	**0**	**1 417**	**1 645**	**5 121**	**9 112**

Table 1. **Example of water accounts table for Mijares-La Plana de Castellón Water Management System for year 2001. Values are in hm^3. Source: EVREN, 2013.**

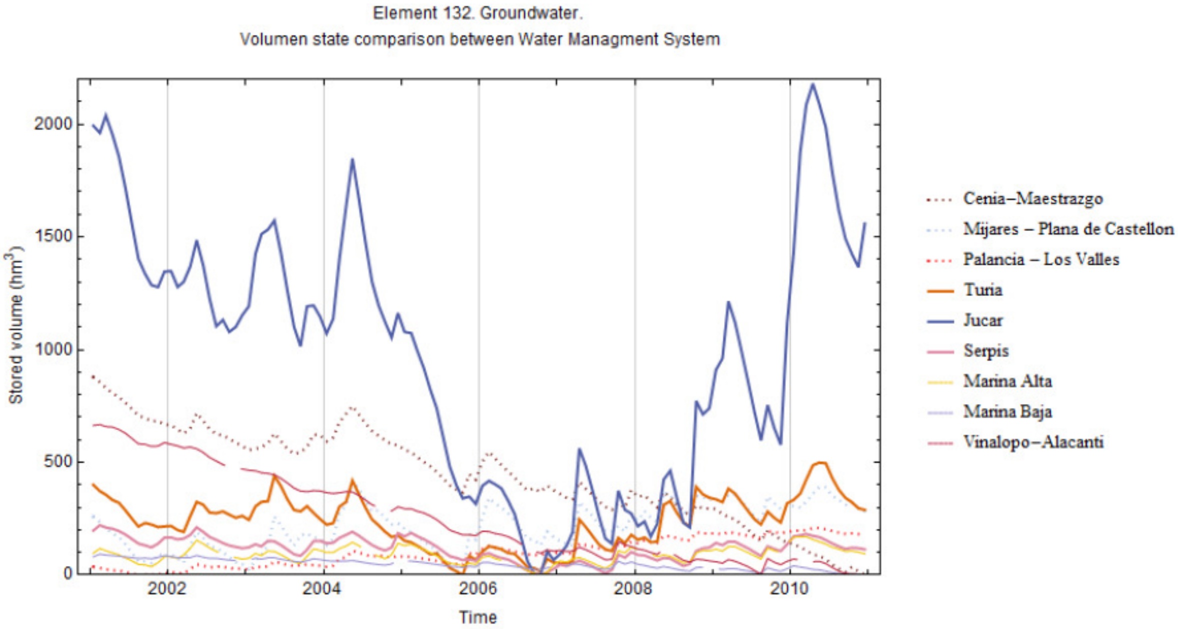

Figure 1. **Graph of evolution of storage state of element groundwater, comparison between distinct WMS. Values are in hm³. Source: EVREN, 2013.**

The project demonstrates the benefits of building a consistent framework for physical water accounts at EU level with a high degree of geographical, temporal and sectoral accuracy, for the consistency of data collection, the development of water accounting methodologies and the assessment of water balance and water efficiency. This will allow the setting up of a new Water Exploitation Index (WEI+), as agreed by the Water Directors at the above-mentioned meeting, and the improvement of water resource indicators.

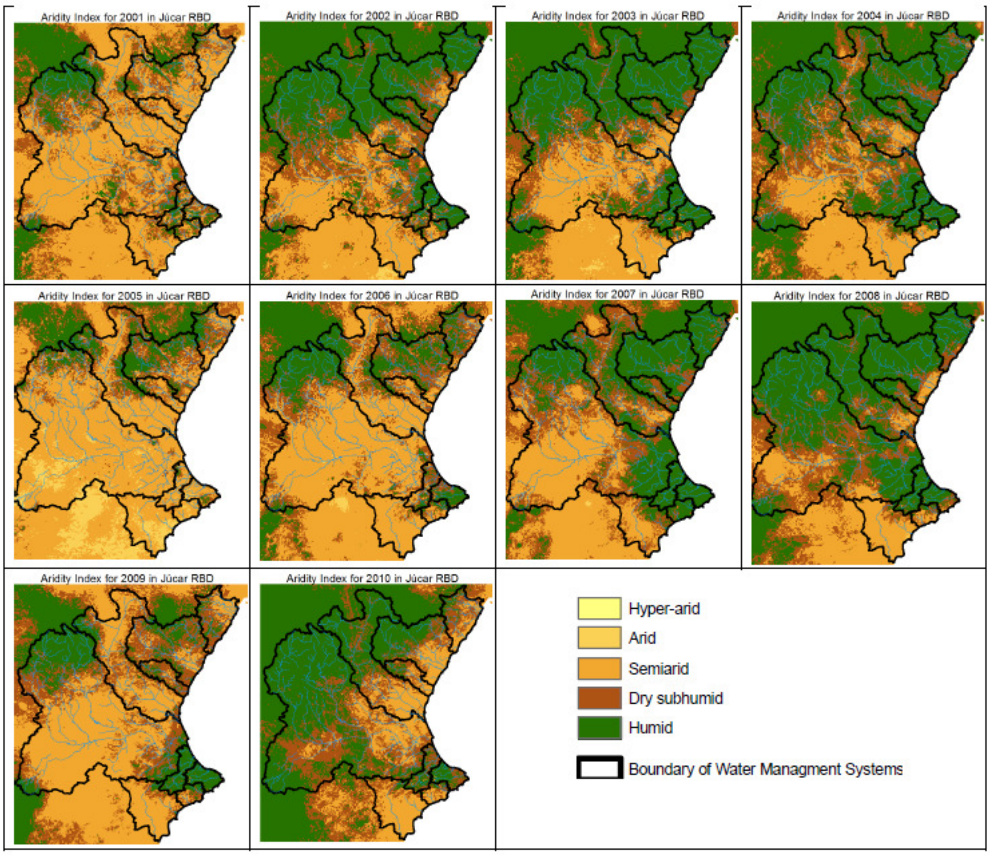

Figure 2. Aridity Index (UNEP) for period 2001-2010 comparison in the Júcar River Basin District.

The project also highlights important gaps in the availability of key data and confirms the need to design a more cost-effective process for reporting as well as the need for statistics for the assessment of quantitative.

On the other hand, water accounts used for a water exploitation index are able to provide medium-scale overview information, which can help the further policy development, as discussed in the EU Water Scarcity and Droughts (WS&D) policy and the 2012 Water Blueprint. However the same methodologies with more detailed, local level information demonstrated it can provide detailed planning instruments for water resource management and water allocation. Therefore, the 2012 Water Blueprint explicitly considers water accounts as a tool for water resource management. In addition, it demonstrates the need for further interaction between modeled and reported data.

Recommendations

Improvements in spatial and temporal aggregations:

The team noted some possible **improvements** along the process and provided recommendations to facilitate the application of SEEA-W in future projects or analyses. Some of the adjustments included the need of aggregating managing water units, to clearly determine spatial and temporal scales, and to obtain support from calibrated hydrological models. Furthermore, to improve data interpretation of WA tables, it would be advisable to provide a subdivision of elements (columns), and differentiate returns and abstractions (rows) by consumptive and non-consumptive uses. Specifically for drought management, water availability and demand assessment data might need to be aggregated in terms of space and time according to their availability. On the other hand, water stress can be a very local and punctual phenomenon that appears only for specific periods and territories, which could be hidden within aggregated series. These two counter facts must be balanced. Therefore, water authorities might require using preferably monthly data (or seasonal in the worst case).

	Element					
Variable	**1311 Reservoir**	**1312 Lakes**	**1313 Rivers**	**132 Groundwater**	**133 Soil**	**Total**
StateInitial	**207**	**0**	**96**	**361**	**197**	**862**
ReturnHydropower			148			148
ReturnIrrigation			2	4		5
ReturnUrbanSupply			2			2
Precipitation	1	0	1		363	364
FromArtificialReservoirs			46			46
FromGW			26			26
FromRivers	41			5		45
FromSoilWater			12	62		74
Evapotranspiration	-1	0	-1		-254	-256
AbsHydropower			-148			-148
AbsIrrigation			-7	-9		-16
AbsRainFedAgr					-87	-87
AbsUrbanSupply			0	-2		-3
ToArtificialReservoirs			-41			-41
ToGW			-5		-62	-67
ToRivers	-46			-26	-12	-83
ToSeaTotal			-34	-5		-38
OtherLosses			-3			-3
Final State	**202**	**0**	**93**	**390**	**145**	**831**

Figure 3. Example of water accounts table for Júcar Water Management System for year 2007. Example of the only water abstraction for refrigeration in the District. Values are in hm3. Source: EVREN, 2013.

Remote sensing potential use:

In basins where monitoring tools and data are available, water balances at monthly resolution can be easy to achieve, but those basins that lack infrastructures or economic resources will need investments. New technologies, like remote sensing (by means of time series of satellite data in high & low resolutions) and modelling of water use based on sectoral activities, can facilitate these tasks.

Water balances to improve water use efficiency:

The water balances obtained for the specific case of the Júcar River Basin District, might for instance, help in assessing measures of the River Basin Management Plan and the existing Drought Management Plan (DMP 2007), improve demands estimations and facilitate any adjustments for environmental protection, management and control, demand and supply, or management of non-conventional sources (e.g. from waste water reuse). In addition, they provide a standardised representation of data, which could facilitate auditing, and comparison with other territories. Water accounts (balances) can therefore be an additional tool to promote the efficient use of water, and demand management at the river basin level, to help water manager assess the hydrological status over a past episode, and to promote participative approaches. However, there is a need to obtain a consistent and reliable set of data at the river basin or sub-basin level and at monthly basis on sectoral demands, and progress towards a long-term application to increase their effectiveness.

Additional future steps:

To enrich the exercise and provide additional inputs to water managers, statisticians, and economists, in particular working towards the completion of additional hybrid tables that focus on water quality and socio-economic (being the latter just slightly covered in this project) ; that should be tested as they can provide an efficient tool for decision making and participatory approach in the selection of suitable programme of measures to face drought and desertification.

In river basins, such as the one studied, where there are robust hydrological models and a long tradition of collecting management related data, it will be possible to achieve this type of analysis. However, in those with less reliable information, the difficulty in developing water accounts can be high, and may lead to imprecise results. If the water balances are to be used to monitor compliance to policies, the previous point should be taken into account. Any progress towards obtaining and applying reliant hydrological models and data collection related to water accounts implementation in those basin that currently lack appropriate tools, will involve economic investments which should be considered and assessed by policy evaluators. Most of the hydrological information can be supplied by global models, but that will not be the case for data on abstractions, returns, flows in altered regime, and the relationships between the various elements with groundwater –which require a detailed and local knowledge.

In future projects or SEEA-W exercises, it would be appropriate to subdivide water management systems, making balances over the territory upstream of gauging stations. This would allow calibrating surface outputs of the system, and thus, better approximate the unknown variables of each subsystem. By subdividing the territory, the balances could be expressed at the water body scale (surface or groundwater) which could be of high interest for the future development of WFD related works.

Halting desertification:

In terms of opportunities to combat desertification, in view of the results, it is observed that at the basin scale the consumptions for the economy (abs-ret) due to human action are relatively small compared to natural phenomena. In any case, the availability of water in the soil will depend on the level of water stored underground and its ability to return to the surface in places at a higher levels. The use of groundwater by the economy should perhaps be taken as a loan that is made to society, but that should be given back. This is due because an inadequate level of groundwater will cause lack of water outlets to the surface and therefore, increase the risk of desertification and damages to the environment, including to other economic areas of the society. Moreover, a greater proportion of cultivated or forested land will result in less availability of water resources to the economy, making the efficiency measures the optimal ones to adopt, especially those who still have wider scope as wastewater reuse in coastal areas.

River Basin Management (RBM) Plans by 2015:

Regarding the **Blueprint**'s recommendations, this type of analysis can help determining the need of including more quantitative data in the first revision of RBM Plans by 2015. In any case, it can help in assessing quantitative data availability and reliability en each river basin district and analyse improvement needs in data collection and models that would allow a better water knowledge and control in river basins.