

SAI PLATFORM WATER STEWARSHIP SEMINAR

APRIL 1-2, HOTEL HOSPES, SEVILLE, SPAIN

INTRODUCTION AND OPENING DISCUSSIONS

MONDAY 1 APRIL 11:20-11:50, APROX

WATER FOOTPRINT AND MANAGEMENT IN THE
GUADALQUIVIR RIVER BASIN

By

JOAN COROMINAS, FUNDACIÓN NUEVA CULTURA DEL AGUA, FORMER
DIRECTOR OF THE ANDALUSIAN WATER AGENCY

and

M. RAMÓN LLAMAS, EMERITUS PROFESSOR. COMPLUTENSE UNIVERSITY
OF MADRID. MEMEBER OF THE SPANISH ROYAL ACADEMY OF SCIENCES



TABLE OF CONTENTS

1. SCOPE AND AIM
2. THE WFD OF THE EU AND THE SPANISH WATER LAW
3. THE USE OF THE EXTENDED WATER FOOTPRINT BY THE WATER OBSERVATORY OF THE BOTIN FOUNDATION
4. MAIN CHARACTERISTICS OF THE GOVERNMENTAL HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN
5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN
6. CONCLUSIONS

1. SCOPE AND AIM (I)

- ▶ Spain seems to be the only EU Member State which requires the use of Water Footprint (WF) in the preparation of hydrologic plans required by the Water Framework Directive (WFD)
- ▶ In order to make the application of this tool the MAGRAMA contracted with the public corporation TRAGSATEC the preparation of a program and tables of data for using the WF in the preparation of the plans of the various hydrological river districts.

1. SCOPE AND AIM (II)

- ▶ MMARM (2010) is a publication that describes the method used to perform such calculations. This method is rather different from the method almost universally used proposed by the WATER FOOTPRINT NETWORK (WFN). The application of this method to the approved Hydrological Plans has not been done by the planning offices of the corresponding Water Authorities. These planning offices do not have direct access to the corresponding programs and data tables.
- ▶ The final results are processed and calculated by TRAGSATEC and given to the basin planners.
- ▶ Surprisingly the use the program and the data , obtained with public money, are not available either the general public or the water authorities.

2. THE WFD OF THE EU AND THE SPANISH WATER LAW (I)

- ▶ The WFD (2000) was transposed into Spanish law in 2003. A good number of authors believe that this transposition was not entirely correct . That is due to the markedly different approaches of the Spanish Water Act 1985 and the EU WFD.
- ▶ The first is focused predominantly for facilitating water to potential consumers, it is a policy which relies mainly on the construction of new hydraulic infrastructures.
- ▶ In the European WFD what is sought is predominantly ecological health of ecosystems.

2. THE WFD OF THE EU AND THE SPANISH WATER LAW (II)

- ▶ The Spanish Water Act requires the implementation of a national water plan to distinguish between deficit and surplus basins. This estimation is the basis for possible future inter-basin water transfers.
- ▶ Another important distinction is that the management plans of the Spanish Water Act are necessarily normative, i.e. all new water permits must be in agreement with the Plan. Instead the WFD hydrological plans may have only an indicative character.

3. THE USE OF THE “EXTENDED” WATER FOOTPRINT BY THE WATER OBSERVATORY OF THE BOTIN FOUNDATION (I)

- ▶ The Botin Foundation began to work in the field of water resources since 1998
- ▶ Llamas (2005) introduced, apparently for the first time in Spain, the concept and importance of Water Footprint concept and the distinction between green and blue water.
- ▶ In 2008 the Botin Foundation decided to create the Water Observatory (WO). Its primary mission was to apply the WF method to the Spanish water resources problems.
- ▶ The details on the philosophy and results of these activities can be seen in www.fundacionbotin.org/agua.htm.

3. THE USE OF THE “EXTENDED” WATER FOOTPRINT BY THE WATER OBSERVATORY OF THE BOTIN FOUNDATION (II)

- ▶ Initially the focus was on Spain. In 2012 a book in English (De Stefano and Llamas, edits.) and a monograph in Spanish (Aldaya and Llamas, edits.) were published. They synthesize all the published papers. The main conclusion reached was that IN SPAIN , THE MOST ARID REGION IN THE EU ,THERE WAS NOT A PHYSICAL WATER SCARCITY. THE PROBLEM LIES IN THE POOR GOVERNANCE OF THIS RESOURCE.
- ▶ In order to see whether this conclusion can be generalized to other regions, in 2000 a study of IWRM seven Latin American countries begun: these are Argentina, Chile, Brazil, Peru, Colombia, Costa Rica and Mexico. This study extends somewhat to the entire Latin American continent and the Caribbean. The book that summarizes this work has just been published (Garrido, Willaarts, and Llamas Willaarts, edits. (2013).

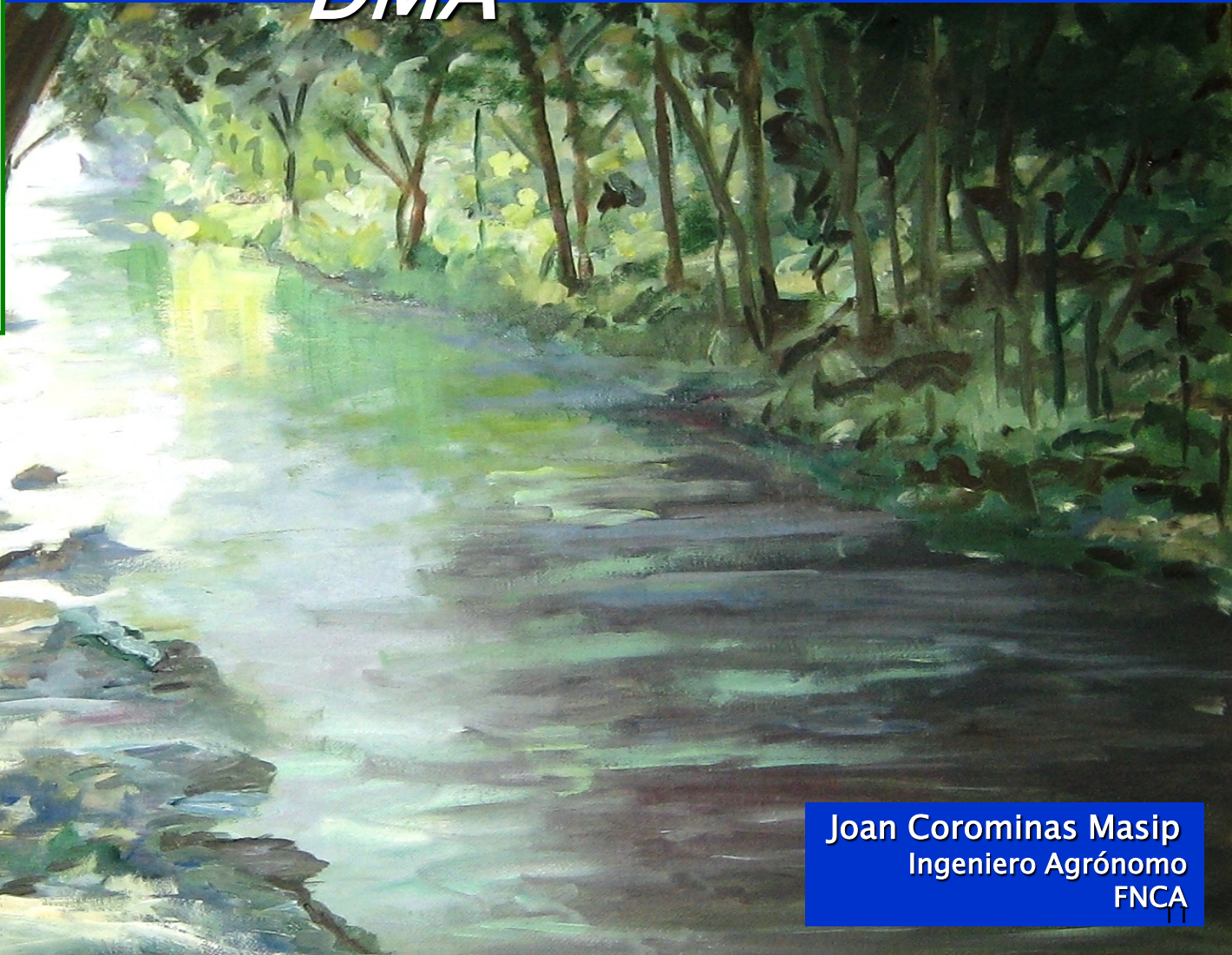
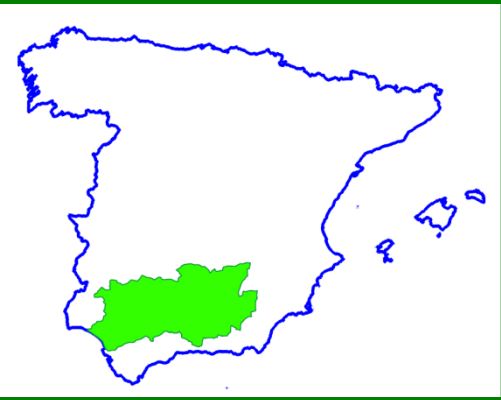
3. THE USE OF THE “EXTENDED” WATER FOOTPRINT BY THE WATER OBSERVATORY OF THE BOTIN FOUNDATION (III)

Simultaneously the SIXTH BOTIN FOUNDATION WATER WORKSHOP was organized in 2011 to debate the experiences in IWRM in a certain number of countries. The book with the proceedings of this Workshop has already been published. (Aldaya, Martínez Santos, and Llamas edit. (2013).

4. MAIN CHARACTERISTICS OF THE GOVERNMENTAL HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (I)

- ▶ The Government Hydrological Plan for the Guadalquivir River was approved by the Government in 2, MAY 2013 (BOE 2.5.13. It follows rather well the requirements of the WFD (2000).
- ▶ In our opinion, the implementation of the WFD has been very useful for the Spanish Water policy in many respects, such as the consideration of the groundwater bodies, the emphasis on the ecosystems health, the trend to recover from the beneficiaries the total cost of the activities necessary for providing them the service, the demand of stakeholders' participation, and others. We include five transparencies in Spanish written by Corominas showing some representative aspects of the approved Plan.
- ▶ Nevertheless the use in the approved plan of the possibilities of the “extended WF” has been very limited as it is explained later.

La planificación hidrológica en la cuenca del Guadalquivir a la luz de la DMA



Seminario sobre gestión
sostenible del agua –
Plataforma SAI
Sevilla (1-4-14)

Joan Corominas Masip
Ingeniero Agrónomo
FNCA

LA CUENCA DEL GUADALQUIVIR

- Superficie: 57.500 km²
- Clima mediterráneo:
 - Inviernos suaves (10–14°C) y veranos calurosos (24–28°C)
 - Precipitaciones en otoño e invierno, con bastante irregularidad interanual: 573 mm. (260–980 mm.)
 - Episodios de sequías hidrológicas: del orden del 25% de los años
- Distribución de la precipitación:
 - Evapotranspiración de bosques y cultivos: 78,5%
 - Escorrentía : 21,5% (de ella un 38% de origen subterráneo)
- Recursos disponibles (superficiales y subterráneos): 2940 Hm³ (51% del total de escorrentías)
- Capacidad de regulación en embalses: 8000 Hm³
- Población: 4,1 millones de habitantes (97% en Andalucía)
- Uso principal del agua: 845 mil ha. de riego (87% de la demanda)



ESTADO EN EL AÑO 2006 DE LAS MASAS DE AGUA, DE LA CUENCA DEL GUADALQUIVIR

CASI UNA CUARTA PARTE DE LAS MASAS DE AGUA SE HAN CARACTERIZADO COMO MUY MODIFICADAS O ARTIFICIALES: **DISMINUYEN ASÍ LOS REQUERIMIENTOS AMBIENTALES**

Masas de aguas superficiales, de transición y costeras

Estado
— Bueno o mejor
— Peor que bueno

Fuente: Plan Hidrológico del Guadalquivir 2009–2015

EL 56 % DE LAS MASAS DE AGUA ESTAN EN UN ESTADO ACTUAL (año 2006) BUENO O MUY BUENO

Masas de aguas subterráneas

Estado Global
■ Buen Estado
■ Mal Estado

RECURSOS Y DEMANDAS EN LA CUENCA DEL GUADALQUIVIR

RECURSOS DISPONIBLES EN LA CUENCA DEL GUADALQUIVIR				
		ACTUAL (2006)	H - 2015	H - 2027
RECURSOS PROPIOS	SUPERFICIALES	2127	2252	2265
	SUBTERRANEOS	851	851	851
	REUTILIZACION			
	SUBTOTAL PROPIOS	2978	3103	3116
TRANSFERENCIAS	HACIA OTRAS CUENCAS	-35	-35	-35
RECURSOS NETOS		2943	3068	3081

**LOS RECURSOS DISPONIBLES
ALCANZAN EL 51% DE LOS
RECURSOS NATURALES**

APORTES NATURALES MEDIOS - serie 1980-2006 -(HM3)	5754
RECURSOS NETOS / APORTES NATURALES (%)	51,1

Fuente: Plan Hidrológico del Guadalquivir 2009-2015

DEMANDAS Y BALANCE EN LA CUENCA DEL GUADALQUIVIR				
		ACTUAL (2006)	H - 2015	H - 2027
USOS PRINCIPALES	POBLACION EQUIV. (MILES HABITequiv.)	4388	4617	4656
	REGADIO (HA)	845.986	880.557	880.557
DEMANDA	URBANAS	436,4	464,6	412
	REGADIO	3485,5	3294,1	3101,4
	GANADERIA	18,6	18	18
	INDUSTRIA Y ENERGIA	67,3	102,1	155,2
	TOTAL DEMANDAS	4008	3879	3687
	DEMANDAS/ RECURSOS NATURALES (%)	69,7	67,4	64,1
BALANCE	INFRADOTACION	-608	-285	
	SOBREEXPLOTACION ACUIFEROS	-164	-124	
	SALDO TOTAL	-772	-409	

**LAS 845 MIL HA. DE REGADIO REPRESENTAN
EL 87% DE LA DEMANDA TOTAL DE LA
CUENCA**

**LA DEMANDA SE ACERCA AL 70%
DE LOS RECURSOS NATURALES,
LO QUE INDUCE A UN
IMPORTANTE DEFICIT : SE
RESUELVE CON INFRADOTACION DE
RIEGOS Y SOBREEXPLOTACION DE
ACUIFEROS**

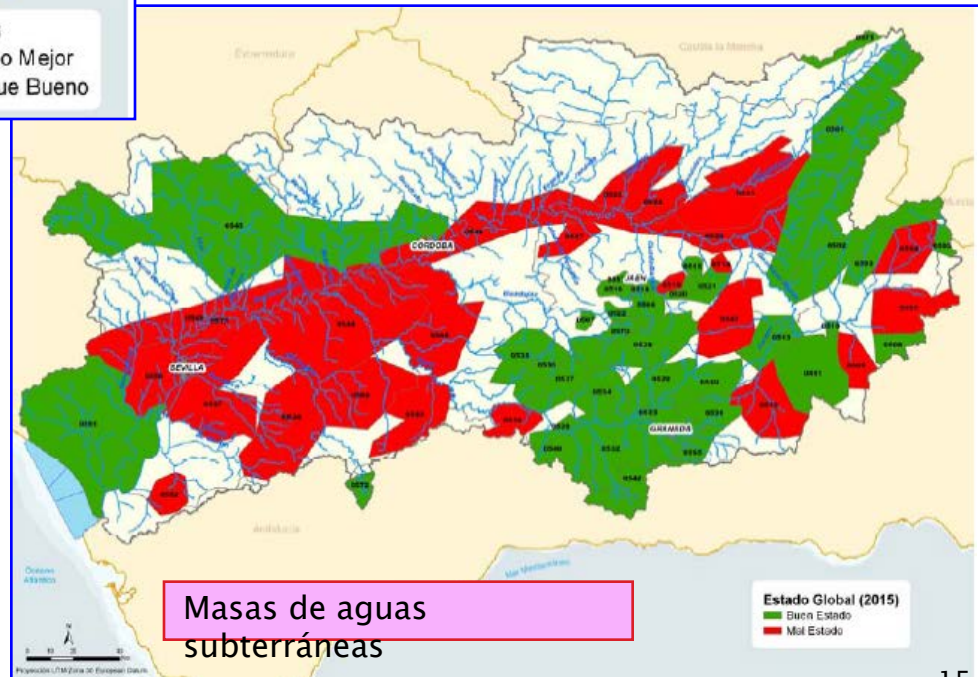
PREVISION DE ESTADO AL H-2015 DE LAS MASAS DE AGUA DE LA CUENCA GUADALQUIVIR

EL 34% DE LAS MASAS DE AGUA NO ALCANZARAN LOS OBJETIVOS AMBIENTALES DE LA DMA AL H-2015



Fuente: Plan Hidrológico del Guadalquivir 2009-2015

SE PRETENDE QUE EL BUEN ESTADO DE LAS MASAS DE AGUA PASE DEL 56% ACTUAL AL 66% EN 2015, CON PRORROGAS HASTA EL 2027 PARA ALCANZAR EL 98%



4. MAIN CHARACTERISTICS OF THE GOVERNMENTAL HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (VII)

- ▶ The Regulation approved for the preparation of the Hydrologic Plans (Orden Ministerial ARM/2656/2008 de 10 de septiembre), is very complete.
- ▶ According to its section 3.1.1.1 (Economic activities) the Plans have to include in their economic report an analysis of Water Footprint of the different socio-economic sectors, taking into account the virtual water used inside the basin and that exported.
- ▶ It is interesting to note that in the whole document of approval published in the BOE (62 articles and 323 pages) no mention is done either to this requirement or to the concept of virtual water.
- ▶ Nevertheless, the appendix V of the document of the MAGRAMA with the report of the plan, which can be downloaded from the MAGRAMA web, (it has about 500 pages) devoted 9 pages to explain the application of the method used to fulfill the mentioned requirement.
- ▶ The method used (MMARM, 2010). is rather different from the almost universal method proposed by the WATER FOOTPRINT NETWORK (WFN) in its classical manual (Hoeckstra et al. 2010). It is based mainly on the monetary transaction among the various economic sectors. The basic data come from the Autonomous Regions statistics and have to be adapted to the river basin limits.

4. MAIN CHARACTERISTICS OF THE GOVERNMENTAL HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (VIII)

- ▶ The terminology used is also different from that of the WFN. This complicates the reading of the report. 25 economic sectors are considered for the input-output calculations. The given data in the MAGRAMA WEB from the agricultural sector are lumped without separating the water consumption by the different crops. Only the data of the year 2005 are analyzed.
- ▶ No economic and social references are done either to the economic value related to each water use or to the jobs created for such water use. Practically no distinction is done between consumptive uses and water withdrawn or applied.
- ▶ This IS probably the reason why in the number 8.6 of the Environmental Sector of the mentioned report is written: “in the following revisions of the Plan the WF has to be considered as an important indicator of the sustainability in the use of the natural resources”.

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (I)

- ▶ The method applied to calculate the consumptive uses is that of the WFN manual (Hoekstra, et al. 2010) that is today used by most experts.
- ▶ On the contrary, the method used by the MAGRAMA is a new one with a different and confusing terminology. This makes its understanding difficult.
- ▶ Our analysis includes separately the (blue and green) water consumption (the main crops cereals, cotton, olives, horticulture and others. This is done in four different regions inside the basin. Also the apparent economic productivity of each crop (and activity) in each sub-region are obtained.

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (II)

The Table 1 from (Salmoral et al. 2011) shows the relevance of green water in this basin

Table 1 Components of the hydrologic cycle and the balance of green and blue water at the scale of the basin.

<i>Rainfall*</i>	<i>Run-off**</i>	<i>Evapotranspiration**</i>
563 mm/year	107 mm/year	456 mm/year
100%	19%	81%
32,042 hm ³	6,087 hm ³	25,955 hm ³
	Bleu WF + Blue water flows	Green water (agriculture, pasture, forests ecosystems)

Source: Salmoral *et al.* (2011)

[hm³ = cubic hectometre = million m³ = 10⁶ m³]

* For the reference year 2003.

** The repartition between run-off and evapotranspiration is given by CHG (2010).

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (III)

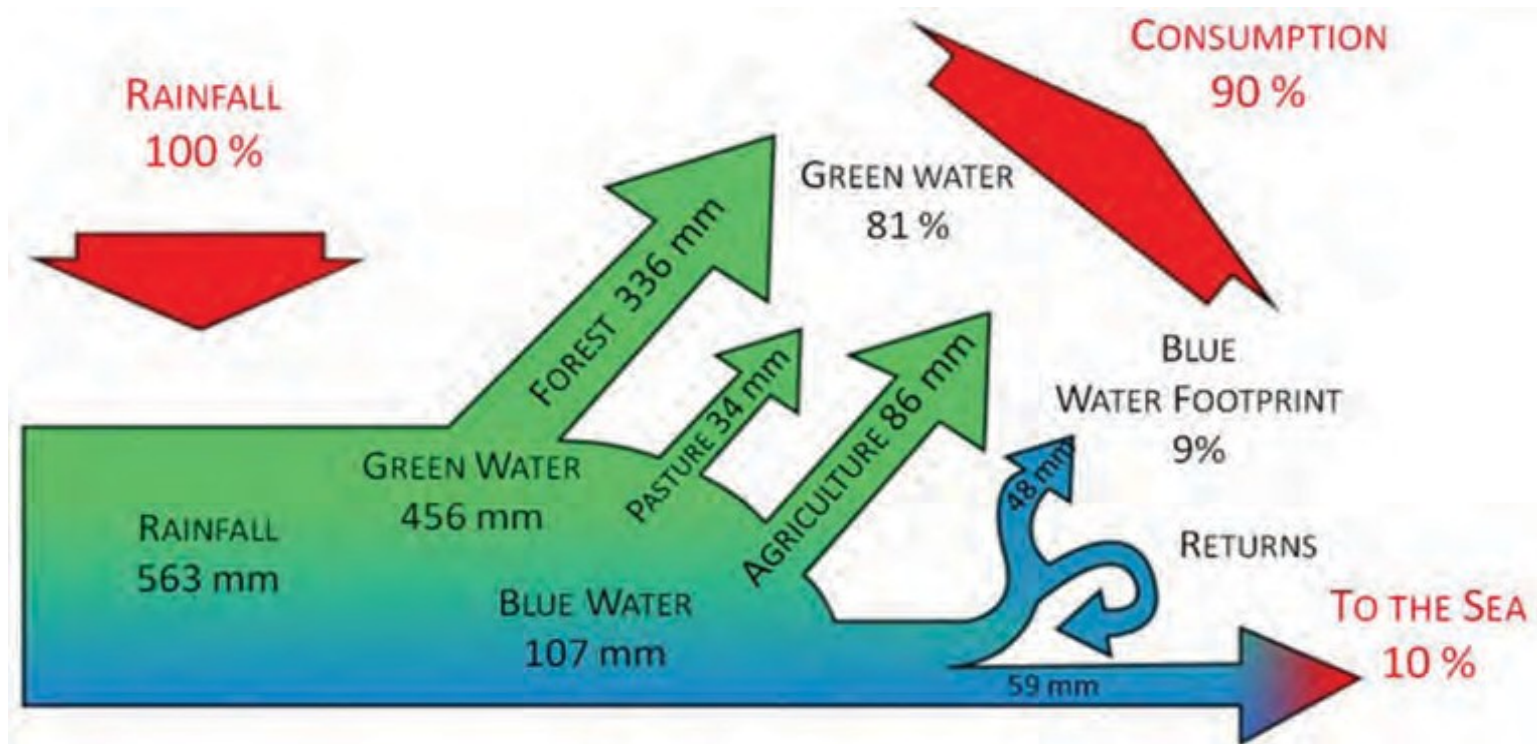


Fig. 1. Schematic representation of the WF including green and blue water (after Salmoral et al., 2011)

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (IV)

The EWF allows studying the variation of the use of the different types of water along the years 1997–2008 (Fig. 1) and also the variation of the economic productivity (Fig. 2).

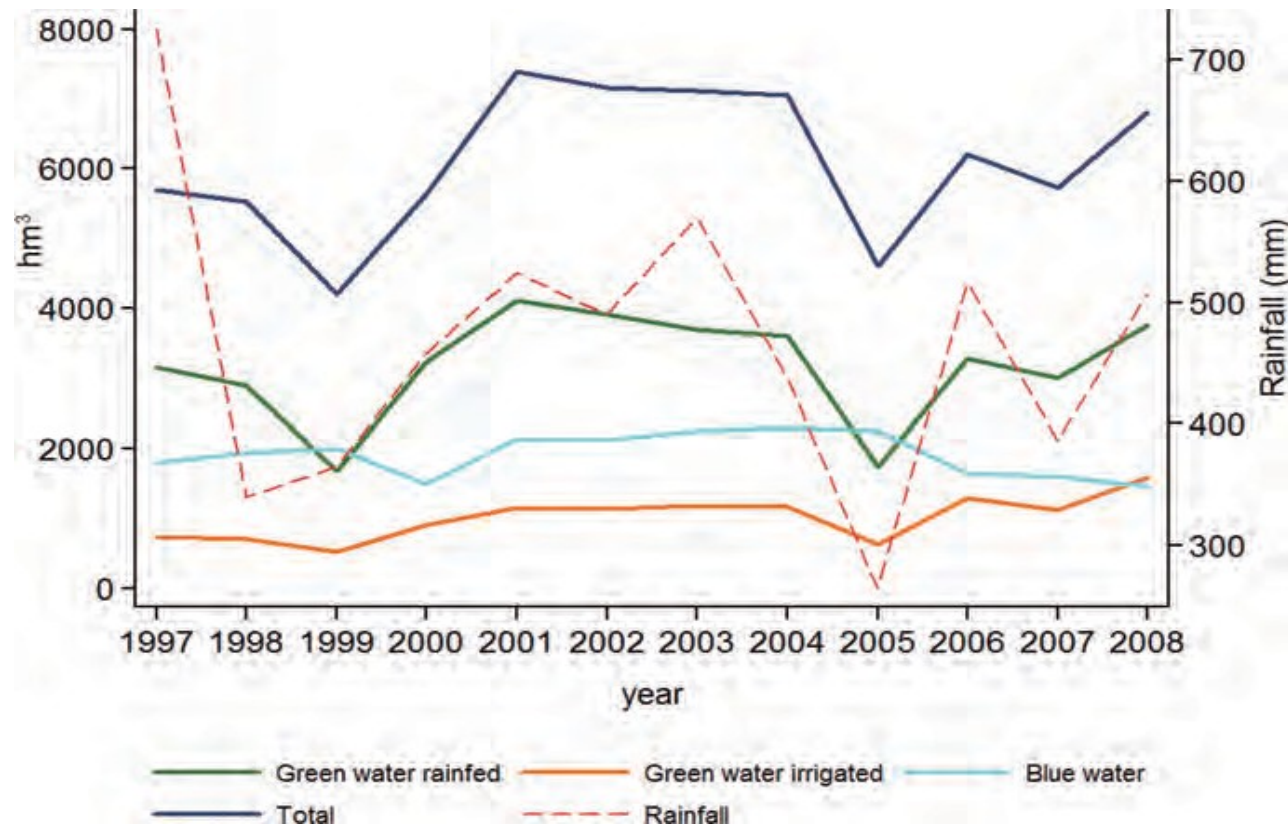


Fig. 1. The Water footprint of crop production (after Salmoral et al., 2011)

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (V)

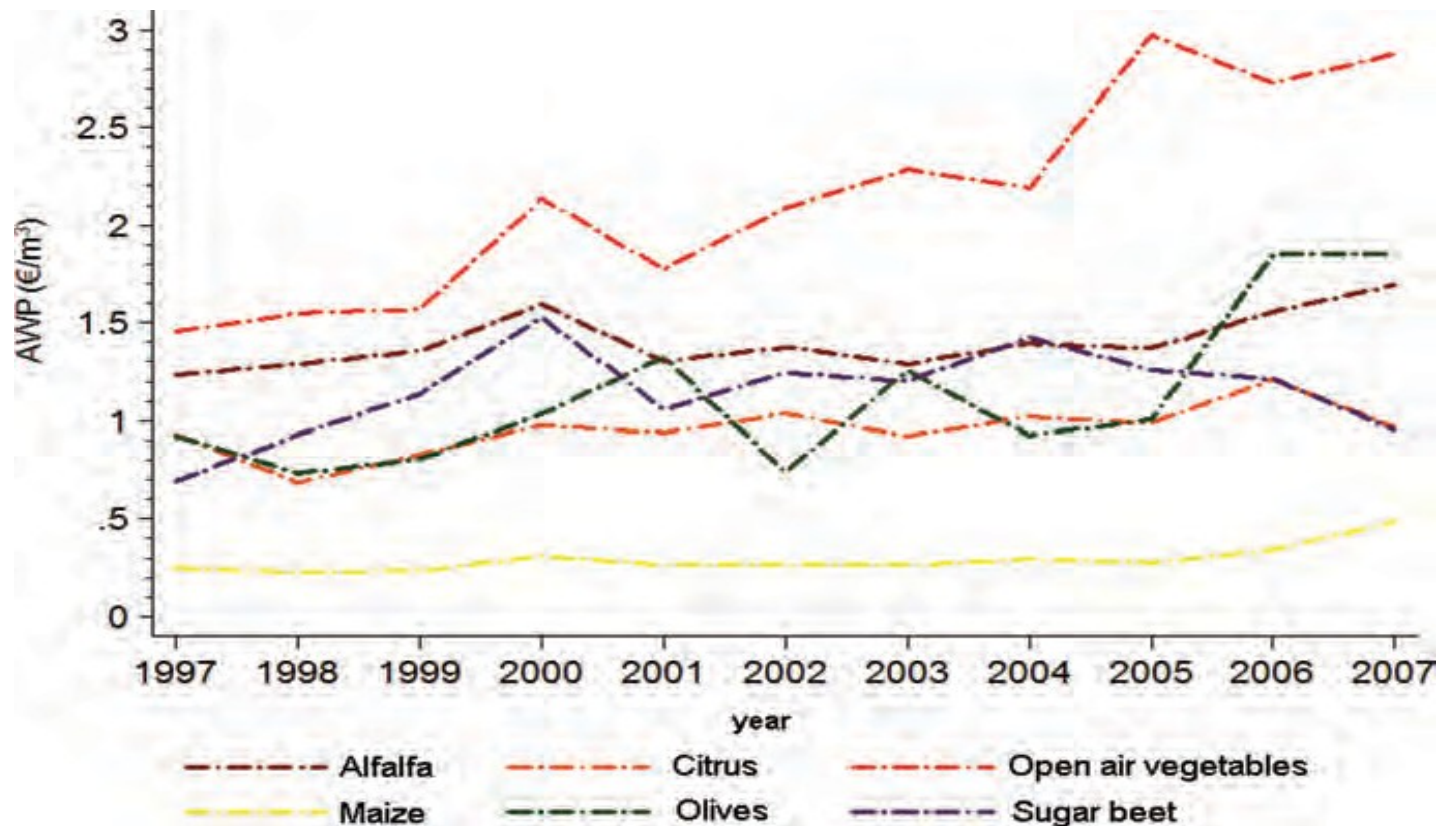


Fig. 2 Blue water productivity €/m³ (between 1997–2007, after Salmoral et al. 2011)

5. MAIN CHARACTERISTICS OF THE BOTIN FOUNDATION HYDROLOGICAL PLAN OF THE GUADALQUIVIR RIVER BASIN (VI)

- ▶ The main conclusion of the Guadalquivir analysis is that most irrigation water (80% of the total blue water consumptive use) is applied to obtain crops of low economic value and water intensive.
- ▶ It seems clear that in this basin, if a reassignment of Water Rights is done, there will be not water scarcity. This reassignment will be done naturally due to economic imperatives, but it will be a rather slow process. The action of the government might facilitate a more fast change without social disturbances.

6. CONCLUSIONS (I)

1. The “extended” water footprint, as applied by the Water Observatory, seems to be a good tool to obtain the quantitative data necessary for a IWRM (Water volumes, economic yield, and employment).
2. This tool facilitates also the analyses of the temporal variations related to the climate and also to changes in other external factors.

6. CONCLUSIONS (II)

3. The analysis done of the Guadalquivir Basin has shown that the up-to-now considered water scarcity can be easily solved by a reassignment of the water rights.
4. This reassignment of water rights is today facilitated by the international food (virtual water) trade.
5. This fact indicated that the increasing role of the World Trade Organization (WTO) is becoming a crucial factor to solve many of the global water problems.

THANKS FOR YOUR
ATTENTION

REFERENCES (I)

- ▶ Aldaya.M.M y Llamas, M. R. (eds.)(2012)
<file:///C:/Documents%20and%20Settings/Usuario/Mis%20documentos/Downloads/44852.pdf>
- ▶ (Aldaya, Martinez Santos, and Llamas(eds.)(2013).”Integrated waterresources manageentin the 21st century:Revisiting the paradigm”–Taylor &Francis 35 pp.
- ▶ [BOE.es – Documento BOE-A-2013-5319](#)
www.boe.es > [BOE](#) > [21/05/2013](#)
21/5/2013 – Real Decreto 355/2013, de 17 de mayo, por el que se aprueba el Plan Hidrológico de la Demarcación Hidrográfica del Guadalquivir.
- ▶ De Stefano, L. and Llamas, M. R. (eds) (2012)
[file:///C:/Documents%20and%20Settings/Usuario/Mis%20documentos/Downloads/44865%20\(1\).pdf](file:///C:/Documents%20and%20Settings/Usuario/Mis%20documentos/Downloads/44865%20(1).pdf)
- Dumont, A., Salmoral, G., y& lllamas, M.,R. (2012) The extended Water Footprint f the Guadalquivir Basin. In De Stefano & Llamas, eds (2012) pp.1o5–114.
- ▶ Garrido, A., Llamas, M.R., Varela–Ortega, C., Novo, P., Rodríguez–Casado, R., Aldaya.(2010) **Water Footprint and Virtual Water Trade in Spain: Policy Implications** (Series: Natural Resource Management and Policy, Vol. 35, M.M.1st Edition., 2010, IX, 150 p. 62 illus., Hardcover ISBN: 978–1–4419–5740–
. <http://www.springer.com/economics/agricultural+economics/book/978-1-4419-5740-5>.
- ▶ Garrido, Willaarts, and Llamas, (eds). (2013).”Water for food ad human well–being in Katin America: Status and challenges in a globalized World” Eartshcan

REFERENCES (II)

- ▶ Hoekstra, A. Y, Chapagain., A. K., Aldaya, M., M., and Mekonnen, M., M., (2009) ,Water Footprint Manual. State of the Art. Water Footprint Network)

LLAMAS, M.R. (2005) "Los Colores del Agua, El Agua Virtual y los Conflictos Hídricos", Discurso inaugural, curso 2005-2006, Real Academia de Ciencias Exactas, Físicas y Naturales, Madrid, 30 p. Publicado también en la Revista de la Real Academia de Ciencias Exactas, Físicas y Naturales, vol. 99,

- ▶ MMARM (2010) Estimación de las necesidades integradas actuales y futuras de España. Adenda. Huella hídrica por organismos de cuenca. Datos de 2005
- ▶ Salmoral, G., Dumont, A., Aladaya, M.,M., RodriguezCasado. R., Garrido, A. y Llamas, M., R.(2011) Analisis de la Huella Hídrica Extendidad de la cuenca del Guadalquivir. Papeles de Seguridad Hídrica y Alimentaria y Cuidado de la Naturaleza, N° 1. Fundación Botín www.fundacionbotin.org/estudio-de-la-huella-hidrica-de-la-cuenca-del-guadalquivir-proyectos-observatorio-del-agua.htm.