



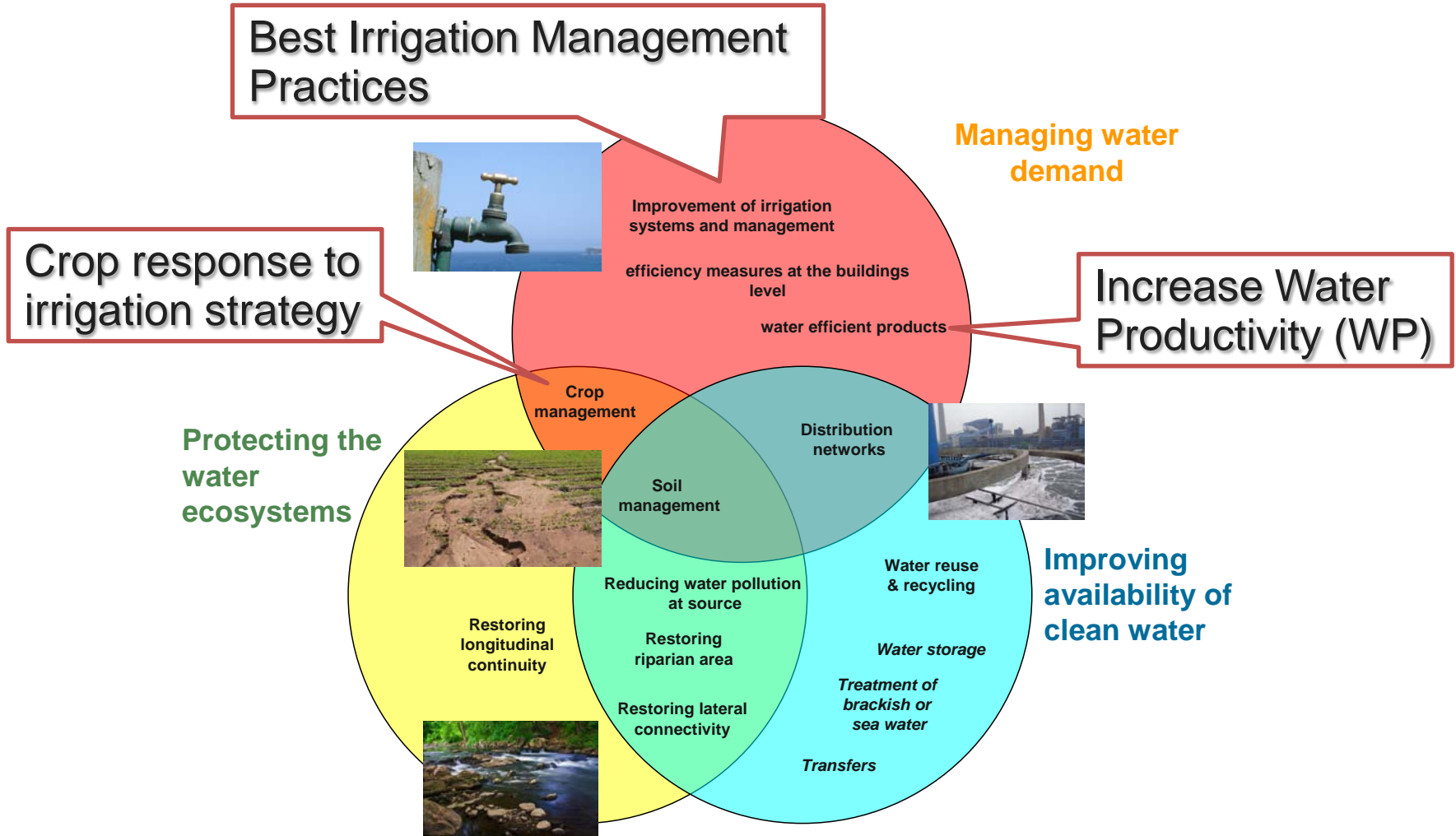
# REmote sensing-based Dss for Sustainable Drought-adapted Irrigation Management

Presented by: **Johannes Hunink (FutureWater)**

Contributors (20):

- **Alain BAILLE , B.MARTÍN, V, MARTÍNEZ, S. GARCIA, F. ALCÓN, R. DOMINGO, A. PEREZ (UPCT, Cartagena, Spain)**
- **S. TAPSUWAN (CSIRO, Perth, Australia)**
- **O. MOUNZER, P.NORTES, J.J. ALARCÓN, G. GONZÁLEZ, J. GARCÍA (CEBAS-CSIC Murcia, Spain)**
- **M.ERENA, P. GARCIA, D. SANCHEZ (IMIDA, Murcia, Spain)**
- **M. VILA, E. FERERES, M. MORALES, R. LÓPEZ, A. MONTORO (Cordoba University, Spain)**
- **R. MORCILLO, J. LOPEZ (AFRE, Madrid, Spain)**

# Context





# Objective

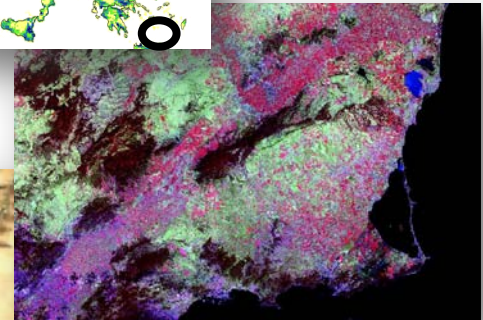
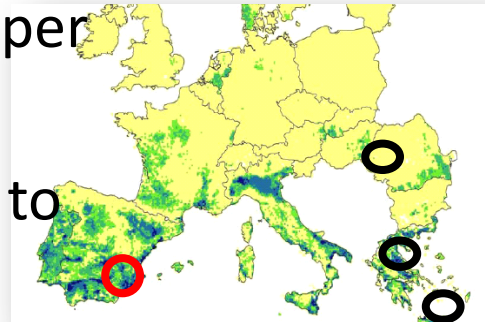


*To improve Irrigation **Water Productivity (IWP)** by developing and validating an **information system** to support **growers** in implementing and managing **deficit irrigation techniques**.*



# Background

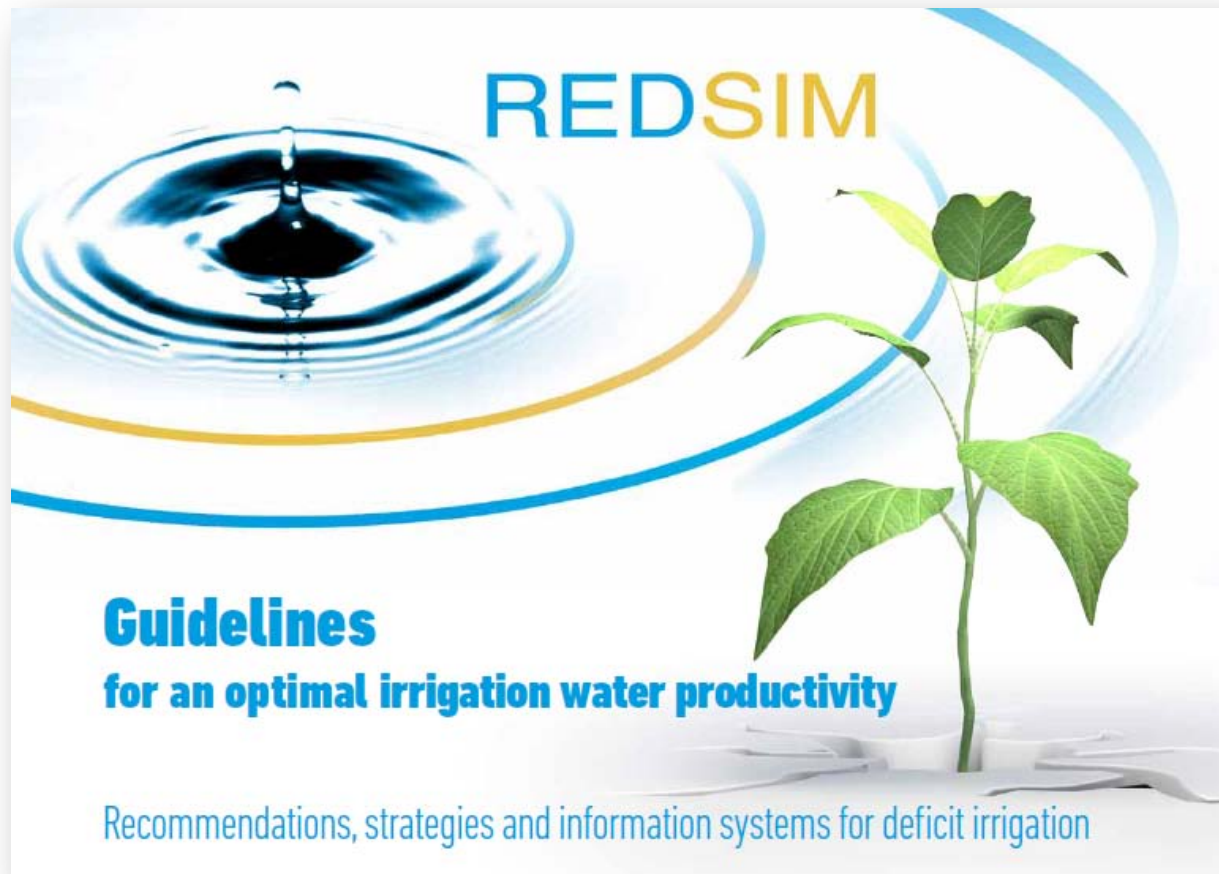
- Water stressed basins (Segura and Upper Guadiana, Spain)
- Water resources here highly sensitive to climate change
- Social and economic value of agriculture (f.e. 1.5 billion€ in Murcia region)
- Irrigated agriculture largest user of surface waters
- Diverse crop mix (fruit trees, vegetables...)
- Imbalance demand and supply and its variability requires Deficit Irrigation





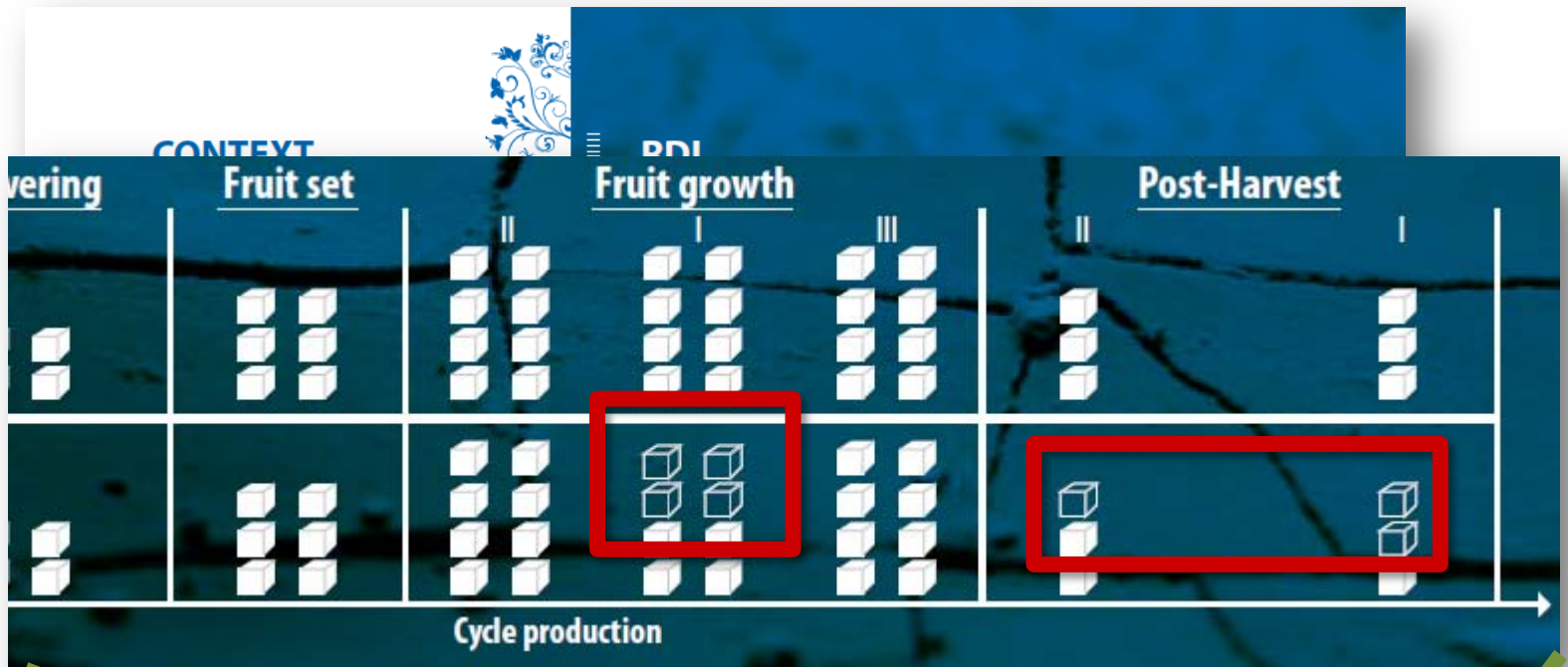
# REDSIM guidelines on deficit irrigation and tools

REDSIM dissemination output: guidelines ...

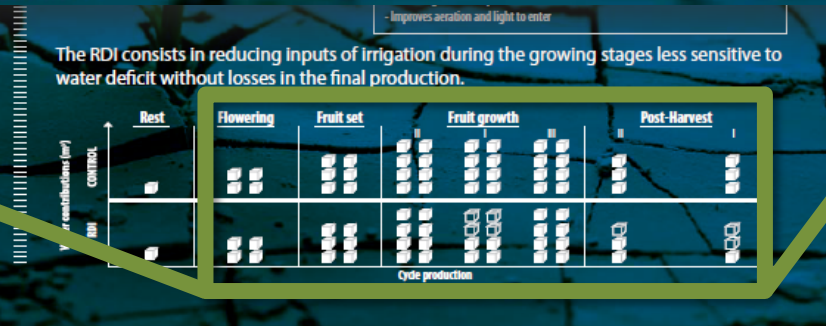




# REDSIM guidelines on deficit irrigation and tools



...tions, it is necessary to obtain a high productivity of irrigation water. This is usually expressed in terms of kg yield per m<sup>3</sup> water applied. There are several techniques that guarantee a high yield while saving water, thus increasing irrigation water productivity. One of them is Regulated Deficit Irrigation (RDI)



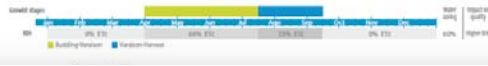


# REDSIM guidelines on deficit irrigation and tools

### 3. How to perform deficit irrigation in vineyards?

**RDI VINEYARD** Universidad de Córdoba / www.uco.es

The vine is one of the species best adapted to water stress conditions, so RDI is an appropriate strategy for efficient irrigation management of this crop. RDI saves water, control vegetative growth, balances production and improves the quality of the grapes (especially in red varieties). Studies on the application of deficit irrigation in vineyards showed the possibility of saving about 60% water reducing production slightly (about 5%). In turn, some quality parameters of grape (Brix, anthocyanin content, acidity and total polyphenol index) can be enhanced due to the effects of moderate stress.



### 4. How to perform deficit irrigation in nectarines?

**RDI NECTARINE** ETSIA - UPCT / www.upct.es

Deficit irrigation in nectarine can be applied during the post-harvest period. During this period the applied amounts can be reduced by up to 50% of crop water demand, which results in a total water saving between 15 and 25%. These savings can be achieved without affecting yield and product quality. Also during phases I and II of fruit growth the applied irrigation water can be reduced, with the aim to increase the soluble solids in the fruits, and thus increase the final product quality.



Crop: Vineyard  
Variety: Viowhite

stages



|              |                   |
|--------------|-------------------|
| Water saving | Impact on quality |
| 18-22%       | 0-5% small fruit  |

### RDI MELON

Universidad de Córdoba / www.uco.es

Generally, the selected irrigation strategy is considered one of the most important factors controlling yield and fruit quality in melon. RDI in melon is a promising irrigation strategy to achieve the best possible performance using less water without compromising on productivity. Studies on the application of the RDI in melon showed the potential to save up to 18% water without reducing yield or fruit quality. Also, a controlled amount of water stress during the ripening period can significantly improve the fruit quality, causing a slight increase in the concentration of soluble solids, mainly in the sugar content of the fruit pulp.



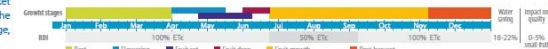
Crop: Melon  
Variety: Iborico  
Experimental site: Alameda de Cervera  
Soil: Sandy loam  
Irrigation system: Drip  
Management: Plastic mulch



### 1. How to perform deficit irrigation in mandarins?

#### RDI MANDARIN

The crop response to water deficit of several citrus varieties is affected by a decrease in the concentration of the irrigation scheduling at the right moment. Studies on the application of deficit irrigation in citrus showed the potential to save between 10 and 28% water. It is possible to achieve these savings without seriously affecting the performance and quality. In mandarin for example, application of RDI resulted in a slight increase in the concentration of vitamin C without affecting other quality parameters relevant to the market and without reducing the total yield. In the years with a higher production than average, the fruit size experienced a slight decrease.

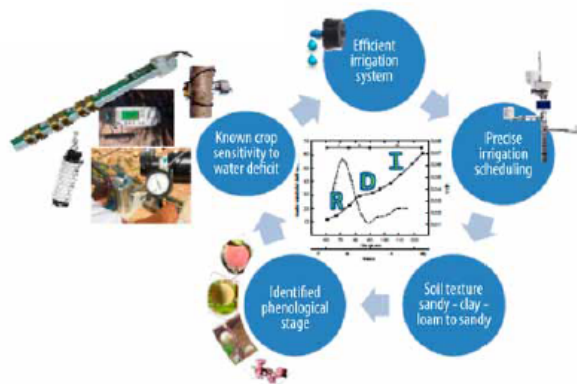


Crop: Mandarin  
Variety: Orogrande  
Rootstock: Carrizo  
Age of trees: 8-12 years  
Experimental site: Campotejar  
Soil: Silty loam  
Irrigation system: drip



## 5. Supporting tools for RDI - REDSIM

### WHAT DO I NEED?



To implement RDI, the farmer needs adequate information on his field, the crops and the water requirements. REDSIM provides several information and advisory tools to support the farmer in implementing this irrigation strategy. These tools join different existing information sources and simulation tools to provide up-to-date and local data and predictions.

For more info, check [www.redsim.net](http://www.redsim.net)

#### What data is available on my plot?



REDSIM-IS is a single web portal that integrates all available spatiotemporal information (meteorological networks, weather radar, satellite remote sensing, surveying, etc.) to provide updated information on soil and crops for better irrigation management, planning and scheduling by the farmer.

#### How much rain received my crop?



This same web portal also includes a new innovative product that uses state-of-the-art algorithms to combine information from weather station networks with rainfall radar in real time. This way, the farmer knows with high accuracy the amount of rain that received his plot during the last hours and days.

#### When and how to irrigate?



The REDSIM irrigation advisory bulletin is sent to the farmer by e-mail with synthesized and up-to-date information which supports decisions on irrigation planning. The bulletin includes: (i) 7 days weather forecast with the forecasts of crop water needs, (ii) options in terms of dosage and frequency of irrigation to meet the predicted demand and soil water, and (iii) its impact on percolation and the a comparison between computed irrigation needs and applied amounts

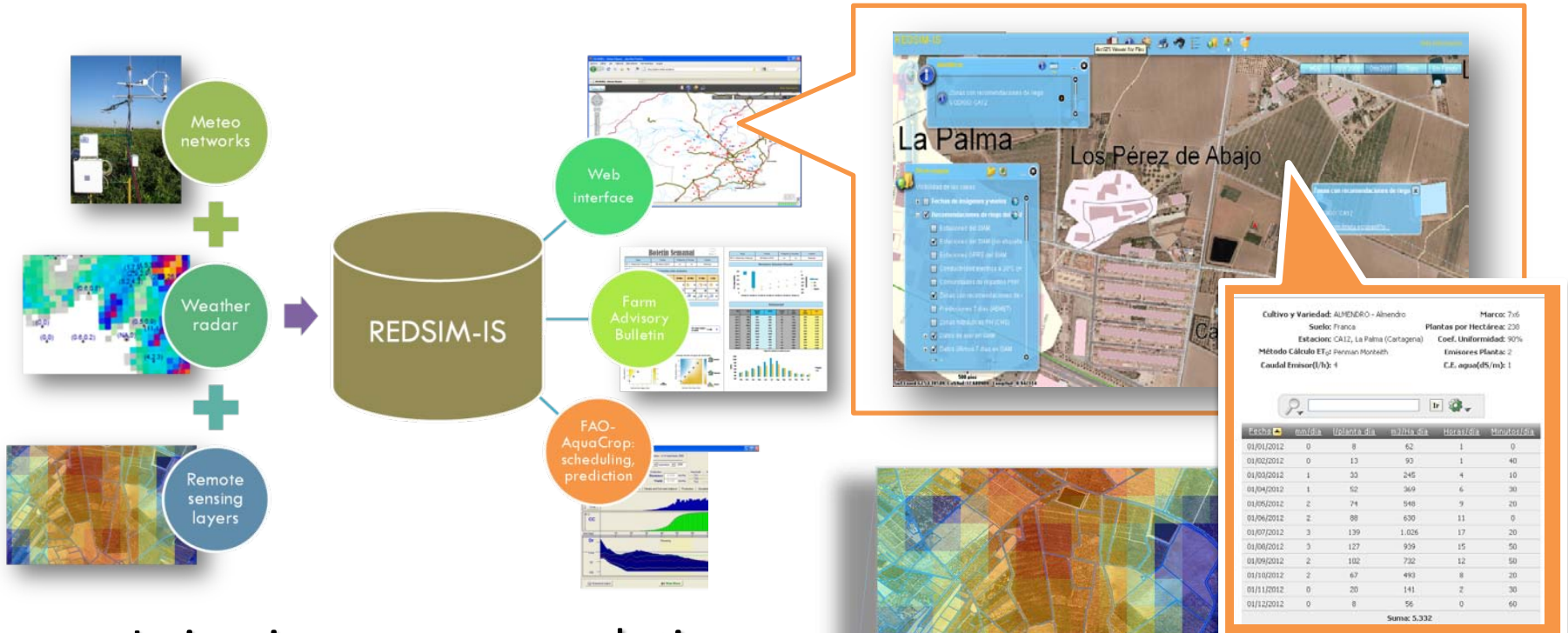
#### How affects Irrigation my productivity?



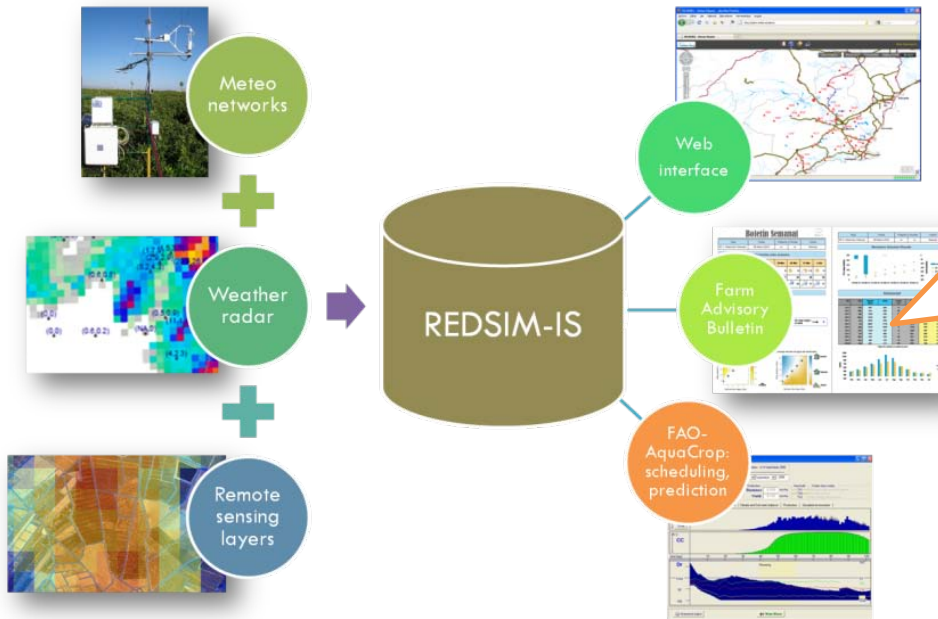
REDSIM allowed demonstrating the benefits of using the latest water productivity tool for practitioners (extension services, farmers, etc). This state-of-the-art tool "AquaCrop" is currently being developed by FAO together with researchers involved in REDSIM. It allows seasonal productivity predictions and supports the farmer in irrigation planning.



# The REDSIM-IS tools



- Irrigation recommendations
- Rainfall radar
- But recently also: flooding events - damages



- Personalized recommendations
- Impacts on losses, and stress
- Other guidelines – “formative evaluation”

### Boletín Semanal

| Hoja                    | Fecha         | Polígono y Parcela | Cultivo           |
|-------------------------|---------------|--------------------|-------------------|
| Nº 1: Resumen Previsión | 25 Junio 2012 | xx VA              | Cítrico (ejemplo) |

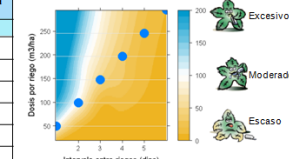
#### Resumen esta semana

|             | 25-Jun | 26-Jun | 27-Jun | 28-Jun | 29-Jun | 30-Jun | 01-Jul |
|-------------|--------|--------|--------|--------|--------|--------|--------|
| Lluvia (mm) | 0      | 0      | 15     | 0      | 0      | 0      | 0      |
| ETo (m3/Ha) | 76     | 79     | 25     | 85     | 89     | 87     | 79     |
| ETc (m3/Ha) | 45     | 47     | 13     | 51     | 53     | 52     | 47     |

#### Opciones de riego

| Intervalo entre riegos | Dosis por riego | Evapotranspiración Relativa | % min de agua útil alcanzado | Percolación Relativa |
|------------------------|-----------------|-----------------------------|------------------------------|----------------------|
| Días                   | m3/ha           | %                           | %                            | %                    |
| 1                      | 49              | 100                         | 100                          | 0                    |
| 2                      | 98              | 100                         | 93                           | 3                    |
| 3                      | 148             | 95                          | 51                           | 11                   |
| 4                      | 197             | 93                          | 35                           | 27                   |
| 5                      | 246             | 84                          | 19                           | 35                   |
| 6                      | 295             | 73                          | 11                           | 40                   |

Porcentaje mínimo de agua útil alcanzado



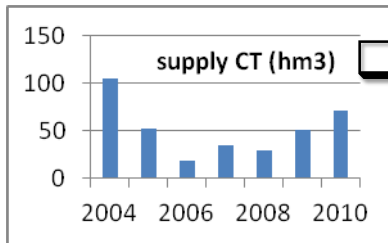
#### Calendario para el riego deficitario

Aplicando el riego deficitario a este cultivo y según este calendario se puede ahorrar alrededor de un 20% de agua. Este ahorro se puede conseguir sin afectar notablemente el rendimiento y la calidad del producto.

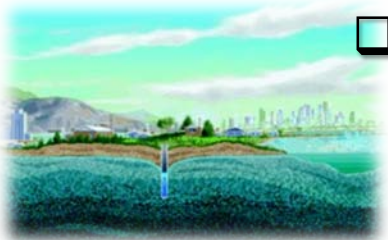
|                   | Ene | Feb      | Mar      | Abr      | May     | Jun     | Jul     | Ago     | Sep     | Oct      | Nov      | Dic |
|-------------------|-----|----------|----------|----------|---------|---------|---------|---------|---------|----------|----------|-----|
| Fases del cultivo |     | 1        | 2        | 3        | 4       | 5       | 5       | 5       | 5       | 5        | 6        |     |
| RDC               |     | 100% Etc | 100% Etc | 100% Etc | 50% Etc | 50% Etc | 50% Etc | 50% Etc | 50% Etc | 100% Etc | 100% Etc |     |

1- Reposo, 2- Floración, 3- Cusajado, 4- Caída de frutos, 5- Crecimiento del fruto, 6- Post-cosecha  
Fuente: CEBAS-CSIC (O. Mounzer)

# Policy relevant findings and recommendations



- For farmers: VARIABILITY (in supply) = RISK. *Deficit Irrigation* techniques can reduce this risk, and reduce groundwater abstractions



- Also for wet periods: *Deficit Irrigation* can save significant amounts of water. Saved or stored in aquifer? → **Conjunctive groundwater and surface water management**



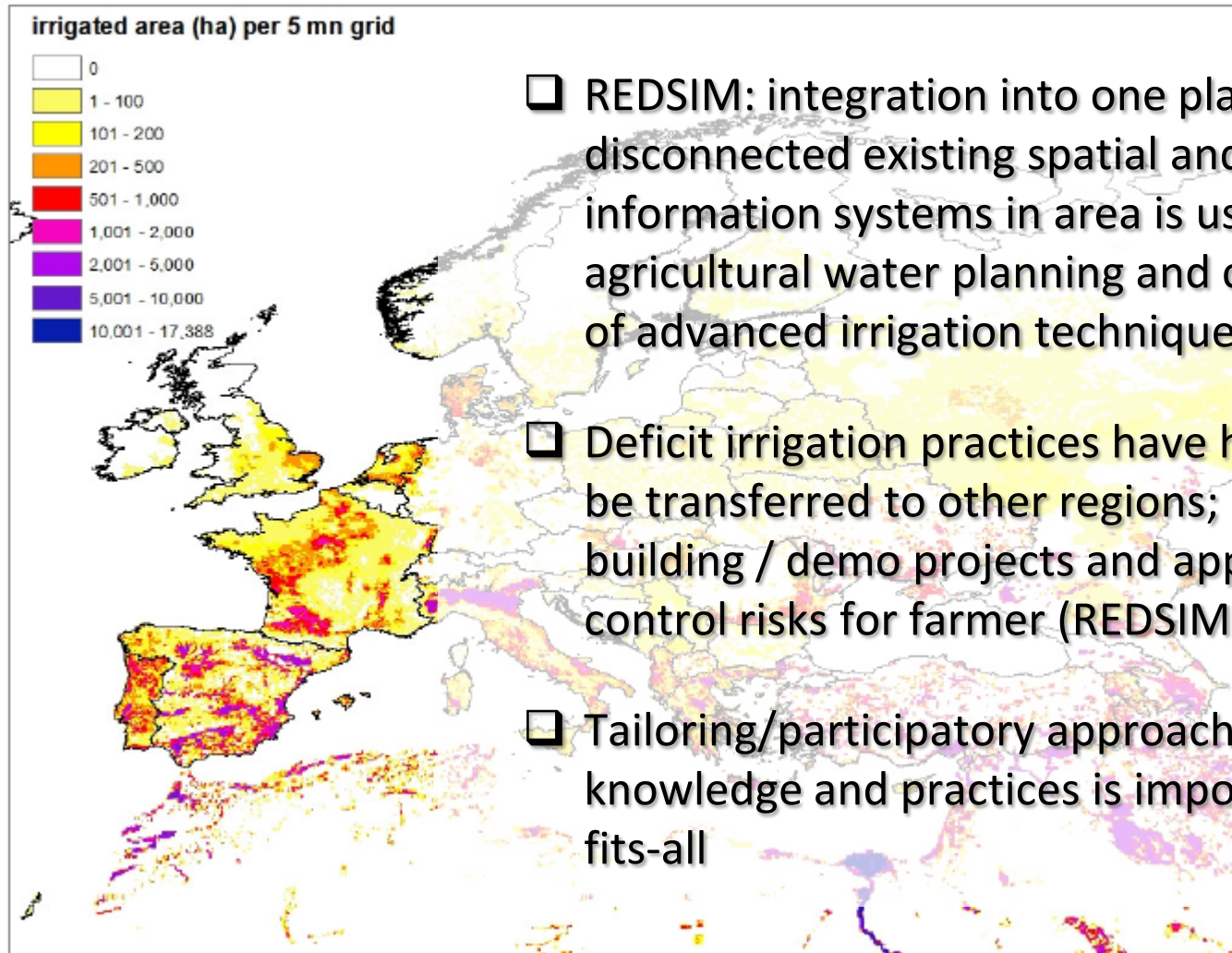
- Precise and deficit irrigation requires use of more advanced irrigation management tools, and economical triggers.



- Farmers' perspective on water saving is of paramount importance: decisions on agricultural water use take place on-farm.



# Policy relevant findings: extrapolation to other regions



- ❑ REDSIM: integration into one platform of disconnected existing spatial and temporal information systems in area is useful for agricultural water planning and could boost uptake of advanced irrigation techniques.
- ❑ Deficit irrigation practices have huge potential to be transferred to other regions; requires capacity building / demo projects and appropriate tools to control risks for farmer (REDSIM)
- ❑ Tailoring/participatory approach to adapt to local knowledge and practices is important, no one-size-fits-all



# Perspectives

- ❑ Extension of REDSIM approach and tools to other crop species
- ❑ Further dissemination through irrigation authority and support water authorities
- ❑ Other services related with extremes and disaster risk management
- ❑ Personalized services for farmers
- ❑ More info:
  - ❑ email me. **Johannes Hunink** - [j.hunink@futurewater.es](mailto:j.hunink@futurewater.es)
  - ❑ [www.futurewater.nl](http://www.futurewater.nl) / [www.futurewater.es](http://www.futurewater.es)
  - ❑ [www.redsim.net](http://www.redsim.net)