MAR to MAR-k€t

INDUSTRIES “MAR WATER DEPENDENT” AT LOS ARENALES AQUIFER, BEFORE AND NOW

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*http://www.marsol.eu
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3- New Pan-European Network on Managed Aquifer Recharge (MAR) related projects
ARENALES HYDROGEOLOGICAL UNIT/ WATER BODY

Los Arenales Water body: 2,400 km², 96 villages in Valladolid, Segovia & Ávila. 46,000 inhabitants
MAR FACILITIES AT LOS ARENALES (MARSOL demo site)

- Los Arenales Water body: 2,400 km², 96 villages in Valladolid, Segovia & Ávila. 46,000 inhabitants
- Example of agroindustrial area with efficiency improvements in water and energy thanks to MAR tech
- Success linked to the supply guarantee without climate dependence
- High quality production

Carracillo District:
- Since 2003
- Channel 40.7 km
- 3 infiltration ponds
- 1 RBF
- 2 artificial wetlands

Santiuste basin:
- Since 2002
- MAR Channel 27 km
- 5 infiltration ponds
- 3 artificial wetlands
- 1 RBF
- 3 infiltration wells

Alcazarén area:
- Since 2012
- 1 RBF > SAT-MAR
- Channel 5.5 km
B- RELATIONS: INDUSTRY-STATE OF THE AQUIFER

- Irrigation: 3,500 ha out of 7,586
- 713 communers
- Mean annual aquifer extraction: 8 hm³/year

- Effect of MAR: 314.3 m³/ha out of 1,318 m³/ha average
- 23.8% irrigation water comes from MAR

Safe yield vs Water mining
Horticultural industries stand out with a turnover of about 45 M€
AGRICULTURE AT EL CARRACILLO

- **3,500 hectares** are irrigated in 11 municipalities

- Carracillo district ranks up in the Spanish agriculture for its production of **horticultural products** (80% of vegetable production of Segovia and 30% of Castilla y León)

- First producer in Spain of **strawberry mother plants**: About 600 hectares produce 60 M units.

![Carracillo's Crop Distribution (ha)](image)
MAR ROLE IN CARRACILLO: BOOSTING THE RURAL DEVELOPMENT

- Irrigated agriculture plays a “vital” role in rural employment:

**Mean figures**

- **Regional Rural Area**
  - 0.46 Agroindustries/km²
  - 0.67 workers/km² in Agricultural sector
  - 0.81 workers/km² in Industry sector

- **Carracillo District**
  - 1.28 Agroindustries/km²
  - 2.38 workers/km² in Agricultural sector
  - 2.74 workers/km² in Industry sector

Employment opportunities are *multiplied by three*

- Strawberry and vegetables industries generate about **700 direct jobs** and **3,000 indirect jobs**

Source: Itacyl, 2015

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High employment rates contribute to the attachment of population in rural areas.

Since 2000 the population in the region has increased by an average of 6%.

Examples with considerable increases; e.g. since MAR began the municipality of Chañe’s population has increased up to 28%.

Evolution of Chañe Population 2002-2014

Source: INE, 2014
**MAR BENEFITS FOR THE AGRICULTURE**

- **MAR** increases water availability allowing the transformation of dry lands into irrigated lands, leading to **greater productions**:

<table>
<thead>
<tr>
<th>Crop</th>
<th>Rainfed</th>
<th>Irrigated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potato</td>
<td>28,472</td>
<td>48,431</td>
</tr>
<tr>
<td>Garlic</td>
<td>5,649</td>
<td>11,058</td>
</tr>
<tr>
<td>Sweet melon</td>
<td>7,978</td>
<td>26,478</td>
</tr>
<tr>
<td>Wheat</td>
<td>2,977</td>
<td>4,610</td>
</tr>
<tr>
<td>Barley</td>
<td>2,446</td>
<td>3,654</td>
</tr>
<tr>
<td>Oats</td>
<td>1,906</td>
<td>3,413</td>
</tr>
<tr>
<td>Rye</td>
<td>1,789</td>
<td>3,272</td>
</tr>
</tbody>
</table>

Source: Junta de Castilla y León, 2014

- Yields per hectare get **duplicated** in most cases, and even **tripled** as for sweet melon.
Price paid to growers evolution: Carrot

Price paid to growers evolution: Sugar beet

Price paid to growers evolution: Potatoe

Price paid to growers evolution: Leek
Pumping energy consumption depends on:

- Energy efficiency of the system
- Depth of the water table
- Height of the application
- Water pressure required
- Maximum water flow volume demand and frequency
- ...

C-ENERGY CONSUMPTION SAVINGS BY MAR

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Energy Efficiency at “Los Arenales”

How is MAR improving the EE?

Example for El Carracillo District (pilot scale)

- Number of wells: 314
- Mean output water flow volume: 9,957 m$^3$ per well and year
- Mean water table depth before MAR: 6.30 m
- Mean water table depth after MAR: 4.00 m

\[ \Delta H = +2.30 \text{ m} \]
What does a 2.30 m water table raise represents in energetic terms?

314 wells – $Q \approx 9957 \text{ m}^3/\text{year}$ and well - $\Delta H = +2.30 \text{ m}$

<table>
<thead>
<tr>
<th></th>
<th>Before MAR</th>
<th>After MAR</th>
<th>MAR savings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy consumption (kWh)</td>
<td>76,430</td>
<td>48,430</td>
<td>-28,000 kWh</td>
</tr>
<tr>
<td>Energy cost (€/year)</td>
<td>8,180</td>
<td>5,180</td>
<td>-3,000 €</td>
</tr>
</tbody>
</table>

Energy savings of 36%
Mapa de Proyectos
Más agua para los valles de Ica, Villacuri y Lanchas

LA TECNOLOGÍA DÉTRAS DE LAS OBRAS

1. Sistema de canales filtrantes
   - Proporciona un suministro constante de agua para una mejor evapotranspiración.
2. Filtros de Drenaje
   - Reducción de la carga de residuos sólidos en el acuífero.
3. Regulación de los niveles
   - Mantenimiento del nivel del agua en el acuífero.
4. Recuperación de agua
   - Captura de agua del canal para su uso en la agricultura.

ESQUEMA PROPUESTO PARA EL AFIANZAMIENTO HIDRICO EN EL VALLE DE ICA

Source: ANA
3- NEW MAR RELATED PROJECTS’ PAN-EUROPEAN NETWORK

ISMAR 10 PAN-EUROPEAN NETWORK

+ Saphani
Industrial scenario and improvements to date
   From * to *****

1. AGRO-INDUSTRY *****
2. WATER SUPPLY INDUSTRY **
3. WASTE WATER TREATMENT PLANTS (SAT-MAR)***
4. DESALINATIONS AGENTS **
5. BOTTLED COMPANIES *
6. GOLF COURSES -
7. PUBLIC ADMINISTRATION BRANCHES ?
8. BALNEARIES & SPAS (SALLUS PER AQUAM) ***
9. HOTELS AND TOURIST FACILITIES (MARKET UPTAKE) *

Review: MAR & agroindustry in Arenales aquifer (C y L, Spain)
CONCLUSIONS

• The Agro-industry development at Los Arenales aquifer is closely related to MAR (the aquifer was declared provisionally over-exploited in 1995)
  • MAR has positive effects on job creation and economic growth
  • MAR plays a vital role in avoiding rural depopulation
  • MAR improves yields and productions, balancing the lower prices

• Improvements in water irrigation systems enhance the efficiency, the environmental conditions, time disponibility, and, in short, better economic results

• MAR techniques provide savings in energy consumption (36%) enhancing the energy efficiency and raising farmers’ incomes

• It is recommended an energy audit to provide a significant improvement in energy efficiency and savings

• Ica city is a good example of MtoM with a single constraint: “excess of future”

• A new network of MAR related projects has been established and the interchange of info is ensured from now on

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