Influence of tree and shrub presence on pasture quality in dehesa system
Dehesas is the most extended silvopastoral system in Europe, with more than 3 millions hectares in SW Spain and Portugal (Eichhorn et al. 2006).

What is the **DEHESA** system?

Grazed open oak woodlands: 10-60 scattered trees per ha
Native grasses as understory
The Dehesa system: Threats

Historical trend
The Dehesa system: Threats

Over-aging tree population

Lack of regeneration

Could be possible?
The role of shrubs

Abandonment of Dehesa promote tree recruitment

Regeneration of Holm oak in Dehesa is associated with the presence of shrubs

The role of shrubs

Climate amelioration

Seedling protection against being grazed

Higher rates of acorn dispersers
Dehesa system was created to promote the grass layer
More plants for the same limited resources...
...could influence the pasture quality???

- Production
- Species Composition
- Nutrient Content
Experimental Design

3 HABITAT x FARM

- Shrub
- Tree
- Control

6 FARMS

6 REPLICATES x HABITAT x FARM

Up to 108 sampling points

Parameters

- PRODUCTION
  - Kg/ha

- SPECIES COMPOSITION
  - Grasses
  - Legumes
  - Others

- NUTRIENT CONTENT
  - N, P, K and Ca
Experimental Design

Cistus ladanifer ≠ Retama sphaerocarpa
effects of TREES on pasture PRODUCTION and SPECIES composition

### Production

- **Tree**: 2500 kg/ha
- **Control**: 1500 kg/ha

### Species composition

- **Tree**:
  - **LEGUMS**: 58% *
  - **GRASSES**: 32% *
  - **OTHERS**: 8% *

- **Control**:
  - **LEGUMS**: 35% *
  - **GRASSES**: 60% *
  - **OTHERS**: 7% *
effects of TREES on pasture NUTRIENT CONTENT

**Nitrogen**
- Tree: 20 mg N/g
- Control: 15 mg N/g
- Increase: +4.97%

**Phosphorus**
- Tree: 1.5 mg P/g
- Control: 0.5 mg P/g
- Increase: +7.78%

**Potassium**
- Tree: 25 mg K/g
- Control: 15 mg K/g
- Increase: +30.71%

**Calcium**
- Tree: 8 mg Ca/g
- Control: 5 mg Ca/g
- Increase: +18.00%
effects of *Cistus* on pasture PRODUCTION and SPECIES composition
### Effects of Cistus on Pasture Nutrient Content

#### Nitrogen

<table>
<thead>
<tr>
<th></th>
<th>Cistus</th>
<th>Control</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg N/g</td>
<td>18</td>
<td>20</td>
<td>-4.73%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-5.69%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-10.69%*</td>
</tr>
</tbody>
</table>

#### Phosphorus

<table>
<thead>
<tr>
<th></th>
<th>Cistus</th>
<th>Control</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg P/g</td>
<td>2.5</td>
<td>3</td>
<td>-2.60%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-1.91%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-11.61%</td>
</tr>
</tbody>
</table>

#### Potassium

<table>
<thead>
<tr>
<th></th>
<th>Cistus</th>
<th>Control</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg K/g</td>
<td>15</td>
<td>10</td>
<td>-4.18%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+5.75%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>+2.97%</td>
</tr>
</tbody>
</table>

#### Calcium

<table>
<thead>
<tr>
<th></th>
<th>Cistus</th>
<th>Control</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>mg Ca/g</td>
<td>5</td>
<td>4</td>
<td>+11.45%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-17.07%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>-3.13%</td>
</tr>
</tbody>
</table>
effects of *Retama* on pasture PRODUCTION and SPECIES composition

**Graphs:**
- **Bar Graph:**
  - *Retama*: 3500 kg/ha
  - Control: 2500 kg/ha

- **Pie Chart:***
  - Retama: 66% LEGUMS, 31% GRASSES, 1% OTHERS
  - Control: 30% LEGUMS, 1% GRASSES, 66% OTHERS

*Note:* The asterisk (*) indicates a significant difference between the groups.
effects of **RETAMA** on pasture **NUTRIENT CONTENT**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Retama</th>
<th>Control</th>
<th>Percentage Change</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Nitrogen</strong></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td>+ 6.77 % *</td>
<td>+1.21 %</td>
</tr>
<tr>
<td><strong>Phosphorus</strong></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td>+ 10.73 %</td>
<td>-3.46 %</td>
</tr>
<tr>
<td><strong>Potassium</strong></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td>-0.96 %</td>
<td>-2.88 %</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td><img src="image" alt="Graph" /></td>
<td><img src="image" alt="Graph" /></td>
<td>+ 7.17 %</td>
<td>+ 13.59 % *</td>
</tr>
</tbody>
</table>

*Significant at p < 0.05
Conclusions

1. Trees showed a marked effect on pasture layer. Indeed they reduced the total production and shift the species composition compared with open areas. However pasture growing underneath trees improved their nutrient content specially N.

2. The effect of shrubs on pasture is very contrasted, from a quasi-complete annulations of pasture production (Cistus), up to a reinforcement of pasture yield and quality (Retama).

3. Cistus reduced significally pasture production and quality with a significant diminution in N content but with no effects on species composition.

4. While Retama increased pasture production and quality, in terms of N content, with a similar effect than trees on species composition.

5. Overall, shrubs have marked effects on pasture layer with the potential to alter the species distribution and quality.
Thanks for your attention

Víctor Rolo Romero
rolo@unex.es