Quantifying Sediment Delivery History in Mediterranean Mountain Watersheds from Lake Records (Iberian Range, Spain)

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Poster & abstract available in Open Access at Digital CSIC: http://digital.csic.es/ and https://scholar.google.es/ (search for Barreiro-Lostres, F.)

1. The Challenge: Quantification

Mediterranean mountains → • Land degradation • Soil erosion → Key Environmental research area

- Long history human occupation
- Strong seasonality of hydrological regimes

Monitoring studies (Experimental catchments)

Too short time span — Not enough
- temporal
- spatial

variability

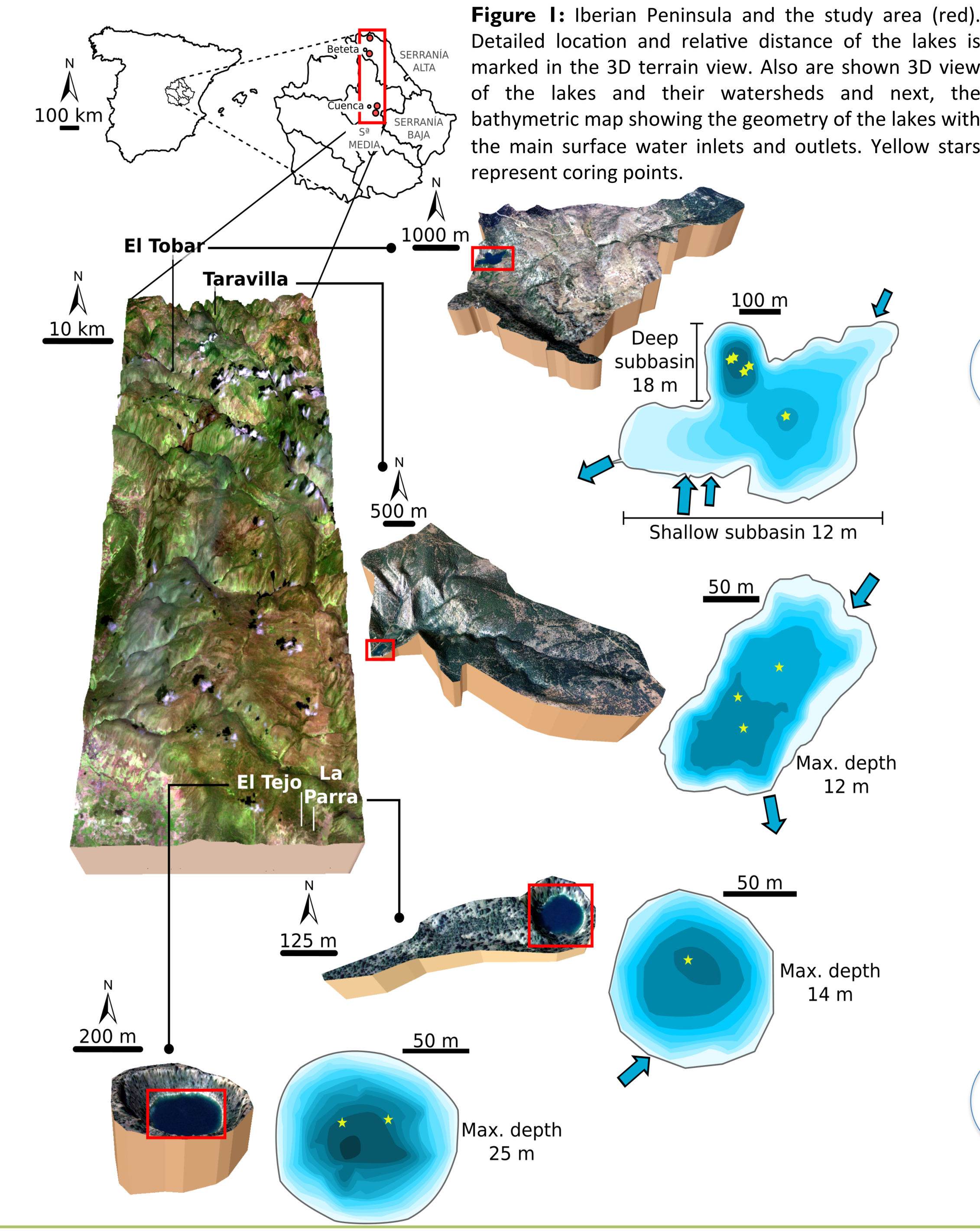

Figure 1: Iberian Peninsula and the study area (red). Detailed location and relative distance of the lakes is marked in the 3D terrain view. Also are shown 3D view of the lakes and their watersheds and next, the bathymetric map showing the geometry of the lakes with the main surface water inlets and outlets. Yellow stars represent coring points.

2. Methodology

We propose a novel strategy (based on Einsele & Hinderer, 1998) — **Lake sequences**
- **High resolution age-models**
- **Multi-proxy analyses**
  - geophysical
    - Mag. susceptibility
    - Density
  - geochemical
    - Detrital related elements (Ti, Si, Rb, K,…)

1 To quantify
- Sediment delivery to the lake — **MI: M**ass accumulated in the **L**ake
- Erosion on the watershed — **Mdc: M**ass **D**enued in the **C**atchment; **DRt:** total **D**enudation **R**ate

in four Iberian Range Mountain karstic lakes (Barreiro-Lostres et al., 2014) (Barreiro-Lostres et al., 2015) (Moreno et al., 2008) — integrating
- Last 1000 years
- Response to
  - Anthropogenic
  - Climatic

  forcings

2 and compare with Experimental data catchments (García-Ruiz et al., 2008)

3. Results

Calculated results are comparable to measured ones

From Lake sequences — From experimental catchments

- Most sedimentary inputs occur during flooding events
- Sedimentary delivery to the lakes spans several orders of magnitud (100 – 98000 T)
- Denudation rate ranges 6 – 480 T km^{-2} yr^{-1}

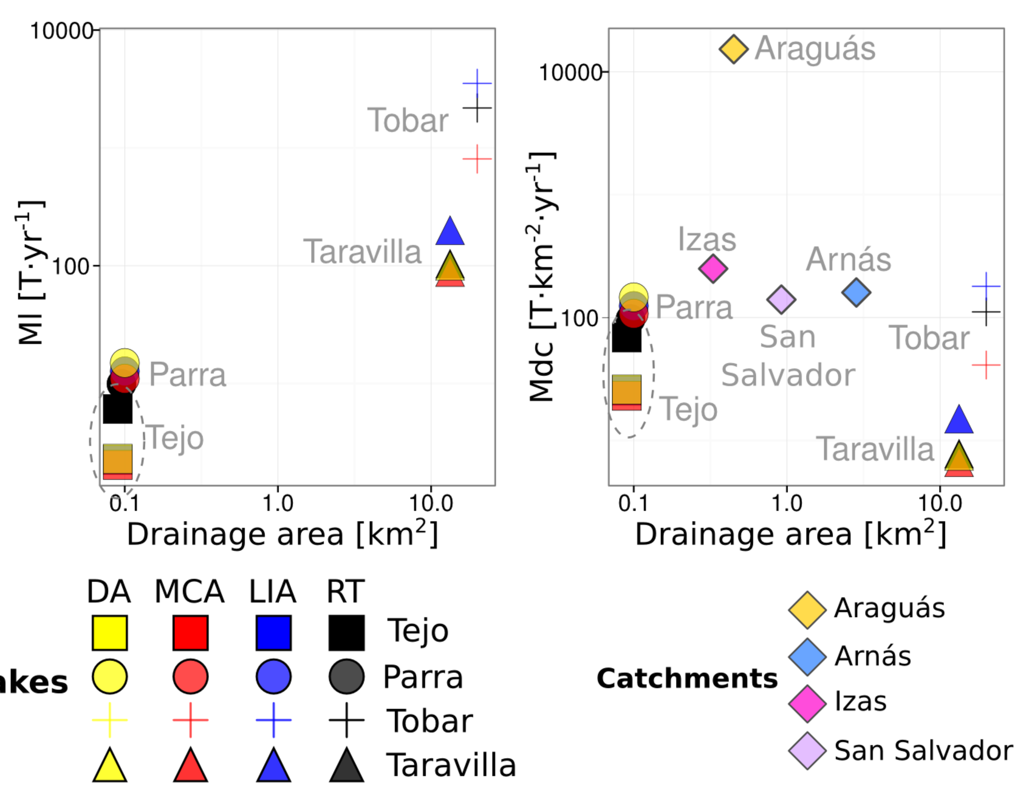

Figure 2: Mass accumulated in the lake (MI) and mass denuded from the catchment (Mdc) related to the drainage area extension for lakes and experimental catchments. For lakes calculations, colors represent different climatic periods: yellow, Dark Ages (DA, 500-900AD); red, Medieval Climate Anomaly (MCA, 900-1300 AD); blue, Little Ice Age (LIA, 1300-1850 AD); black, recent times (RT, 1960-2010 AD).

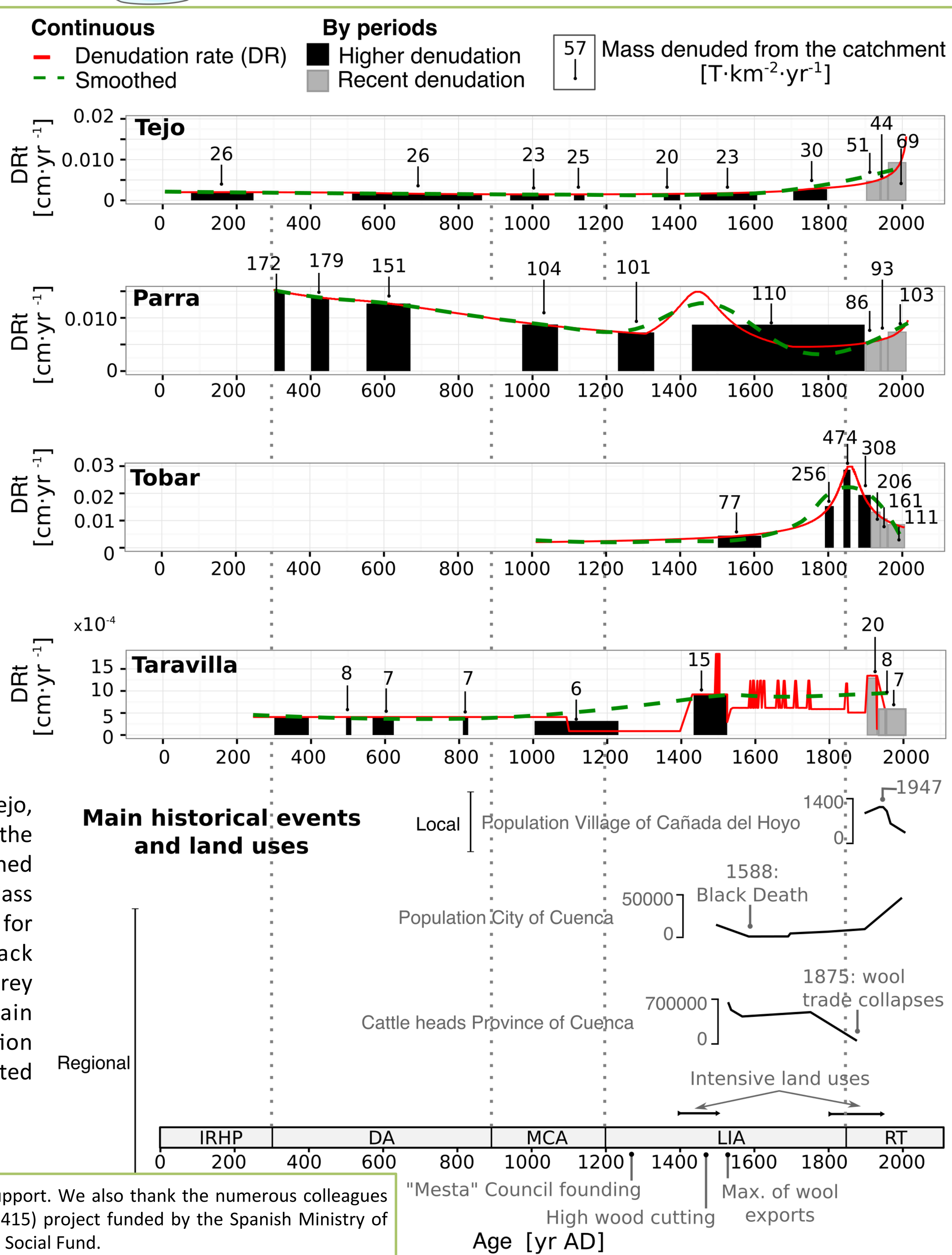

Figure 3: Total denudation rates (Drt) for El Tejo, La Parra, El Tobar and Taravilla lakes during the last 1000 years (continuous red line; dashed green line represent smoothed values). Mass denuded from the catchment (numbers) for periods of past higher denudation (black rectangles) and during recent denudation (grey rectangles) are also plotted. Below, main historical events, land use and population changes at local and regional scales are located along the time-line.

Periods of sediment accumulation in the Lakes **associated with higher denudation** in the watersheds correspond to

- Cooler/wetter climatic phases
  (Roman & Dark Ages, 0-800 CE)
  (LIA, 1200-1850 CE)
- Periods of increased human pressure in the watersheds
  Middle Ages
  - *Intense sheep transhumance ('Mesta')*
  - *Intense deforestation (12th-13th centuries)*

4. Conclusions

Key factors controling sedimentary fluxes from Mediterranean catchments are:

1. **Precipitation** (intensity, seasonality, runoff).
2. **Critical effect of** watershed size.
3. **Paramount role** at centennial scale of land cover (forested, degraded areas) related to **land use changes**.
4. **Synergistic effects** between climate and land use changes.

References:
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