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

Blas Valero-Garcés¹, Fernando Barreiro-Lostres¹, Ana Moreno¹, Penélope González-Sampériz¹, Santiago Giralt², Estela Nadal-Romero³

(1) Spanish Scientific Research Council, Pyrenean Institute of Ecology, Zaragoza, Spain; (2) Spanish Scientific Research Council, Institute of Earth Sciences Jaume Almera, Barcelona, Spain; (3) Department of Geography - Environmental Sciences Institute (IUCA), University of Zaragoza, Zaragoza, Spain

1. The Challenge: Quantification

Mediterranean mountains
- Long history human occupation
- Strong seasonality of hydrological regimes
- Land degradation
- Soil erosion

Monitoring studies
(Experimental catchments)
- Low temporal spatial variability
- Too short time span

Environmental research area

Results
- Calculated results are comparable to measured ones
- Most sedimentary inputs occur during flooding events
- Sedimentary delivery to the lakes spans several orders of magnitude (100 – 98000 T)
- Denudation rate ranges 6 – 480 T km⁻² yr⁻¹

References:

2. Methodology

We propose a novel strategy (based on Enzo & Hinderer, 1998)

1. To quantify

- Sediment delivery to the lake
- Erosion on the watershed

M: Mass accumulated in the lake
Mdc: Mass Denuded in the Catchment

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

3. Results

- 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, I200-I850 CE)
  - Periods of increased human pressure in the watersheds
  - Middle Ages
    - Intense sheep transhumance (‘Mesta’)
    - Intense deforestation (12th-13th centuries)

4. Conclusions

Key factors controlling 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.

Acknowledgements: We thank to the Spanish Environmental Agency of the Regional Government (Junta de Comunidades de Castilla-La Mancha) for the courteous attention and logistic support. We also thank the anonymous reviewers for the useful comments to improve the final draft. This research has been supported by the CONSEJO DIRECTOR CSIC-2008-01 (contract funded by the Spanish Ministry of Economy and Competitiveness and by the FEDER program (0-2007-0005) funded by the EU). B. Valero-Garcés acknowledges the Visiting Professorship contract supported by C.I.C.I.C. and the European Social Fund.