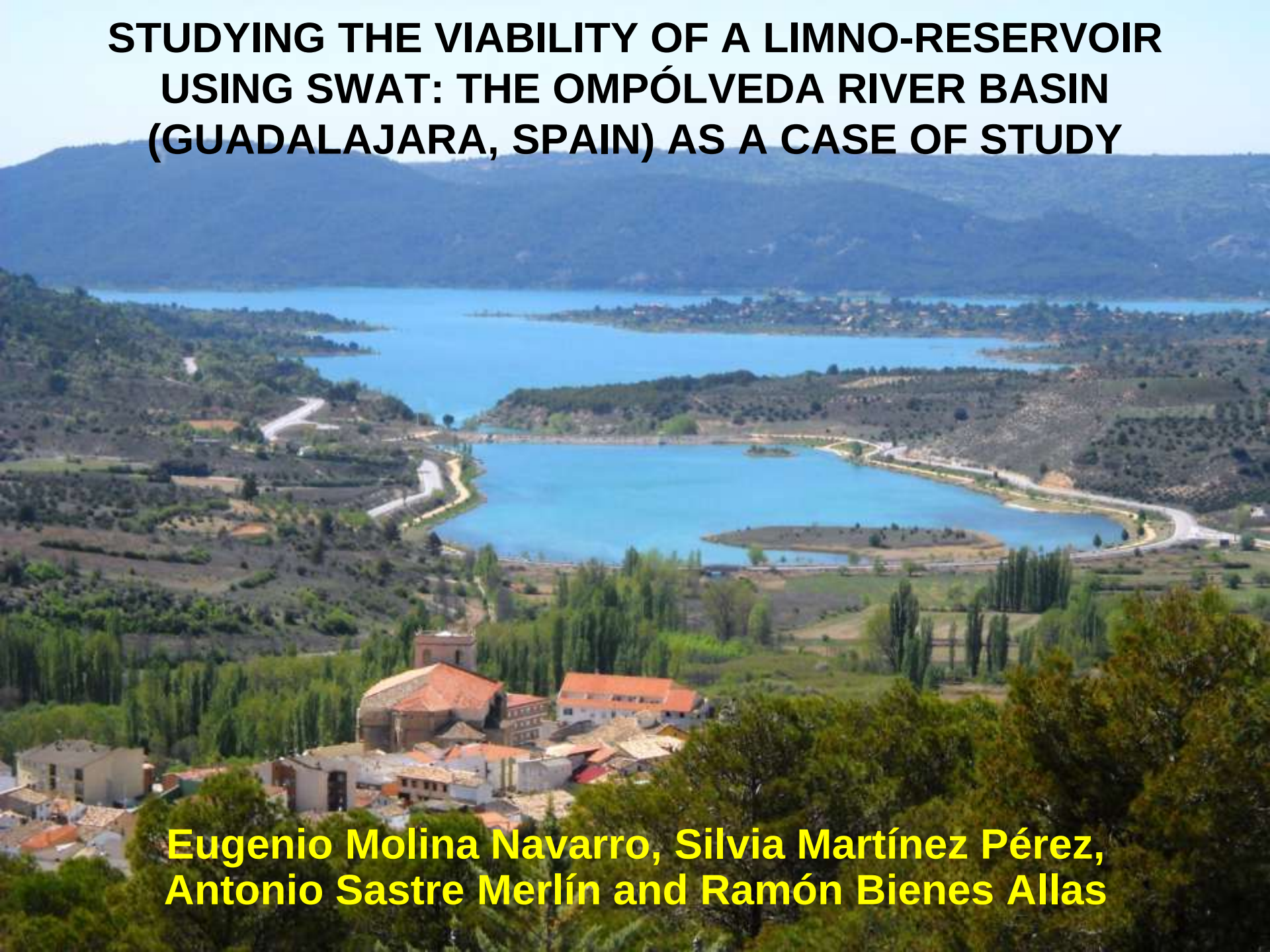
STUDYING THE VIABILITY OF A LIMNO-RESERVOIR USING SWAT: THE OMPÓLVEDA RIVER BASIN (GUADALAJARA, SPAIN) AS A CASE OF STUDY



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1. Introduction

WHAT A LIMNO-RESERVOIR IS?

A body of water with a constant level created as a consequence of building a small dam (known as "edge dam" or "flood dam") on the edge of a reservoir. A limno-reservoir is independent of the management of the main reservoir.

We have termed them "limno-reservoirs" since they act more like a lake than a reservoir.

(Molina Navarro *et al.*, 2010)

Corrective / Compensative Action
of the negative environmental impacts of large reservoirs

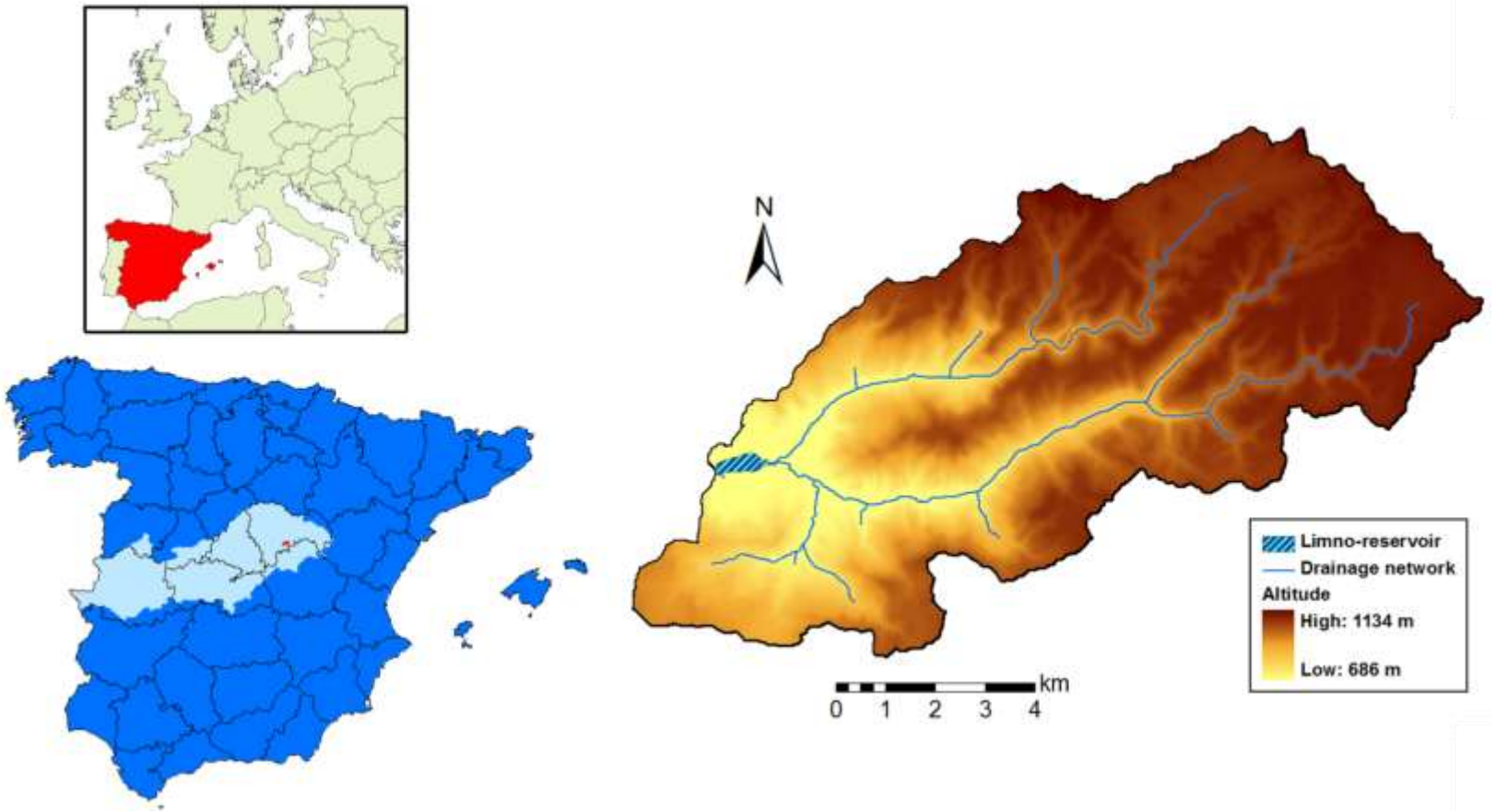
Pareja Limno-Reservoir view.

LIMNO-RESERVOIRS IN SPAIN

22 limno-reservoirs in 15 large dams

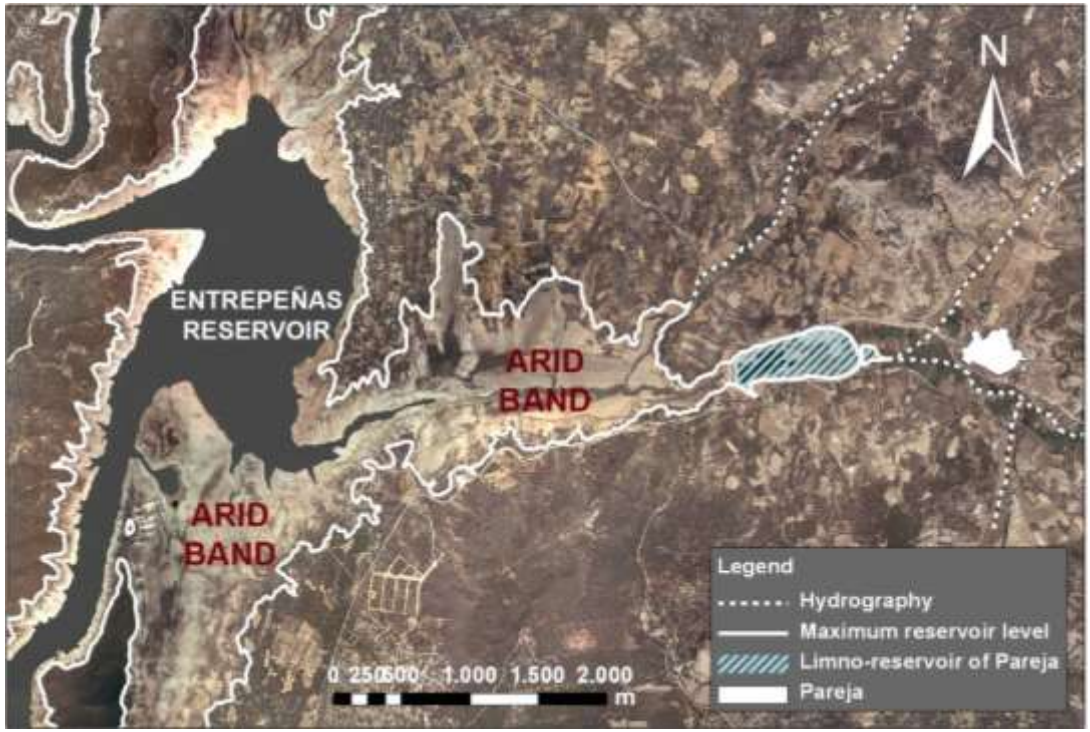
OMPÓLVEDA RIVER BASIN

Location:



Location of the Ompólveda River Basin, current location of the Pareja Limno-Reservoir and digital elevation model

PAREJA LIMNO-RESERVOIR



Comparison of the volume of water stored in the Entrepeñas reservoir in 2006 with its maximum capacity

13/feb/2009

24/nov/2009

14/apr/2011

OBJECTIVES

Gauging station just in the basin outlet → Inoperative since the Limno-reservoir creation but opens the possibility of creating and hydrological model

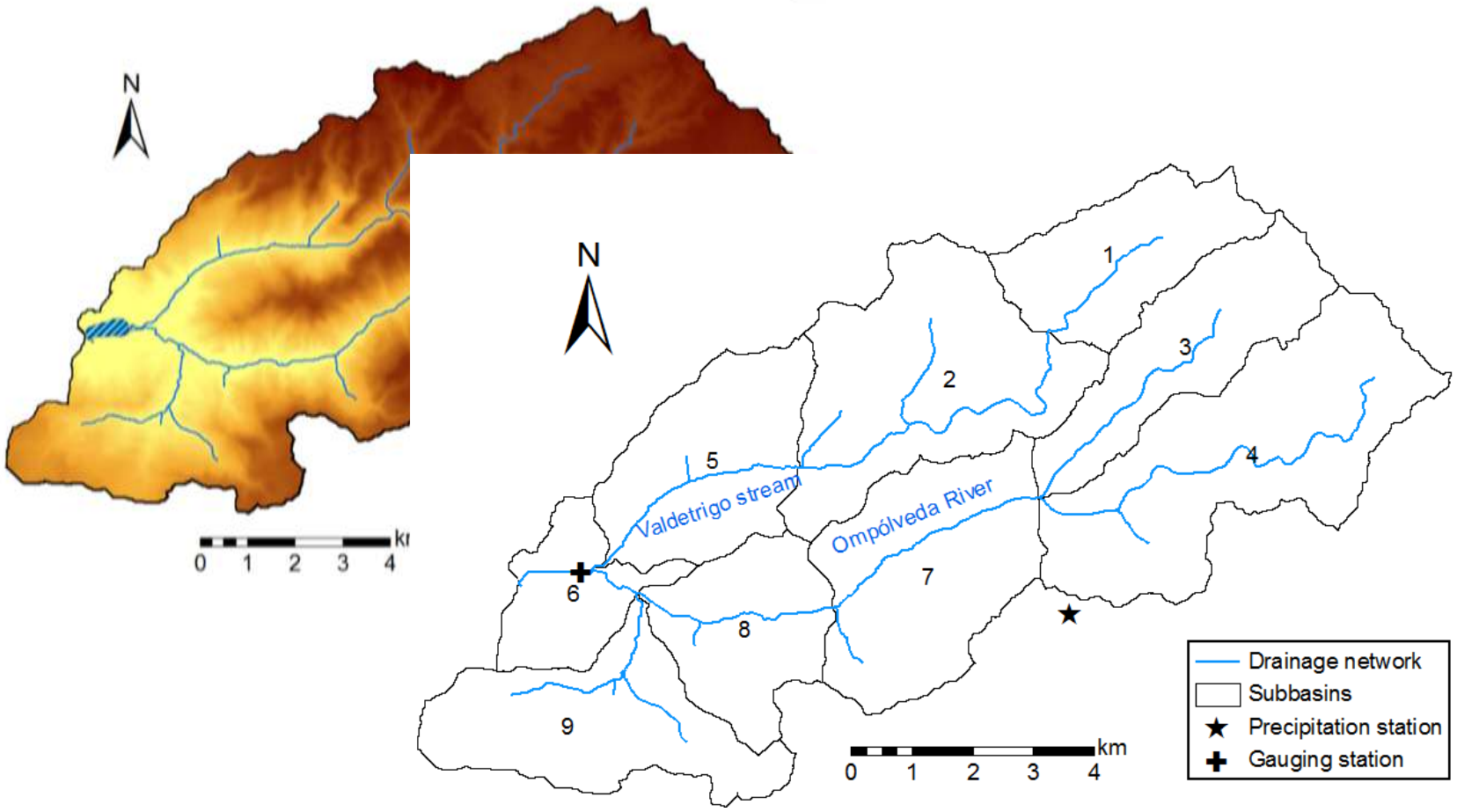
Main Goal:

Analyze the hydrological response of the Ompólveda River Basin and its sediment yield:

- **Check the situability of the basin to apply SWAT**
- **Set up the SWAT model in the Ompólveda Basin.**
- **Analize the preliminar simulation results**

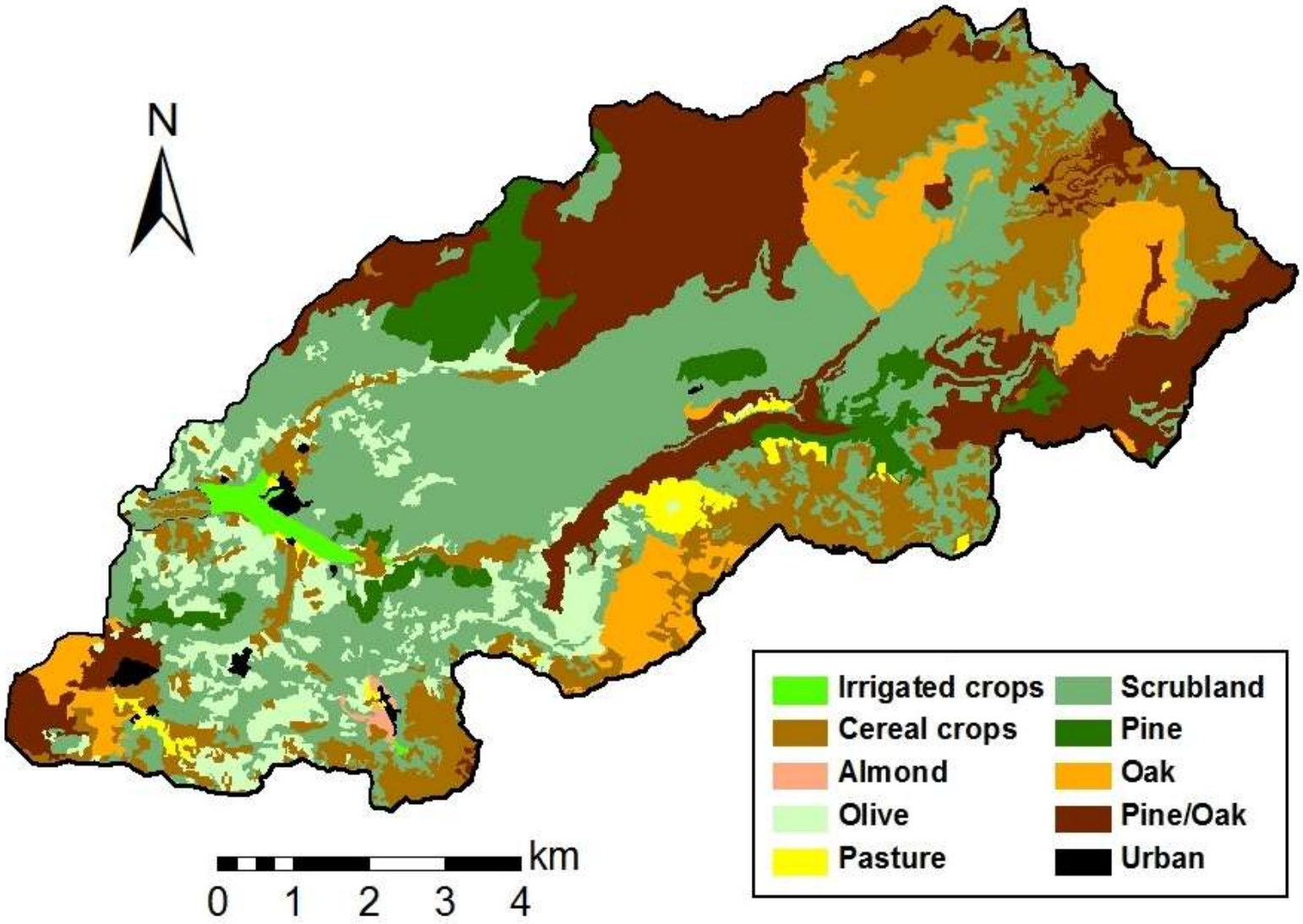
2. Data inputs and model set up

DEM (5x5 m) of the Castilla-La Mancha Goverment

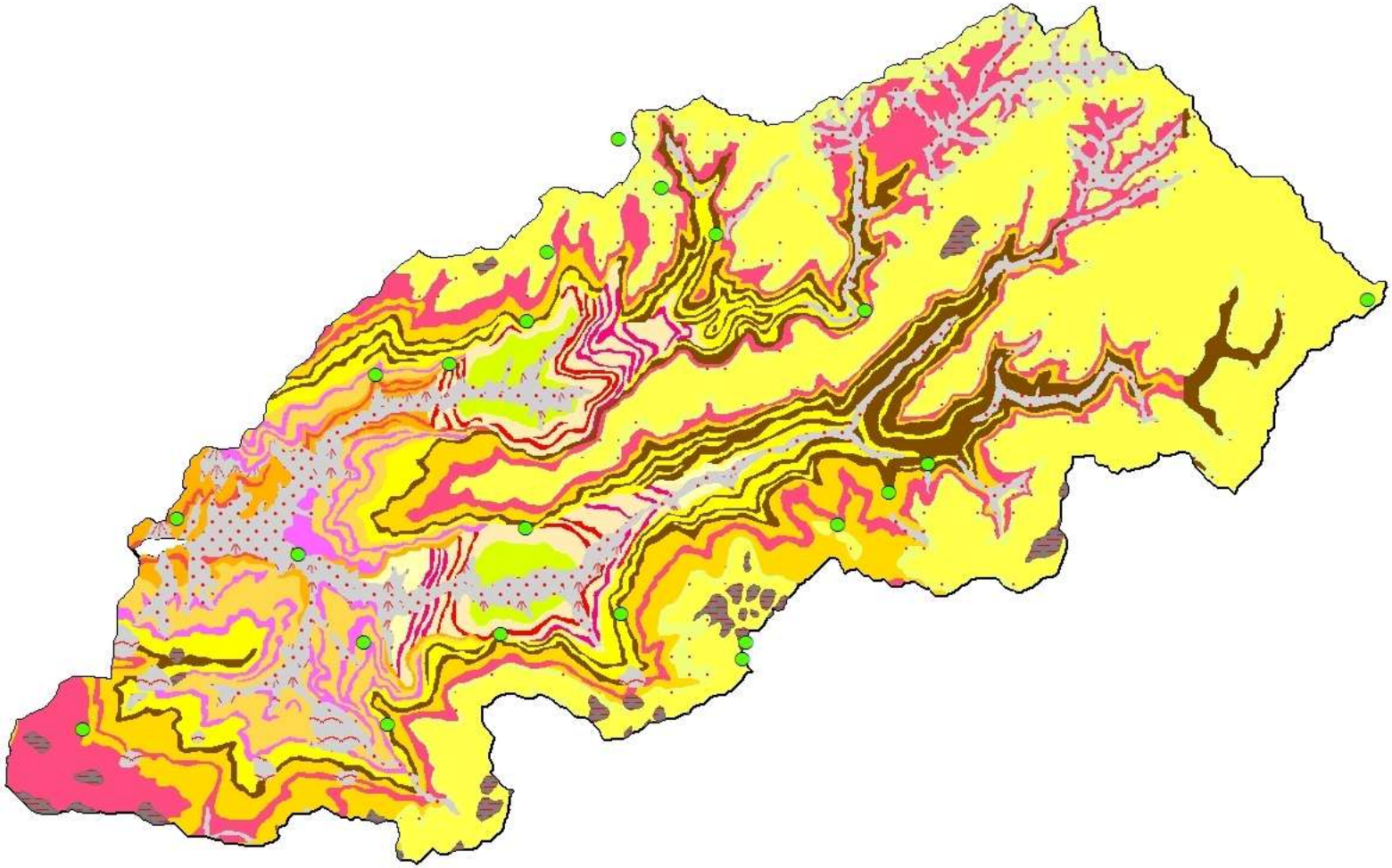


Subbasin division and precipitation and gauging stations

Spanish Ministry of the Environment Land Uses Map

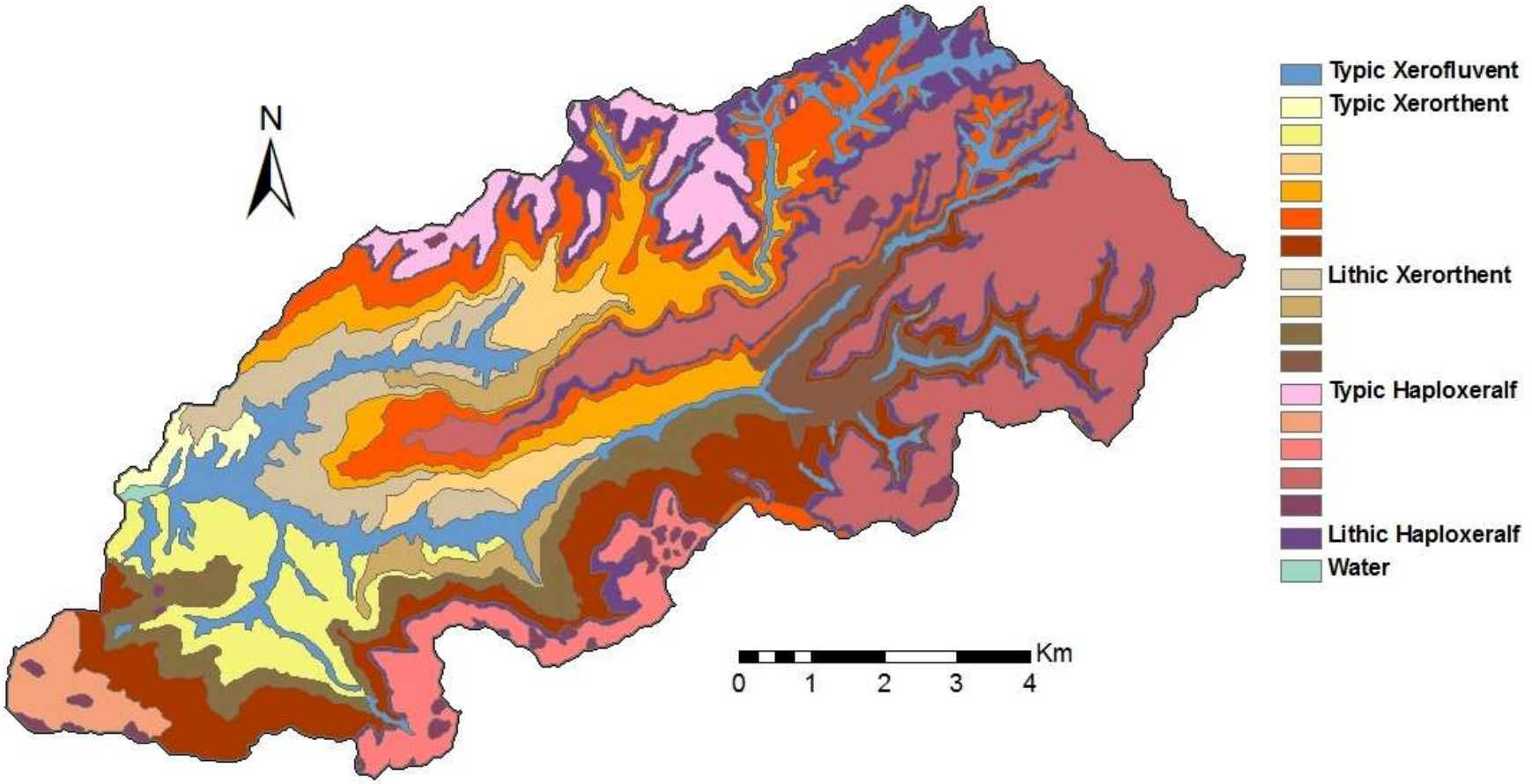


Soils Map: Lithology + geomorphology + land cover + orientation = 22 Sampling points



Soil sample analysis + USDA Soil Taxonomy criteria

= 17 different soils mapped



SLOPE: 0-8%, 8-30% and >30% (FAO, 1980).

HRU Definition:

- Threshold levels: 15% land use, 10% soils and slope
- 252 HRUs obtained (22-36 per subbasin)

Weather data:

- Precipitation: Escamilla station
- Temperature: Guadalajara station

SWAT inputs edited

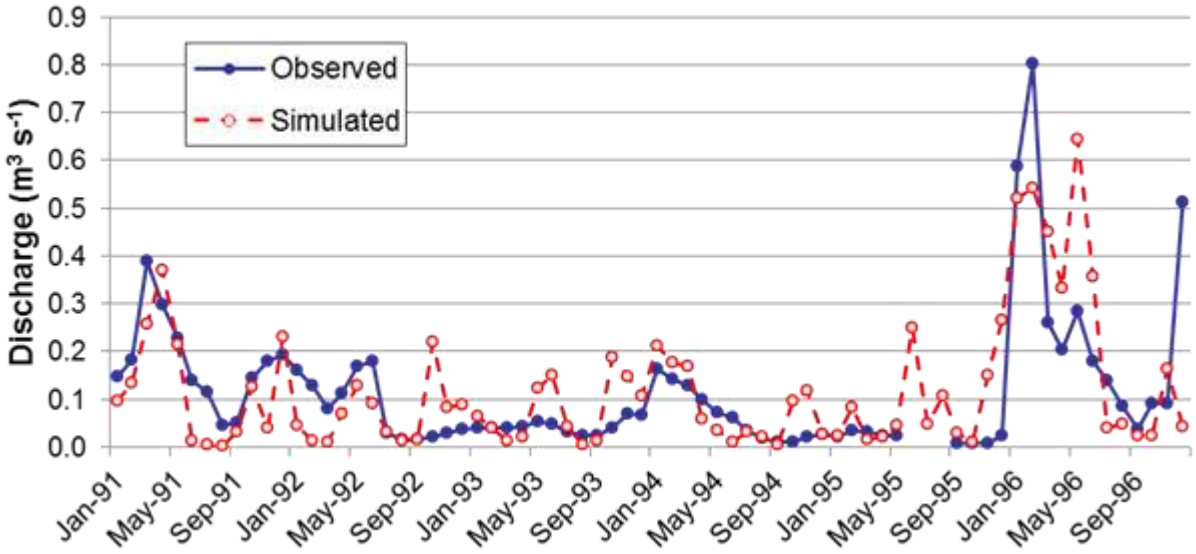
Watershed, water use, routing, subbasin, groundwater

3. Results and discussion

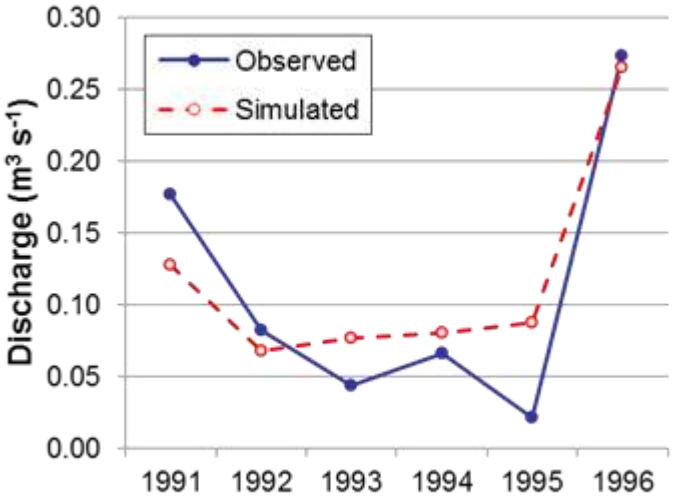
SENSITIVITY ANALYSIS AND AUTO-CALIBRATION

Parameter	Description	Sensitivity Ranking	Initial Value	Final Value
ALPHA_BF	Baseflow recession coefficient	11	1.00	0.01
CANMX (mm)	Maximum canopy storage	-	0	10
CH_K2 (mm h^{-1})	Effective hydraulic conductivity in the main channel alluvium	-	0.1	29.6
CH_N2	Manning's n value for the main channel	12	0.04	0.60
CN2	SCS curve number for soil moisture condition II	3	35.0-63.0	38.8-70.0
EPCO	Plant uptake compensation factor	6	1.00	0.53
ESCO	Soil evaporation compensation factor	2	0.01	1.00
GW_DELAY (days)	Delay time for aquifer recharge	8	5.0-15.0	4.4-14.4
GW_REVAP	Groundwater "revap" coefficient	4	0.10	0.11
GWQMN (mm)	Threshold water depth in the shallow aquifer for base flow	1	200	1055
RCHRG_DP	Deep aquifer percolation fraction	-	0.05	0.36
REVAPMN (mm)	Threshold water depth in the shallow aquifer for "revap"	7	1	58
SOL_AWC (mm mm^{-1})	Soil available water capacity	5	0.07-0.12	0.07-0.12
SOL_K (mm h^{-1})	Soil saturated hydraulic conductivity	9	2.5-12.0	2.6-12.6
SURLAG (days)	Surface runoff lag coefficient	10	3.0	4.3

CALIBRATION PERIOD (1991-1996)



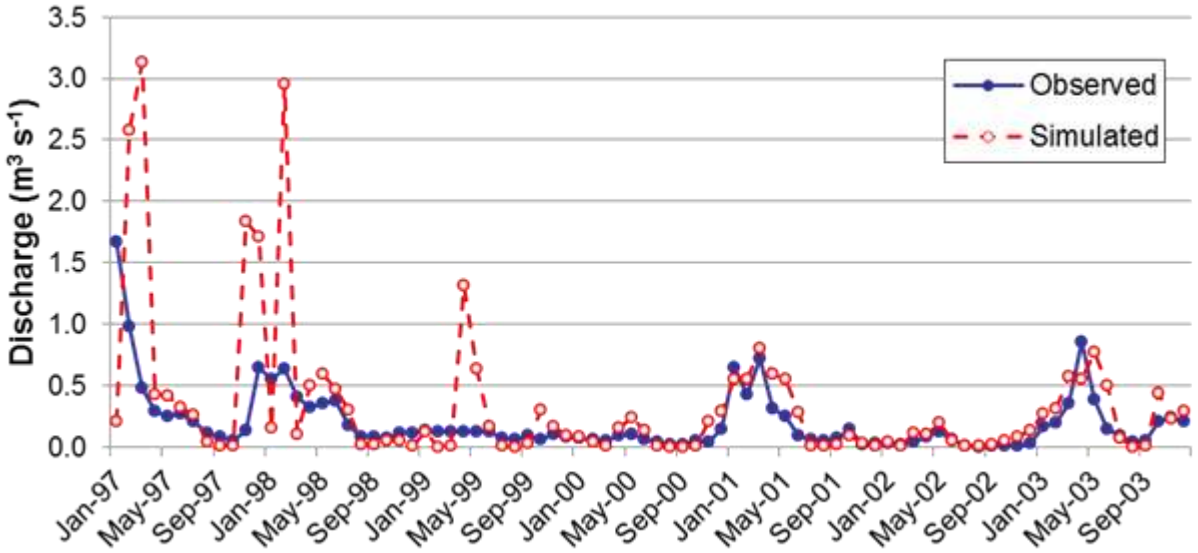
Mean monthly discharges



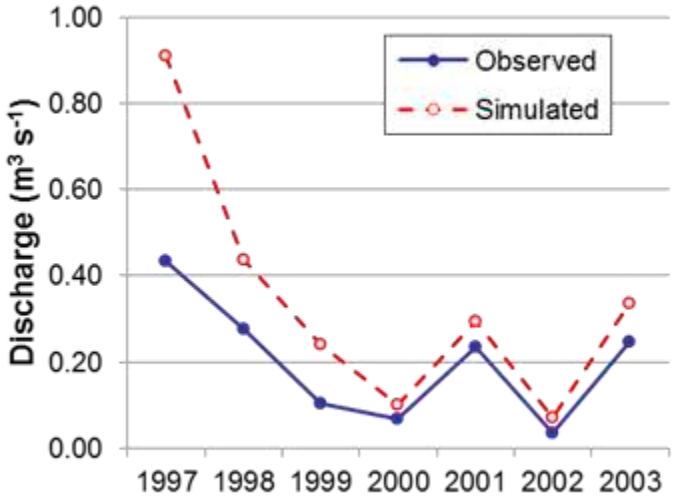
Mean annual discharges

	r	NSE
Monthly	0.68	0.36
Annual	0.91	0.72

VALIDATION PERIOD (1997-2003)



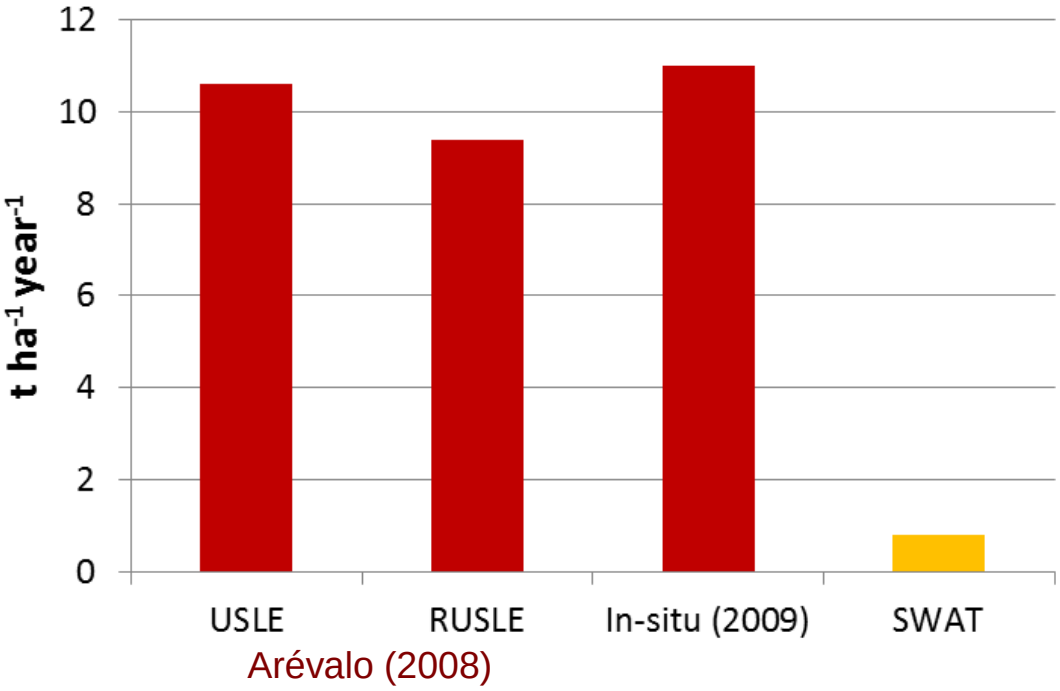
Mean monthly discharges



Mean annual discharges

	r	NSE
Monthly	0.50	-3.40
Annual	0.95	-1.93

SEDIMENT LOADING



Arévalo (2008)

NOT CALIBRATED

Most of the sediment loss produced in the basin would not enter in the Pareja Limno-reservoir ➔ Implications in siltation risk

Confluence of Ompólveda and Valdetrigo (23-02-2010)

Limno-reservoir edge (23-02-2010)

4. Conclusions

- Hydrologic response of the Ompólveda River Basin can be analyzed using SWAT

- Model performance was satisfactory during calibration (1991-1996) but the adjustment decreased during validation (1997-2003)

- Sediment yield could not be calibrated, but shed some light on the limno-reservoir siltation risk

FURTHER WORK

- IMPROVING the SWAT model application in the Ompólveda River Basin (Improve calibration and validation using SWAT-CUP, check the goodness of the observed data, change initial groundwater parameters) ➔ **HYDROLOGIC VIABILITY OF THE PAREJA LIMNO-RESERVOIR**

- Comparing sediment yield in the improved model to field research (*in situ* soil loss studies and limno-reservoir sediment studies) ➔ **LIMNO-RESERVOIR SILTATION RISK**


Thanks for your attention!
Any question?