Evaluation of direct anthropic effects over riparian vegetation zonation in several stretches of Mediterranean rivers in Spain

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INTRODUCTION

The Júcar River Basin District is one of the most relevant watersheds in the Mediterranean region of Spain both for its size and for the high regulation which is subjected to. The district system includes Mijares, Serpis, and Cabriel rivers as three of the most relevant ones. The objective of this work is to evaluate how hydrological changes are affecting riparian vegetation in some representative stretches.

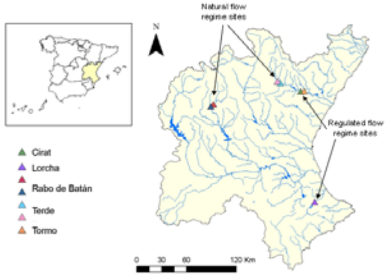


Fig.1 Location of the study sites (Jucar River Basin District)

The affections have been established by comparing them with the results obtained by simulating the estimated natural conditions. The model employed is called RibAV.

The RibAV model (Morales and Francés, 2009) can be applied in a wide range of conditions across semiarid environments. An evaluation of several anthropic impacts can be done considering changes in hydrological regimes.

RibAV MODEL

- This mathematical model is conceptualized as a static tank flow model based on the actual riparian plants evapotranspiration (ET)
- The most relevant model parameters are: soil retention curves, vegetation functional types parameters and daily hydro-meteorological data
- The general model output variable is an ET index based in the quotient between the current and the potential ET
- The RibAV model simulates a certain number of riparian vegetation functional types

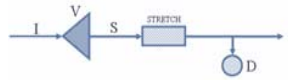
TV → terrestrial vegetation
RA → riparian trees or adult shrubs
RJ → riparian juveniles plants or small shrubs
RH → herbaceous riparian plants

DATA AND SCENARIOS

The hydrological regimes were modified in order to obtain several flow regulation scenarios

The stretches with no regulation were affected with:

- dam regulation by a reservoir 20%, 40%, 60%, 80% and 100% of the annual flow



- agricultural, urban and hydroelectric demand without water consumption

The stretches with hydrological regulation were analyzed by comparing the historical data simulations to the theoretical natural flow regime ones.

QBR INDEX

The QBR index of riparian quality is based on four components of riparian habitat: total riparian vegetation cover, cover structure, cover quality and channel alterations (Munné *et al.*, 2003).

It Is possible with RibAV results to analyze variations of this index over the different scenarios concerning:

- Total riparian vegetation cover: number of riparian simulated points (RA, RJ and RH) over terrestrial ones (TV).
- Cover structure: number of RA simulated points respect the total riparian ones (modified by the number of RJ and RH simulated in the points adjacent to the channel)

Cover quality and channel alterations: constant

CONCLUSIONS

Changes in Mediterranean semiarid hydrologic systems cause changes in river associated vegetation

RibAV model is an useful tool for evaluating several anthropic impacts considering changes in hydrological regimes, but some predictions should be qualified

The QBR index is useful to determine riparian quality variations in different scenarios, but stretch QBR seems to be relatively insensitive

Hydrologic regulation by dams (w/o water consumption) is not always unfavorable for riparian plants. Even so an appropriate flow regime is needed in terms of quantity and seasonality

RESULTS

Dam regulation can improve the presence of riparian functional types in natural stretches provided that the flow is not very restricted.

Several flow scenarios allow better riparian quality, favoring RA and RJ presence instead of RH or TV.

Optimal demand scenarios			
	Dam capacity (%)	Relative flow $Q_s / \overline{Q}$ (%)	Variability
Agricultural	20 40 - 100	12.40 12.40 – 18.60	monthly
Urban	20 % 40 - 100	12.34 61.69	seasonal
Hidroelectric	20 - 100	58.34	constant

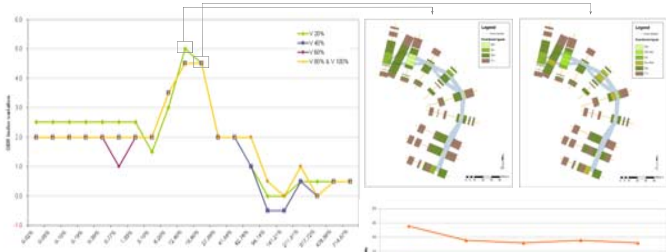


Fig.2 QBR index variations in agricultural demands scenarios


Fig.3 Terde simulations of optimal agricultural demands for different dam capacities

Fig.4 QBR index variations in urban minimum demands scenarios

Fig.5 QBR index variations in urban averaged demands scenarios

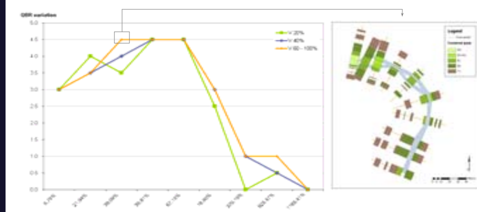


Fig.6 QBR index variations in urban maximum demands scenarios

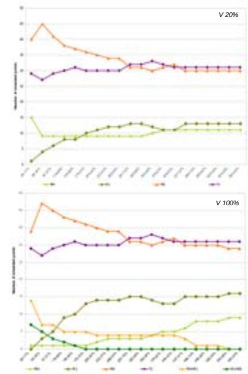


Fig.7 Number of simulated points of vegetation functional types in hydroelectric demands scenarios

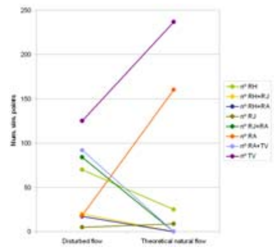


Fig.9 Number of simulated points of vegetation functional types in Lorcha (Serpis river)

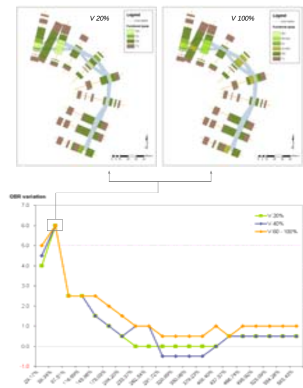


Fig.8 QBR index variations in hydroelectric demands scenarios

Dam regulation in stretches with disturbed regime show a lower presence of isolated TV and RA and an increase of RH and combined functional types

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