

## ***Interactive comment on “Hydrologic and land-use change influence landscape diversity in the Ebro River (NE Spain)” by A. Cabezas et al.***

**A. Cabezas et al.**

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### AUTHOR COMMENT TO ANONYMOUS REFEREE 1

The manuscript shows relevant data about the transformation of the fluvial Ebro ecosystem along the last century, and it has quality for publication in the journal. Although changes in the study area may be representative of most of the basin, general conclusions can not be drawn from the analyzed data of a specific reach of the middle basin.

Author Response (AR).1. We will try to reduce the extent of our conclusions through the paper and not over extrapolate results.

Specific comments: Abstract, line 7: "...as well as the overall basin". This part of the

sentence should be deleted, since overall basin changes can not be concluded from the analyzed data.

AR.2. See AR1

Abstract, line 16: "Under the current socio-economic context...". What do you mean ?

AR.2. When we refer to the socio-economic context we mean the management of the Ebro River administration ([www.chebro.es](http://www.chebro.es)). As long as we understand, water management is focussed on favouring agricultural activities and only a few examples of ecological management both of the river and the adjacent floodplains can be found. Also a big percentage of the population support dredging, channelization and dyke construction.

Is the present economic crisis ? Can we lower floodplain heights in a relevant part of the system with limited funding ?

AR.3. If society would be awake about the economical values of the ecosystem functions this would be seen as an investment rather than as a cost. Anyway, in a more practical point of view, there are some examples in Holland where lowering of floodplain heights can be self-sustained by selling the material for different purposes as housing. In fact, we have done something similar in the Ebro River and the experience has been quite good.

Methods, study area, line 14: the present annual discharge to the Mediterranean Sea is no 18138 Hm<sup>3</sup>, this was the discharge in natural past conditions. Nowadays is around 12000 Hm<sup>3</sup>, due to a decreasing trend mostly caused by irrigation; please update the figure with the CHE data or use a reference.

Methods, study area, line 17: same comment than previous, is 230 m<sup>3</sup>/s the mean discharge at present or is the discharge in natural past conditions ?

AR.4. You are right, I have calculated it with the data from 1927-2003 (Study Period) and the value is 14.442 Hm<sup>3</sup>/y, I will have to check for the average discharge (consid-

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ering the gauge station I choose). All will be corrected in the revised version.

Landscape analysis: here an important point is to include some statistical analysis of the accuracy in identifying habitat type. How did you validate the habitat attribution derived from the GIS analysis ? Did you check it with field data ? Please, carry out this type of analysis and include some references of other similar works in which this has been done.

AR.5. In recent aerial pictures (2003 and 1998), each digitized polygon was delimited at the field over printed aerial pictures (prior and after the 2003 flooding, the reason why we considered the 2003 aerial picture interesting). Since we have done it &#8220;a priori&#8221; and not &#8220;a posteriori&#8221; we consider that any statistical validation as the Kappa index has no sense, the study area is not that big. We have to explain this more clearly in the revised paper.

For the historical pictures, this kind of validation is not possible, we have not vegetation maps. An interpretation key was used (2763, 15) as it has been done in another cases for the interpretation of historical pictures. Those references will be included in the revised version, although

Geerling, G. W., A. M. J. Ragas, R. Leuven, J. H. van den Berg, M. Breedveld, D. Liefhebber, and A. J. M. Smits (2006), Succession and rejuvenation in floodplains along the river Allier (France), *Hydrobiologia*. 565, 71-86.

Is the most appropriated.

Results, hydrological analysis, line 22 (and discussion, lines 10, 12 and 26): the decrease in mean annual discharge is probably not since 1981. In order to see the hydrological changes along time you do not have to divide the whole data set in the same periods you used for the picture analysis. Please, either applies a statistical test to the whole data set in order to identify when the decreasing trend is significant, or just state that the average discharge of the period after 1981 is significantly lower than

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the periods before 1981, but without saying that the decrease took place exactly in 1981 (however, to state that the mean annual discharge of some particular period is significantly different than other, you also need to perform some statistical test).

AR.5. You are right, I will follow your indication and I will say in the revised paper that we observed differences rather than the decline started in this year.

Results, landscape analysis, lines 13-17: this paragraph should rather go to the methods section. Results, landscape analysis, line 30: at the end of the section, at least in my text, there is 5 lines of text that are not from the manuscript, so just delete them (in case they are in the original manuscript).

AR.6. This will be corrected in the revised version

Discussion, page 2771, line 10: since the closest dams upstream the study area are quite far away (as long as I remember), the riverbed incision is may be not relevant in this reach.

AR.7. This will be corrected in the revised version, but we had to considered a little channel bed incision since the river discharge is constricted to the main channel due to dykes and vegetation encroachment. Anyway, we coincide with you on the point that is not relevant as can be downstream of a big dam.

Discussion, page 2775, line 2: is the suggested initial economic investment feasible ? Are you referring only to the study area or is this investment feasible at a larger scale in the Ebro basin ?

AR.8. The initial investment should be applied at the study reach, we will clarify that in the revised version, although this strategy could be applicable to another reaches at the Middle Ebro. For the question about feasibility, please see AR.3.

Technical corrections: Results, page 2766, line 7: "...has decreased in since..." should be "...has decreased since..." Discussion, page 2770, line 25: "...human-manages..." should be "...humanmanaged..." Conclusions, page 2775, line 15: "...(1957-1957..."

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should be "...(1927-1957)..." References, page 2778, line 11: "Lopea-Moreno" should be "López-Moreno". Please, put the accent in names, like García, Comín, etc.

AR.9. All this corrections will be achieved in the revised manuscript.

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Interactive comment on Hydrol. Earth Syst. Sci. Discuss., 5, 2759, 2008.

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