

Reply to Review #3 on “Hess Opinions: Socio-economic and ecological trade-offs of flood management – benefits of a transdisciplinary approach” by Karl Auerswald et al.

We appreciate the encouraging comments and helpful amendments. In blue we explain how we considered the reviewer’s advice in our manuscript.

Anonymous Referee #3

The opinion paper from Auerswald et al. gives a good overview about the ecological and economic consequences of river channelization and rectification, levee building, flood control, river damming, and the consequent loss of ecosystem services to humans. The authors argue that the traditional engineering solutions of river channelization should include alternative solutions that consider more balanced decisions involving both ecological and economic measures (green infrastructure). They conclude that the conservation of the few remaining pristine floodplain systems should have highest priority, and I strongly agree with this argument.

Although the main findings and arguments are not new from the perspective of river and wetland ecology, I like the opinion paper because it highlights the urgent demand to continuously raise awareness about the economic and ecological consequences of river channelization to the general public, stakeholders, and policy makers. This awareness is particularly lacking in most parts of densely populated central Europe, and partly North America, where most rivers were channelized, dammed, and diked more than a hundred years ago. As such, because most citizens of these countries never lived along a pristine river and floodplain, the ecosystem services that these ecosystems provide are also poorly known and acknowledged by most societies. As elsewhere, ecologists face strong opposition and drag when trying to conserve pristine river floodplains, or when they make proposals for river and floodplain restoration. In densely populated regions, there are many economic activities along rivers and in floodplains that create complex conflicts of interest, such as between agriculture, forestry, housing and urban development, flood protection, industrial needs and water carriage. I think that these conflicts of interest can only be solved when a sound evaluation of the economic value of ecosystem services (including flood protection) is weighted against the economic return from channelized rivers and destroyed floodplains. I therefore agree with Reviewer 1 that the paper could benefit from the inclusion of some statement where positive and negative economic effects of river channeling are compared. Given the enormous damage and repair costs that densely populated countries increasingly experience due to catastrophic flood (and drought) events, alternative, green infrastructure solutions along rivers and floodplains are the single sustainable way to prevent societies from further damage.

We added at the beginning of our outlook:

“In the past, there were many good reasons for river reconstruction like improvement of disease control by sewage collection and treatment (Preston and Van De Walle, 1978; Nitsdale, 1996; Kesztenbaum and Rosenthal, 2017), hydropower extraction (Koch, 2002), navigability (Smith and Winkley), and reclamation of land for urbanization, infrastructure and arable agriculture by increasing return periods of floods (Déchamps et al., 1988). “

In the main conclusion, however, the paper could also benefit from the inclusion about the opportunities that emerge from the restoration of already channelized river and decoupled floodplain systems. There is an increasing number of river and floodplain restoration projects all over the northern hemisphere, and most of them show that even small-scale projects are able to locally restore pristine conditions, to increase habitat and species diversity, and to restore further (but not all) important ecosystem services, such as water retention and flood control. **Pristine river floodplains are highly dynamic**

landscapes, and their biota is per definition adapted to a certain degree of ecological disturbance. This makes river floodplains relatively easy to restore - at least in temperate regions - despite the enormous costs that these restoration measures cause through the deconstruction of channel fixation, dikes, and dams.

Some suggestions for potential inclusion in the reference list:

-A couple of years ago, the French concept of the "Espace de liberté" for rivers was developed through

Malavoi J.-R. (1998) – Bassin Rhône-Méditerranée-Corse. Guide Technique N2 : Détermination de l'espace de liberté des cours d'eau. Secrétariat Technique du SDAGE, Lyon, 40 p. It describes the idea to deconstruct river fixations to increase ecosystem services provided by free-flowing river channels.

-As most rivers and floodplains in the northern hemisphere are strongly modified through humans, important ecological concepts (such as the flood-pulse concept by Junk et al. 1989) mostly derive from other parts of the world, such as the Amazon. Traditional communities and their economies in the Amazon are well-adapted to flood events, and this might be a good example how floods can also be incorporated in the daily life of densely populated countries and modern economies. See:

Junk WJ, et al. (eds.): Amazonian Floodplain forests: Ecophysiology, Biodiversity and Sustainable Management. Ecological Studies 210, Springer Verlag, Heidelberg, Berlin, New York

-A good review on the impact of river dams for the Amazon is from

Latrubesse EM, et al. (2017): Damming the rivers of the Amazon basin. Nature 546: 363-369

We added:

“Pristine river floodplains are highly dynamic landscapes, and their biota are *per se* adapted to a certain degree of ecological disturbance. This makes river floodplains relatively easy to restore - at least in temperate regions - despite the enormous costs that these restoration measures cause through the deconstruction of channel fixation, dikes, and dams.”

And additionally cited among others: Malavoi (1998), Latrubesse et al. (2017) and Junk et al. (2011)