Combined effects of climate change and dam construction on riverine ecosystems (van Oorschot et al. 2018) [1]

River morphology and riparian vegetation continuously adapt to changing discharge conditions, which makes it a challenge to distinguish long-term development driven by natural discharge variation from the impacts of flow alteration due to climate change and due to dams. The aim of this study was to investigate how such flow alterations affect bio-geomorphological processes and habitat suitability of several fluvial plant and animal species. This is done with a numerical model representing dynamic interactions between morphodynamic processes and riparian vegetation coupled to habitat suitability models of fluvial species. We compared a control run with natural flow regime to altered flow for two scenarios with different dam operating regimes, two scenarios with climate change, and for combinations of dams and climate change.

Results show that flow stabilization leads to incision, acute reduced seedling recruitment and decline of riparian vegetation. Climate change generates a gradual response, where high flow extremes counteract an otherwise reduced seedling recruitment of pioneer vegetation, while drying reduces riparian vegetation recruitment and causes vegetation shifts towards lower elevations on the floodplain. Modelled habitat availability for facilitated plant and animal species declines most when the synchronicity between critical life history events and habitat requirements is disrupted by altered flow conditions, with opposite effects for different species. Dynamic interactions between bio-geo-morphological processes with somewhat different characteristic timescales create non-linear and adaptive behaviour of morphology, habitat patterns and facilitated species habitat. This implies that only models that include bio-geomorphological feedbacks can forecast impacts of multiple flow alteration pressures, whereas addition of single-pressure regime effects is overly simplistic.

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Links
[1] https://reformrivers.eu/combined-effects-climate-change-and-dam-construction-riverine-ecosystems-van-oorschot-et-al-2018
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