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The Future Of European Floodplain Wetlands Under A Changing Climate

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Floodplain wetlands are defined by their recurring inundation caused by flooding of adjacent rivers and often, the health of riverine ecosystems is dependent on the natural pattern of these inundation events (Junk et al. 1989). In the future, climate change may severely alter flood patterns over large regional scales. Consequently, besides other anthropogenic factors, climate change depicts a potential threat to river ecosystems. The aim of this study is to evaluate the impact of climate change on floodplain inundation for important floodplain wetlands in Europe and to place these results in an ecological context.

This work is performed within the SCENES project considering three different climate change projections for the 2050s. The global scale hydrological model WaterGAP is applied to simulate current and future river discharges which are then used to i) estimate bankfull flow conditions, ii) analyse all overbank flows by different inundation parameters, and iii) evaluate the hydrological consequences and their relation to ecology. Bankfull flow marks an important breakpoint as above this level generally flooding occurs which hydraulically connects rivers to adjacent floodplains and riparian wetlands leading to radical change in the biological processes. Bankfull flow is determined by flood frequency analysis whereas we make use of the partial duration series and an increasing threshold censoring procedure. Any flow greater than bankfull flow is considered a critical flow to investigate. Volume, duration and timing of inundation are regarded as crucial for sustaining floodplain habitats and their ecological functions. Finally, we combine the modelling approach with a scenario analysis which has become a common tool for assessing future trends of environmental problems, particularly those that are complex and poorly described.

Precipitation and temperature interact differently at different locations leading to unfavourable changes in the river flow regimes with large geographical differences in directions and causes. First results of our analysis indicate that in snow affected catchments (e.g. in Eastern Europe), duration and volume of inundation are expected to decrease in the 2050s and inundation may appear earlier in the year. Higher temperatures are reducing the proportion of precipitation falling as snow as well as the duration of snow cover. Hence, our results show considerably reduced snowmelt induced flood peaks. As a consequence, habitat for fish, vertebrates, water birds and floodplain specific vegetation will be reduced causing a loss in biodiversity, floodplain productivity and fish production. In warmer regions, inundation strongly depends on the simulated precipitation patterns rather than temperature. To take into account the uncertainty of climate modelling, two SRES emission scenarios from three different global climate models are applied. This allows identifying regions with contradictory results (e.g. in France) for future floodplain inundation.

Junk, W.J., Bayley, P.B. & Sparks, R.E. 1989 The flood pulse concept in river-floodplain systems. Canadian Special Publication of Fisheries and Aquatic Sciences, 110–127.