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Connectivity of floodplains in Germany – which floodplain extent is relevant?

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Floodplains are transitional ecosystems, rich in biodiversity, endangered and adapted to inundation by floods. Flood magnitude, hydrologic connectivity and elevation define the extent of an active floodplain. In past centuries, active floodplains in Germany were reduced by up to 90% of their original size – in terms of the area that is statistically inundated at least once every 100 years. But, does this area reflect the area relevant for floodplain ecosystems and for evaluating their functioning and the services they provide? Analyzing two scenarios of Flood Hazard Maps (FHM), a German-wide comparison including 78 rivers was carried out to quantify the extent of floods with statistical occurrence intervals of 5 to 25 years, so-called ‘frequent floods’ (T-frequent), and intervals of 100 years, or ‘medium floods’ (T-medium), as well as selected characteristics. The comparison was carried out on the river (basin) level, and based on hydrological catchments. By additionally analyzing measured discharges of relevant gauges from the past 20 years, real inundation was quantified. As a result, even in exceptional wet years these ‘frequent floods’ occur for a few days per year or not at all. The extent of the two FHM scenarios differs for most areas: Only at 13% of gauging units was the T-frequent inundation extent similar to that of T-medium. Furthermore, within T-medium the land use of arable land doubles and that of urban areas more than doubles, showing how disconnected the T-medium floodplain is in many parts. On the other hand, 25% of grasslands are Natura 2000 meadows occurring within the borders of T-frequent but only 6% are Natura 2000 meadows outside these borders, indicating the effect of connectivity and thus inundation, making these habitats valuable in terms of biodiversity mainly in T-frequent. This study provides evidence that, especially for regulatory services like water purification, water retention and climate mitigation, T-frequent might be more suitable for consideration. With more frequent flooding, less intensively used areas are connected more often, holding back water, nutrients and sediments – in addition to comparatively more areas relevant for nature conservation. For flood protection and also as a refuge for flora and fauna and for connection of habitats, of course the extent of disastrous 100-yr floods are important.