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Pulses, linkages, and boundaries of coupled aquatic-terrestrial ecosystems

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Riverine floodplains are linked ecosystems where terrestrial and aquatic habitats overlap, creating a zone where they interact, the aquatic-terrestrial interface. The interface or boundary between aquatic and terrestrial habitats is an area of transition, contact or separation; and connectivity between these habitats may be defined as the ease with which organisms, matter or energy traverse these boundaries. Coupling of aquatic and terrestrial systems generates intertwining food webs, and we may predict that coupled systems are more productive than separated ones. For example, riparian consumers (aquatic and terrestrial) have alternative prey items external to their respective habitats. Such subsidized assemblages occupy a significant higher trophic position than assemblages in unsubsidized areas. Further, cross-habitat linkages are often pulsed; and even small pulses of a driver (e.g. short-term increases in flow) can cause major resource pulses (i.e. emerging aquatic insects) that control the recipient community. For example, short-term additions of resources, simulating pulsed inputs of aquatic food to terrestrial systems, suggest that due to resource partitioning and temporal separation among riparian arthropod taxa the resource flux from the river to the riparian zone increases with increasing riparian consumer diversity.

I will discuss the multiple transfer and transformation processes of matter and organisms across aquatic-terrestrial habitats. Key landscape elements along river corridors are vegetated islands that function as instream riparian areas. Results from Central European rivers demonstrate that islands are in general more natural than fringing riparian areas, contribute substantially to total ecotone length, and create diverse habitats in the aquatic and terrestrial realm. In braided rivers, vegetated islands are highly productive landscape elements compared to the adjacent aquatic area. However, aquatic habitats exhibit a much higher decomposition capacity for coarse particulate organic matter. Therefore, linking habitats that differ in their capacity to produce, store, and transform organic matter and nutrients may increase the overall functional performance of the entire ecosystem. Finally, the relative extent and the spatiotemporal dynamics of dry and wet areas within a catchment may control greatly the capacity of the river network to efficiently retain nutrients and organic matter. All these findings provide new opportunities for the future management of riparian corridors.