Interactions between flooding and upland disturbance drives species diversity in large river floodplains

Abstract

Understanding and predicting vegetation patterns in floodplains are essential for conservation and/or restoration of river floodplains subject to hydrological alterations. We propose a conceptual hydro-ecological model to explain the disturbance mechanisms driving species diversity across large river floodplains. These ecosystems harbour a unique set of flood-tolerant species different from the surrounding upland vegetation. In elevation gradients across pristine floodplains, the greater the flooding, the fewer the number of plant species. As terrain elevation increases, flood depth and duration decrease, and it is more likely that species composition is influenced by external natural or human-driven disturbances. The spatial interaction between the natural flood regime and upland factors creates patterns of disturbance gradients that influence how floodplain vegetation establishes. In regions where upland conditions are subject to strong external disturbances, species diversity peaks at intermediate stages along the disturbance gradient. We demonstrate this concept with observations from the Central Amazon and Pantanal in Brazil, the Mekong's Tonle Sap in Cambodia, and the Okavango Delta in Botswana. We discuss how this model could be further elaborated and validated to inform management of large river basins under the impact of upstream-induced flood pulse alterations.