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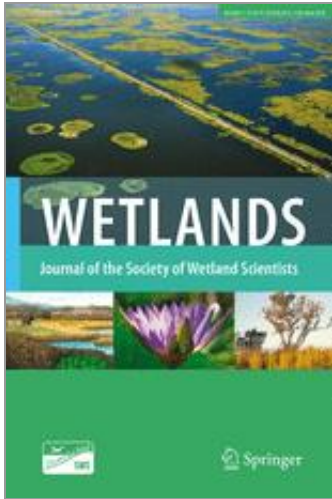
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Physiological-ecological impacts of flooding on riparian forest ecosystems

Abstract

Riparian forest ecosystems are important for their high productivity of biomass, their biodiversity, and ecological services including control of floods and erosion, removal of nutrients from agricultural runoff, alleviation of pollution effects, and as habitats for birds and mammals. Intermittent cycles of flooding by meandering streams followed by soil drainage are essential for regeneration, optimal growth, preservation of biodiversity, and sustainability of these valuable ecosystems. The straightening of river channels and disruption of intermittent river flow by dams lead to decreases in downstream forest productivity and ecological services, reflecting arrested forest regeneration, suppression of tree growth, and early tree mortality. These responses result from inadequate seed supplies and poor seedbeds, as well as deficiencies of ground water and mineral nutrients. Water deficits in downstream forest trees induce dysfunctions in photosynthesis and mineral nutrition, which lead to growth inhibition and plant mortality. Very few bottomland forest species can withstand extended soil inundation. Hence, prolonged upstream flooding by interruption of river flow is followed by massive losses of biomass as a result of poor seed germination, arrested plant growth, and accelerated mortality of trees. The adverse impacts of flooding on upstream forests are associated with physiological dysfunctions induced by soil anaerobiosis. These include changes in respiration, photosynthesis, protein synthesis, mineral nutrition, and hormone relations, together with increased exposure to a variety of phytotoxic compounds. There is urgent need for developing more integrated and holistic flood-management policies that will recognize the need for protecting and restoring valuable riparian forests while also meeting other flood-control objectives.



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