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Emerging global threats across life-history traits in major riparian trees under multiple stressors

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Global dieback of forests is currently top priority in Ecological Agenda. In riparian forests, hydroclimatic alterations are currently coupling with biotic pressures, and cumulating with historical floodplain degradation, depleting ecosystem functions and services. This is especially grave due to disproportionate ecological importance of these water-dependent ecosystems in relation to their surface area extent. In recent decades, a multiplicity of riparian stressors emerged or exacerbated their incidence and severity from population to ecosystem scales compromising resilience of riparian species, which evolved under natural disturbance regimes. Decline and mortality have been already observed on several taxa; due to short and long term abiotic (drought severity, hydrologic alteration) and biotic (pests, diseases) pressures affecting populations across all life stages. Scattered existing knowledge limits our understanding on the underlying mechanisms, the impacts of multiple stressor interaction, the populations expected response, and the extent consequences. Challenges posed often require novel analytical methods applicable at diverse spatial and temporal scales. In addition, as these issues are usually tackled from different research fields (hydrogeomorphology, ecophysiology, plant pathology. . .) advances often remain isolated. This contribution presents an integrative synthesis to identify research gaps, convey innovative tools and approaches and establish future research and management priorities on major riparian trees with potential applicability across species and biomes. First we establish a baseline in the state of knowledge on multiple riparian stressors across tree life-history traits, from seed to mature adult, crucial for forest vulnerability under hydroclimatic and biotic stressors. Secondly we present a conceptual framework on directionality and magnitude of stressors interactions including non-linear and threshold effects. Thirdly we convey emerging and underused tools for addressing emerging global threats including advances in field monitoring technology (remote sensing from satellite, UAV, LiDAR) and statistical approaches (bayesian approaches, statistics of extremes, early warning signal tools). The integration of innovative data collection tools and scientific approaches fosters unprecedented ability to obtain and process ecological datasets providing considerable promise to reduce uncertainty in the prediction of species and ecosystem responses under multiple stressors.