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Biodiversity mediates human-environment interactions in deltas

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River and sea ecosystem services contribute to the rapid and intensive development of delta social-ecological systems. This development, alongside other global change drivers, threatens the biodiversity of these deltas and in turn the ecosystem services that this biodiversity supports. However, biodiversity can itself mediate anthropogenic impacts by increasing ecosystem resilience. Linkages between biodiversity and ecosystem services are increasingly established, but we lack understanding of whether the mediating effects of biodiversity are global and ubiquitous, and whether they mediate global change drivers in deltas.

Here, we examine the potential for biodiversity to mediate the relationships between five anthropogenic indicators and global change drivers (population, infrastructure, land use change, climate change in temperature and precipitation) and 19 ecosystem properties and services. We assess these relationships across a global dataset of 235 large deltas. We find that in 89% of cases, greater biodiversity (species richness and the intactness of biodiversity) is connected to a weakened or reversed association between anthropogenic drivers and ecosystem services. Such weaker or reversed associations were found across different ecosystem services (e.g. food production, carbon sequestration, soil regulation), most commonly with climate change and population.

We then investigated the contribution of biodiversity and abiotic and anthropogenic drivers to delta ecosystem service supply. Ecosystem service supply was most strongly and consistently associated with abiotic drivers (mostly climatic), but biodiversity and anthropogenic drivers were also important to individual services (productivity and crop-related services respectively). Deltas showed fewer than expected associations between biotic, abiotic and anthropogenic indicators and ecosystem services, yet weakened or reversed associations were more frequent than in other social-ecological systems. Our results empirically show how biodiversity can both act as a resource and mediate social-ecological relationships, but that both of these roles could be compromised as deltas become more modified.