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TITLE: Quantifying the influence of urban land use on mangrove biology and ecology: A meta?analysis

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ABSTRACT:

Abstract Aim The aim was to quantify the influence of urban land use and urban populations on mangrove systems around the world over the past four decades. Location Global. Time period 1997?2015. Major taxa studied Avicennia, Laguncularia, Rhizophora, Aves, Actinopterygii, Crustacea and Mollusca. Methods This review extracts results of mangrove studies on forest cover and structure, nutrient dynamics, sediment contamination and faunal community assemblages conducted around the world between 1997 and 2015. These observations are then correlated with surrounding social?ecological spatial characteristics pertaining to urbanization. Results Mangrove coverage in large cities is mostly decreasing, and at a greater rate than means for corresponding countries. Both expanding urbanization and existing agriculture are most strongly correlated with mangrove losses, which are primarily occurring 5?10 km from urban areas. Along a gradient of surrounding urban land use, mangrove leaf ? 15 N content increases, and leaf carbon to nitrogen ratios decrease. Sediment concentrations of almost all examined heavy metals are strongly and positively correlated with both surrounding urban and mangrove extent. The diversity of subsistence fisheries increases significantly with surrounding mangrove extent. Worm diversity decreases with increasing surrounding urbanness (urban index), and mangrove specialist bird diversity increases with increasing surrounding urban coverage as well as with mangrove coverage. Main conclusions Mangroves increasingly coexist within highly anthropogenic landscapes along urbanized coasts. Most ecological reports of these systems, however, lack quantified representations of the urban landscape, such as population density or impervious surface coverage. The results of this analysis suggest that some of the reported patterns of forest coverage, nitrogen dynamics, heavy metal contamination and faunal community assemblages in isolated urban mangroves are systemic across the world. These findings are particularly pertinent to 21st century tropical coastlines, which will see some of the greatest urbanization rates over the next century and will guide urban mangrove ecology towards the development of more synergistic social?ecological systems.

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