Forward Modelling of Climate Change-Induced Sedimentation and Effects on Coastal Ecosystems

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Future climate trends threaten to disrupt sedimentation processes through changing precipitation patterns, affecting river discharge and sediment loads, and sediment runoff to coastal regions. This presents emerging risks to anthropogenic environments and coastal ecosystems such as coral reefs, wetlands and seagrass meadows, potentially impacted by sedimentation through ecological degradation and decreased biodiversity. Current research highlights the need of incorporating sedimentation processes' potential effects on ecosystems in developing conservation management strategies. The project created a hundred-year simulation of future sediment erosion/deposition for the Burdekin region, in tropical Queensland, Australia adjacent to the Great Barrier Reef, as a 'proof of concept' for the process to be applied elsewhere in aiding conservation. Precipitation and other data were based on future climate change projections, Shared Socioeconomic Pathways (SSPs), developed by the IPCC Sixth Assessment Report (AR6). The project used Badlands, a surface process model which simulates sediment erosion/deposition and stream discharge. Results corroborated with the hypothesis of the positive effect of discharge on sedimentation (geometric mean p-value of 0.0498). Simulations also highlighted areas of the Burdekin region susceptible to elevated coastal sediment erosion/deposition such as Ingham and Magnetic Island (cumulative sediment deposition > 9m). Particularly, the research provided an open-source framework to analyse sedimentation patterns using freely accessible software, documentation and data. This promotes open science, allowing for conservation management strategies formulated by stakeholders or academics with limited technical abilities or access to research capital.

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