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## Documenting the global impacts of beach sand mining

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For centuries, beach sand has been mined for use as aggregate in concrete, for heavy minerals, and for construction fill. The global extent and impact of this phenomenon has gone relatively unnoticed by academics, NGOs, and major news sources. Most reports of sand mining activities are found at the very local scale (if the mining is ever documented at all). Yet, sand mining in many localities has resulted in the complete destruction of beach (and related) ecosystems along with severe impacts to coastal protection and tourism.

The Program for the Study of Developed Shorelines at Western Carolina University and Beachcare.org have initiated the construction of a global database of beach sand mining activities. The database is being built through a combination of site visits and through the data mining of media resources, peer reviewed papers, and reports from private and governmental entities. Currently, we have documented sand mining in 35 countries on 6 continents representing the removal of millions of cubic meters of sand.

Problems extend from Asia where critical infrastructure has been disrupted by sand mining to the Caribbean where policy reform has swiftly followed a highly publicized theft of sand. The Program for the Study of Developed Shorelines recently observed extensive sand mining in Morocco at the regional scale. Tens of kilometers of beach have been stripped of sand and the mining continues southward reducing hope of a thriving tourism-based economy.

Problems caused by beach sand mining include: destruction of natural beaches and the ecosystems they protect (e.g. dunes, wetlands), habitat loss for globally important species (e.g. turtles, shorebirds), destruction of nearshore marine ecosystems, increased shoreline erosion rates, reduced protection from storms, tsunamis, and wave events, and economic losses through tourist abandonment and loss of coastal aesthetics.

The threats posed by sand mining are made even more critical given the prospect of a significant rise in global sea level over the coming decades. Most governments recognize the local impacts of sand mining and mining activities are illegal in many localities. However, enforcement of these protections has been problematic and there has been little pressure to stop the practice from local or international environmental groups.

In many cases, addressing the issue of sand mining requires addressing the local issues that allow it to persist. This includes poverty, corruption, and unregulated development. In areas where beach sand mining significantly supports the local economy, care needs to be given that local workers are given alternative means of income, and builders are provided an affordable substitute for the sand (e.g. crushed rock). Regardless, it is time for both academics and NGOs to address the cumulative environmental impacts of the direct destruction of the world's beaches through mining activities.