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TITLE: Rigorously valuing the role of U.S. coral reefs in coastal hazard risk reduction

AUTHOR: ['Curt D. Storlazzi', 'Borja G. Reguero', 'Aaron Cole', 'Erik N. Lowe', 'James B. Shope', 'Ann E. Gibbs', 'Barry Nickel', 'Robert McCall', 'Ap van Dongeren', 'Michael W. Beck']

ABSTRACT:

The degradation of coastal habitats, particularly coral reefs, raises risks by increasing the exposure of coastal communities to flooding hazards.The protective services of these natural defenses are not assessed in the same rigorous economic terms as artificial defenses, such as seawalls, and therefore often are not considered in decision making.Here we combine engineering, ecologic, geospatial, social, and economic tools to provide a rigorous valuation of the coastal protection benefits of all U.S. coral reefs in the States of Hawai?i and Florida, the territories of Guam, American Samoa, Puerto Rico, and Virgin Islands, and the Commonwealth of the Northern Mariana Islands.We follow risk-based valuation approaches to map flood zones at 10-squaremeter resolution along all 3,100+ kilometers of U.S. reef-lined shorelines for different storm probabilities to account for the effect of coral reefs in reducing coastal flooding.We quantify the coastal flood risk reduction benefits provided by coral reefs across storm return intervals using the latest information from the U.S. Census Bureau, Federal Emergency Management Agency, and Bureau of Economic Analysis to identify their annual expected benefits, a measure of the annual protection provided by coral reefs.Based on these results, the annual protection provided by U.S. coral reefs is estimated in:? Avoided flooding to more than 18,180 people;? Avoided direct flood damages of more than $825 million to more than 5,694 buildings;? Avoided flooding to more than 33 critical infrastructure facilities, including essential facilities, utility systems, and transportation systems; and? Avoided indirect damages of more than $699 million in economic activity of individuals and more than $272 million in avoided business interruption annually.Thus, the annual value of flood risk reduction provided by U.S. coral reefs is more than 18,000 lives and $1.805 billion in 2010 U.S. dollars.These data provide stakeholders and decision makers with spatially explicit, rigorous valuation of how, where, and when U.S.

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