Resilient coastal lands: Envisioning transformative adaptation scenarios in the face of climate change in Cispatá Bay.

Climate change poses significant threats to coastal areas worldwide, including rising sea levels, increased flood risk, coastal erosion, saltwater intrusion into freshwater systems, and impacts on marine ecosystems. Addressing these challenges requires an Integrated Coastal Zone Management (ICZM) approach that strategically and adaptively tackles long-term issues in coastal regions. Transformative adaptation, which addresses the root causes of climate-related vulnerabilities over the long term, is an effective response involving fundamental changes in the interactions between people and nature. Coastal zones in the Colombian Caribbean Sea are exposed to natural hazards like coastal erosion, sea level rise, marine pollution, and storm surges, which all expected to intensify with climate change. The Integrated Management District of Cispatá Bay (DMI), located within the Sinú River and Gulf of Morrosquillo Coastal Environmental Unit (CEU), was established in 2006 to conserve valuable mangrove ecosystems and promote sustainable resource use by local communities. Covering approximately 27,000 hectares, including Cispatá Bay, surrounding mangrove forests, and the Sinú River estuarine delta, the DMI's integrated management plan highlights the necessity of formulating and implementing adaptation measures to address sea level rise. The proposed project aims to support resilient coastal land management and climate change adaptation in Cispatá Bay by proposing transformative adaptation measures and tailored climate change indicators, supported by high-resolution integrated models that incorporate physical, ecological, and socioeconomic variables, and leveraging machine learning algorithms. The process will strongly emphasize participatory approaches, actively involving stakeholders and drawing upon local knowledge and initiatives. The coastal models assimilate remote sensing data and large-scale model outputs, enabling the incorporation of essential variables relevant to the study area for hindcasting historical conditions and projecting future scenarios under different climate change trajectories to support data-driven decision-making. The overarching goal is contributing to transform potential climate change threats into opportunities that benefit both local communities and ecosystems in the area.

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