

# Triple Threat in Coastal Socioecological Systems: Climate Change, Biodiversity Loss and Pollution in the Honduran Caribbean

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## I. Introduction

The Honduran Caribbean coast faces a triple threat composed of climate change, biodiversity loss, and pollution-factors that endanger the socio-ecological resilience of its coastal ecosystems and communities (UNEP, 2021; IPCC, 2022). These challenges are further exacerbated by institutional fragmentation and limited community participation in marine-coastal governance, which hinder the effective implementation of sustainability strategies (Rivera *et al.*, 2018). In this context, it is essential to analyze and strengthen existing public policies by integrating Integrated Coastal Management (ICM) approaches and nature-based solution (NbS), in line with the objectives of the UN Decade of Ocean Science for Sustainable Development 2021-2030 (UNESCO-IOC, 2021), with the aim of promoting a more resilient and sustainable Honduran coastline.

## II. Objectives

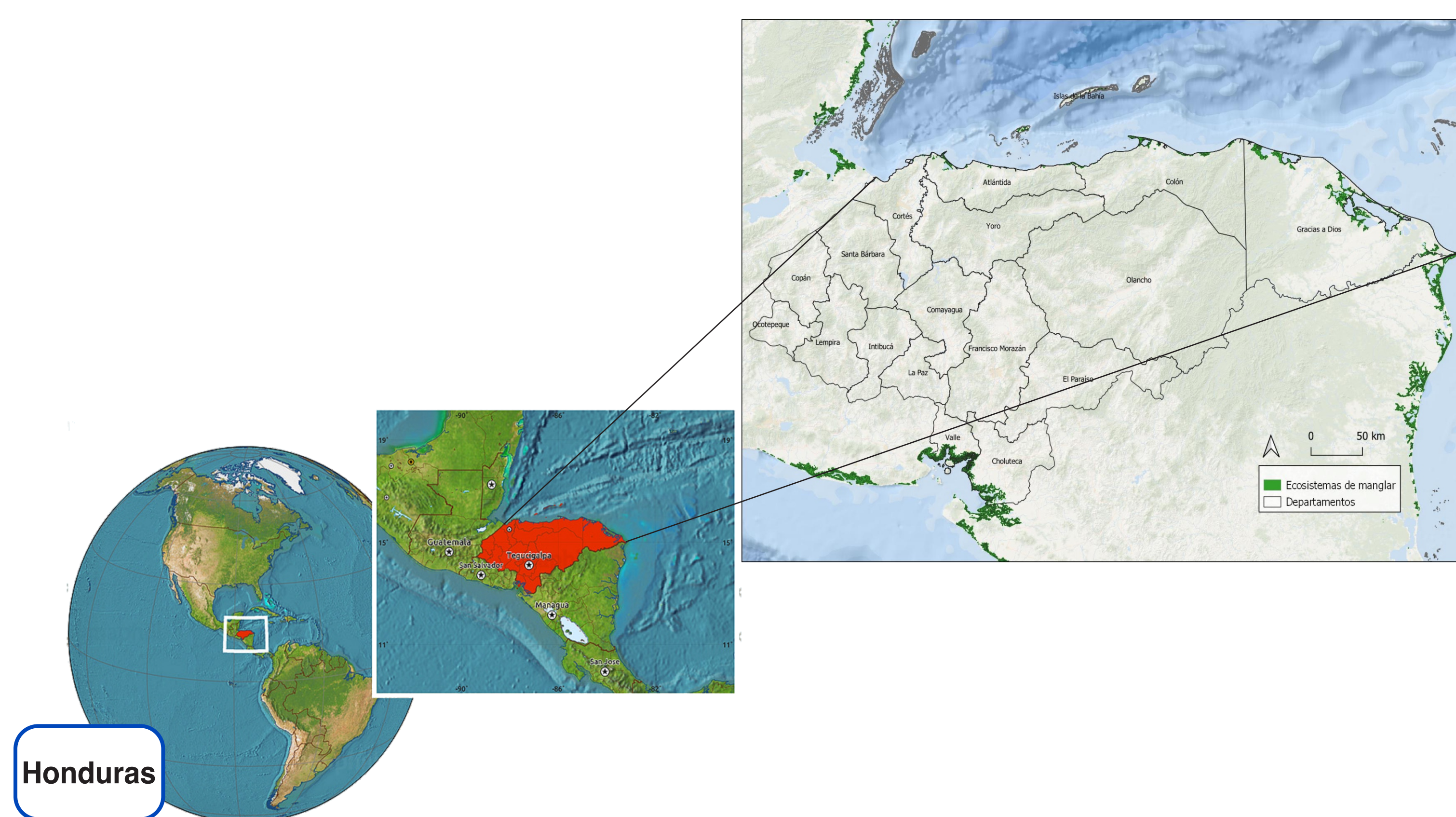
To analyze public policies aimed at coastal sustainability in the Honduran Caribbean, identifying their progress and limitations in the face of the triple threat, in order to propose actionable guidelines that strengthen coastal governance and promote integrated sustainable coastal management solutions.

## III. Methodology

The research was conducted using a mixed and multidisciplinary approach, structured in four phases:

- 1. Document review:** analysis of legal frameworks, coastal policies, and regional experiences (UNEP, 2021; Arenas, 2012).
- 2. Socio-environmental assessment:** application of the DPSIR model to evaluate the triple threat based on scientific reports (IPBES, 2019; World Bank, 2020).
- 3. Institutional analysis:** interviews and stakeholder mapping to identify governance and coordination gaps (Barragán, 2010).
- 4. Policy proposal:** development of guidelines to strengthen coastal governance and promote nature-based solutions.

## IV. Study area



## V. Results

Preliminary findings show that the sustainability of the Honduran Caribbean coast is compromised by three main factors: biodiversity loss, climate change, and marine and land-based pollution. At the institutional level, gaps in intersectoral coordination and fragmentation in the implementation of public policies are identified, which limit the effectiveness of coastal management (Martínez & Mendoza, 2024). The analysis using the DPSIR (Drivers–Pressures–State–Impact–Response) model made it possible to characterize the most relevant pressures:

- Deforestation of mangroves and the expansion of African oil palm (*Elaeis guineensis*) in protected areas, reducing natural resilience to extreme events.
- Coral bleaching and coastal erosion linked to rising temperatures and sea level.
- Transboundary pollution, mainly from the Motagua River basin, which affects environmental quality in key sites such as Omoa, Cortés, and Roatán, Bay Islands.

The results confirm the need to move toward a model of Integrated Coastal Management (ICM). In this regard, Arenas (2012) emphasizes that the successful implementation of ICM in Ibero-America requires participatory processes and multilevel coordination, principles applicable to the Honduran Caribbean. In a complementary manner, Caviedes *et al.* (2020) highlight the importance of strengthening regional governance within the framework of the Central American Integration System (SICA), which offers an opportunity to align national management with international sustainability frameworks. In sum, the results indicate that Honduras' coastal resilience depends on overcoming institutional fragmentation, strengthening coordination with local actors (especially Garífuna and Miskito communities), and leveraging regional and international frameworks for more integrated and equitable coastal management.

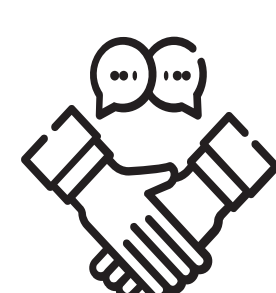
## VI. Conclusions



The analysis of public policies related to the sustainability of the Honduran Caribbean coast shows that, despite certain advances such as the creation of marine protected areas and climate change adaptation plans, significant gaps persist that limit the effectiveness of coastal governance.



Institutional fragmentation and weak intersectoral coordination hinder integrated coastal management, which is consistent with previous assessments on the need to strengthen ICM frameworks in Ibero-America.



Limited community participation in decision-making represents a challenge for ensuring long-term sustainability. The inclusion of the Garífuna and Miskito peoples as key stakeholders is an essential requirement for advancing toward more just and effective governance models.



The results confirm the urgency of incorporating stronger measures to address climate change pollution, and biodiversity loss, in line with what has been stated by international organizations.



Finally, it is concluded that Honduras has the opportunity to strengthen its coastal governance by aligning its national frameworks with international commitments to sustainability and regional resilience.

## VII. References

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