

## Article

# Stakeholders' Perceptions of Nature-Based Solutions for Hurricane Risk Reduction Policies in the Mexican Caribbean

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**Abstract:** Nature-based solutions (NbSs) have long recognized the value of coastal and marine ecosystem management and associated ecosystem services as useful tools for climate change mitigation (e.g., blue carbon) and adaptation (e.g., coastal protection against flooding and storm surges). However, NbSs remain poorly acknowledged and mostly absent from coastal planning for disaster risk reduction policies in the Caribbean, as well as from ex-post disaster reconstruction funds. With the increasing frequency and intensity of hurricanes in the region, NbSs are now more needed than ever. Taking Mexico as a representative case study for the wider Caribbean, we here seek to identify and analyze the barriers and opportunities perceived by relevant stakeholders for mainstreaming coastal-marine NbSs into coastal management and disaster risk reduction policies (e.g., mangroves as green infrastructure) to protect coastal societies and national economies against hurricanes. We conduct semi-structured, in-depth interviews with twenty stakeholders covering academic, governmental, tourism, NGO, coastal planning, and financial domains. Among the twenty-three identified barriers, governance, institutional, financial, and human-capacity aspects are the most dominant perceptions behind the current lack of NbS implementation. Future action for the policy integration of NbSs requires widespread political will and better quantification of both the provision of ecosystem services and their economic benefits under conventional markets.

**Keywords:** nature-based solutions; green infrastructure; mangroves; reefs; hurricanes; disaster risk reduction; coastal management; Caribbean; policies

## 1. Introduction

Coastal areas around the world are experiencing more extreme hydrometeorological events such as hurricanes, floods, and long-term droughts due to climate change [1]. These hazards, coupled with societal and economic vulnerabilities, often result in disasters, causing loss of life and property, long-term socio-ecological disruptions, and displacement [1–3]. Furthermore, extensive land-use changes and the degradation of coastal ecosystems are exacerbating the risk of climate-driven disasters by increasing the exposure and vulnerability of the affected societies, infrastructure, and assets to these intense hydrometeorological events [1,4,5].

Mexico and the Caribbean region are not exceptions to this trend. Since the 1970s, extreme hydrometeorological events have increased in magnitude, and the resulting damage has risen four-fold [6,7].

In 2020, the North Atlantic basin (North Atlantic Ocean, Caribbean Sea, and Gulf of Mexico) experienced its fifth consecutive hurricane season with above-average activity [8,9]. A record was set in 2020 for the most tropical cyclones ever, with 30 named storms, 13 hurricanes and 6 major hurricanes (category > 3). These numbers are more than double the long-term averages for the region. This increase in extreme events has contributed to making this region the second most disaster-prone in the world, led by the Asia-Pacific region [3]. Moreover, large, vulnerable populations have settled in many low-lying coastal areas in the North Atlantic basin. These communities are highly dependent on tourism and natural resources for their livelihoods [4], making the improvement of disaster risk management in the region imperative.

Different measures to reduce and manage current and future risks from coastal hazards include the construction of hard infrastructure [10], the relocation of communities and assets out of high-risk zones [11], and/or solutions based on the conservation and restoration of ecosystems, frequently referred to as nature-based solutions (hereafter, NbSs) [12,13]. The International Union for Conservation of Nature (IUCN) defines NbSs as “actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits” [14]. NbSs are considered an umbrella term that comprises these and other well-known concepts, such as green and blue infrastructure, ecosystem-based adaptation (EbA), and ecosystem-based disaster risk reduction (Eco-DRR) [14,15].

NbSs are based on the premise that healthy ecosystems and the maintenance of their environmental services have a buffer effect on climate hazards and reduce the risks and impacts of extreme events, while simultaneously providing a range of other co-benefits [16]. For instance, mangrove forests, as green infrastructure, can reduce the physical exposure and impacts of natural hazards for coastal communities by acting as a first line of defense or buffer against erosion, flooding, storm surges, and rising sea levels [17]. Likewise, healthy coral reefs have been proven to reduce wave energy by as much as 97 percent during coastal storms, which reduces coastal erosion and flooding [18–20]. At the same time, these ecosystems also provide benefits such as carbon sequestration, habitat provision for fish and crustaceans, water purification, and tourism income [21–24]. These benefits are key to local development and adaptive capacity, and can help communities to better adapt to climate change and extreme events, and to cope with and recover from disasters [25–27]. In a region such as the Caribbean, where tourism accounts for up to 50 percent of some countries’ gross domestic product [28], the combination of disaster risk reduction (hereafter DRR) with the protection of natural capital through NbSs must become a precondition for development, not just an option.

NbSs have been acknowledged and encouraged in several important international development agendas, including the Sendai Framework for Disaster Risk Reduction [29], the Paris Agreement on Climate Change [30], and the Sustainable Development Goals (SDGs) [31] (Annex A). Despite NbSs being increasingly recognized as a cost-effective, no-regret strategy for climate change adaptation and disaster risk mitigation [12,17,23,32–35], they continue to be either ignored or treated as second-best choices for adaptation, with

conventional approaches such as grey infrastructure remaining the preferred option [36]. The implementation of NbSs in the Caribbean continues to be low, although the number of NbS projects and studies for coastal protection have increased in recent years (mainly due to dramatic hurricane seasons beginning in 2017) They often involve only pilot projects and are carried out in an ad hoc manner [12,37–39] (Table 1). Exceptions to this trend are exemplified by large funding bodies such as the Green Climate Fund, which are beginning to promote NbSs for coastal resilience. Examples include Cuba’s adaptation project MI COSTA (2021): Coastal Resilience to Climate Change in Cuba through Ecosystem Based Adaptation (GCF project fp157) [40], and the Global Fund for Coral Reefs Investment Window (GCF project fp180) [41].

Several barriers to the adoption of NbSs have been identified. Some studies suggest that many actors may have limited awareness of the relevance of ecosystems for societal resilience, or the potential of NbSs to help meet risk management objectives [36]. Meanwhile, others indicate that there is still a general perception that the construction and, especially, the maintenance of NbSs are more costly than conventional grey infrastructure measures [42]. Furthermore, there is evidence to suggest that NbSs continue to be viewed by stakeholders as too difficult to implement, or are not being considered at all [43]. A lack of sufficient technical references, design standards, and guidelines also represent an important factor for the failure to consider NbSs [44]. Finally, limited access to appropriate financing is also identified as a major barrier preventing the adoption of NbSs [45,46]. A lack of political will [47], weak governance and institutional arrangements [43,48], as well as poor inter-sectoral communication [49] were other factors identified as barriers hindering NbS implementation.

In the region of Mexico, Central America, and the Caribbean, extensive research has been conducted on extreme events such as hurricanes and its impacts on socio-economic and ecological systems [50–60]; the role of coastal-marine NbSs in reducing risk from hydro-meteorological events; as well as the risk, vulnerability and resilience levels of various coastal areas [12,23,37,61–63]. Some authors have also analyzed social perceptions of coastal risk and community responses to extreme events in order to understand adaptive capacity and how this translates into policy [64–66]. Some research also exist on the enabling factors that support private sector adoption of NbSs in urban settings, and its impacts [52,67].

Despite these studies, and with the exception of Cuba, NbS such as green infrastructure (e.g., mangroves protecting coastal societies from hurricanes and storm surges) remain fully absent in national and regional Risk Reduction Policies in the Caribbean. Similarly, ecosystem restoration remains un-earmarked in international ex-post disaster reconstruction funds. Hence, this study aims to analyze the perceptions of relevant stakeholders on the barriers for mainstreaming NbSs into risk reduction and coastal planning policies to face increasing hurricanes in the Caribbean region. We chose the Mexican Caribbean (particularly the Yucatan Peninsula) as a case study, but its socioeconomic and ecological contexts make it representative of the wider Caribbean region.

The availability of information on NbSs, as well as the active participation of key stakeholders in interviews during our data collection phase, were crucial in the selection of the Mexican Caribbean as the case study. Furthermore, the country’s leadership and experience in risk management, as well as its well-established legal framework on climate change, make the country a good case study to understand why NbSs have not been considered more extensively for hydrometeorological risk reduction. Despite the numerous NbS projects and initiatives that have been implemented over the past 20 years in the country, there is still much room for improvement and growth—especially in coastal areas—to achieve systematic consideration of NbSs as a tool to mitigate the risks of extreme events.

**Table 1.** Examples of NbS projects in Mexico, Central America, and the Caribbean. Source: Authors (2022).

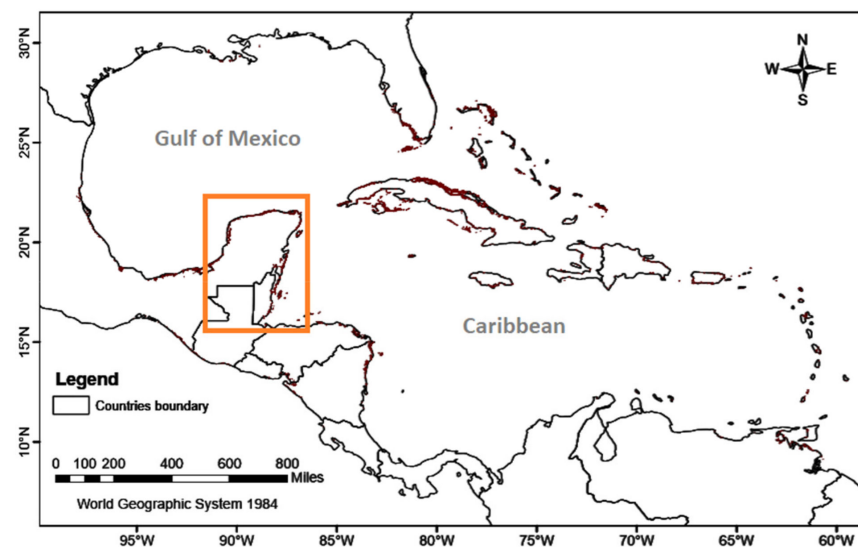
Country	Project	Objectives	Main Partners
Bahamas	Climate-Resilient Coastal Management & Infrastructure Program	Building resilience to coastal risks using traditional and nature-based solutions as coastal protection infrastructure.	Gov. of The Bahamas and the Inter-American Development Bank (IDB)
Belize	Marine Conservation and Climate Adaptation Project	Implementing priority ecosystem-based marine conservation and climate change adaptation measures to strengthen the climate resilience of the Barrier Reef System in Belize	Gov. of Belize, World Bank
Cuba	Coastal Resilience to Climate Change in Cuba through Ecosystem-based Adaptation—“MI COSTA”	Increasing coastal climate resilience by employing an ecosystem-based adaptation approach.	Gov. of Cuba, United Nations Development Programme (UNDP)
Mexico	Coastal Zone Management Trust	Financing actions for the conservation and restoration of coral reefs and beaches, which includes the purchase of a parametric insurance policy.	Gov. of Mexico, The Nature Conservancy (TNC)
Mexico	Ecosystem-based adaptation to climate change in the Tourism sector: “ADAPTUR”	Strengthening capacities related to ecosystem-based adaptation to climate change (EbA) in the Tourism sector	Gov. of Mexico, IKI Alliance
Regional (Mexico, Belize, Guatemala, and Honduras)	Integrating climate change into marine protected areas and coastal management of the Mesoamerican Reef Ecoregion: “Costas Listas”	Improving the adaptive capacities of the region’s coastal communities by identifying and implementing “climate-smart” principles in the management of marine protected areas and coastal development policies in the countries of the Mesoamerican Reef System.	Regional Gov., World Wide Fund for Nature (WWF), International Climate Initiative (IKI)
Regional (Dominican Republic, Grenada, and Jamaica)	Resilient Islands	Helping the Caribbean Islands to cope with the impacts of climate change by promoting the protection of coastal habitats to reduce risks.	The Nature Conservancy (TNC), International Federation of the Red Cross and Red Crescent Societies (IFRC)
Regional (Belize, Honduras, and Guatemala)	Use of nature-based solutions to Increase Resilience to Extreme Climatic Events in the Atlantic Region of Central America	Increasing resilience to extreme weather events through the restoration of degraded landscapes.	World Resource Institute (WRI), Tropical Agricultural Center for Research and Higher Education (CATIE)
Regional (several countries)	Protecting and Restoring the Ocean’s natural Capital, building Resilience and supporting region-wide Investments for sustainable Blue socio-economic development (PROCARIBE)	Protecting, restoring, and harnessing the marine and coastal natural capital of the region to catalyze investment in a sustainable, climate-resilient economy.	United Nations Development Programme (UNDP), Global Environment Facility (GEF)

Although the socioeconomic and political conditions of the region may vary, as may the degree to which each country is affected by extreme coastal events, understanding the Mexican case can encourage more research on the factors that promote or impede NbS mainstreaming and further implementation in different country, cultural, and socio-economic contexts within and across the whole region. More research on the reach of transnational policies may help us to move beyond understanding the barriers to NbS and provide guidance on how to systematically overcome such obstacles, while gaining greater regional understanding and cooperation.

## 2. Materials and Methods

### 2.1. Context and Study Area

Mexico is a culturally rich and a highly diverse country. In addition to having a varied topography, it is located between two biogeographical domains: the Neotropical and the Nearctic, and between the two largest oceans in the world: the Atlantic and the Pacific [55]. This multi-ocean location makes it highly exposed to numerous hydrometeorological phenomena on both its Atlantic and Pacific shores [56]. With over 11,000 km of coastal line, the country is frequently hit by hurricanes on both coasts [56,57]. According to the World Bank data, 65% of the population and 71% of the GDP are exposed to risk from natural hazards in Mexico [58] (Figure 1). Between 2000 and 2018 Mexico registered USD 2357 million in losses due to natural hazards, of which, 86.8% was from weather-related hazards [58,59].



**Figure 1.** The Mexican Caribbean, which includes the Yucatan Peninsula, is highly affected by hurricanes and is representative of the rest of the Caribbean in terms of risk reduction needs and policies that include NbSs.

The great coastal extension and its rich biodiversity are valuable resources for the people of Mexico and its economic development. In the Yucatan Peninsula alone, mangroves currently protect over 300,000 people from flooding, and prevented over USD 9 billion of losses annually [21]. In addition, coral reefs contribute not only to coastal protection from storms and floods, but also provide millions of dollars per year in tourism revenue [60], as well as supporting small-scale fisheries [61]. Nevertheless, the accelerated development of some economic activities in the region has led to unregulated growth in the coastal zone, causing environmental pollution and resource overexploitation. These problems, combined with high rates of population growth and urbanization, have impacted the health of socio-ecological coastal systems, further increasing their vulnerability to disasters [57].

Beginning in the 1980s, Mexico has been taking steps to manage and reduce risk as well as to improving recovery after disaster events [57]. Although efforts to increase

resilience through NbSs have also been made over the last 20 years [62], the country still relies mostly on grey infrastructure to manage weather-related risks [23,39].

## 2.2. Data Collection

This study relied on a combination of primary and secondary data. First, we reviewed the literature on NbSs for risk reduction (previously identified) barriers and opportunities, as well as their specific contexts. Second, we interviewed twenty (20) stakeholders with at least some experience with NbSs in the Mexican Caribbean area.

To explore local stakeholder perceptions on NbSs and to discover what hinders or promotes their implementation for coastal resilience, semi-structured, in-depth interviews were conducted (See Supplementary). This explorative method allowed participants to express their opinions freely and in their own terms. Information for our analysis was obtained from participant conversations. Semi-structured interviewing often starts with general open questions within a pre-set framework—in this case, related to NbSs—so questions follow the flow of the respondent's answers rather than following a predetermined list of questions [63].

Limitations of this method include the difficulty in analyzing and comparing answers; it is also time-consuming and prone to bias. Furthermore, generalization is not possible with a small sample, and the semi-structured nature of the interviews may lessen reliability. However, the interviews allow for a deeper exploration of key stakeholders' thoughts and experiences, which can result in richer in-depth knowledge and insights about a specific topic [64]. While the number of participants interviewed is modest for a regional assessment of NbS barriers, the representativeness and diversity of insights already provides valuable information on institutional positions on NbSs mainstreaming in national policies for hurricane risk reduction in the Mexican Caribbean.

Based on purposive and snowball sampling approaches [65,66], we targeted a number of stakeholders who worked either directly or indirectly in sectors and organizations relevant to the implementation and endorsement of NbSs in Mexico. Purposive sampling targets the selection of respondents from a segment that is known to have information that can help answer relevant research questions. We collected a total of 20 interview responses from a total of 59 selected stakeholders from fields related to DRR, climate change adaptation (hereafter CCA), coastal and environmental management, finance, non-governmental organizations, civil associations, and governmental sectors (see Table 2 and Supplementary). Furthermore, "snowball" or "chain-referral" sampling was used to locate potential interviewees identified by respondents [67]. In this manner, key stakeholders that had not been originally identified were referred to us by the interviewees.

All interviews were held either online or via telephone. The interviews were conducted in Spanish, and recorded, transcribed, and translated into English. The questionnaire included 4 sections. The first focused on the stakeholders' activities and responsibilities within their organizations and how those related to NbSs. The second aimed to investigate their knowledge, awareness, and experiences with NbSs, while parts 3 and 4 sought to gain insights about their perceived barriers and opportunities regarding NbS adoption in the region (See Supplementary).

It is worth mentioning that we initially aimed for a transnational study with Mexico, Belize, Guatemala, and Honduras as case studies due to their geographic proximity and the interconnectivity of their coastal-marine ecosystems. We performed a stakeholder analysis of the region to detect key informants and submitted a total of 116 questionnaires between May 2021 and July 2021. In parallel, we also invited 59 selected stakeholders to participate in the above mentioned semi-structured interviews. After two months, we had not received enough responses to the web-based questionnaire to support transnational research. From the interviews, 20 stakeholders agreed to participate: 17 from Mexico, 2 from Belize, and 1 from Honduras (Table 2). We thereafter retained Mexico only as our case study, as it hosted more willing stakeholders and more available information. We kept the three responses

of the Belizean and Honduran stakeholders as part of this study as they did not vary the overall perceptions from the Mexican region.

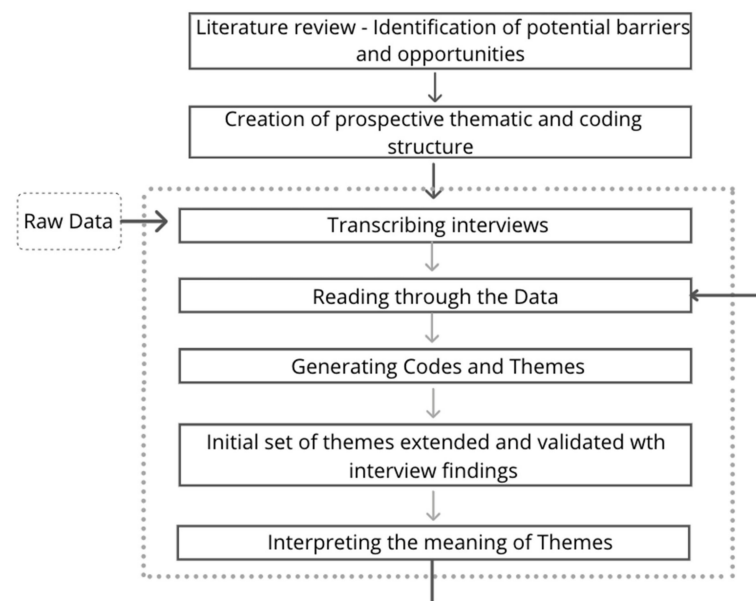
**Table 2.** List of stakeholders interviewed. Source: Authors (2022).

Code	Stakeholder Groups	Field	Organization
A1	Academia (A)	DRR and Critical Infrastructure	Private Sector Alliance for Disaster Resilient Societies (ARISE)
A2		Fisheries	Center for Research and Advanced Studies of the National Polytechnic Institute of Mexico (CINVESTAV)
A3		Biology, Nature Conservation	National Autonomous University of Honduras
C1	Civil Association (C)	Nature Conservation	Pronatura Mexico
C2		Nature Conservation	Pronatura Península Yucatán
G1	Government (G)	Coastal Management	Coastal Zone Management Authority and Institute of Belize (CZMAI)
G2		Forestry	National Forestry Commission (CONAFOR)
G3		DRR	National Center for Disaster Prevention—Hydrometeorological Risk Subdirection (CENAPRED)
G4		Tourism	Ministry of Tourism of Mexico (SECTUR)
G5		Tourism	Tourism Institute Honduras (IHT)
I1	International and Transnational Organization (I)	Sustainable Development	United Nations Development Program (UNDP)
I2		Coastal Management and Nature Conservation	Resilient Reefs—Great Barrier Reef Foundation
I3		Nature Conservation	Mexican Fund for Nature Conservation (FMCN)—Kanan Kay Alliance
I4		Sustainable Development	German Cooperation for Sustainable Development (GIZ) GmbH
I5		Agriculture and Development	Food and Agriculture Organization of the United Nations (FAO)
I6		Nature Conservation	World Wide Fund for Nature (WWF)
I7		Nature Conservation	Mesoamerican Reef Fund
P1	Private Sector (P)	CCA	Zurich RE Foundation—Flood Resilience Alliance
P2		Social and Environmental Impact Investment	SVM Mexico—Social and Environmental Impact Investment Advisory in Latin America
P3		Tourism	Iberostar Group

### 2.3. Data Analysis

A qualitative approach was used in the coding of the interview transcripts to identify and group key themes. The data analysis and coding strategy was guided by the following steps (also shown in Figure 2). First, a draft coding structure was created based on an initial set of potential barriers and opportunities identified by reviewing existing literature. Transcripts and notes were then organized and analyzed using a thematic coding technique based on the six-step guidelines described by Creswell, 2009 [68]. Categorization of the data in the transcripts was carried out. During the coding process, common topics and themes throughout the material were found, and then, grouped together. Finally, the initial list of barriers and opportunities identified in the literature review was extended and validated by comparing it with the findings from the analysis of the interviews. New codes that were not previously identified were added, and codes in the initial structure that did not appear in the interview's responses were deleted.

Codes were used to generate frequency tables to better visualize, compare, and analyze the results. This technique facilitated the identification of intersections and overlaps among opinions and concepts. It also permitted the authors to reinforce what was currently understood, identify new gaps in the published literature, as well as potentially provide a new theoretical understanding of the topic [68].



**Figure 2.** Data analysis steps. Adapted from [68,69].

### 3. Results and Discussion

Our analysis resulted in a list of 23 barriers (Table 3), categorized into four broad key themes. Only topics that were identified by at least two different respondents were reported.

**Table 3.** Perceived barriers of nature-based solutions (NbSs). Source: Authors (2022).

Theme	Perceived Barrier	No. of Responses
<b>Knowledge and Capacity</b>	Lack of skill knowledge and technical capacities for NbS planning and implementation	9
	Lack of knowledge and awareness about NbSs	8
	Lack of proper monitoring, evaluation, and knowledge dissemination mechanisms	7
	Difficulties calculating and communicating ecosystem value (economic and protective)	5
	Uncertainties about functionality and effectiveness of NbSs	5
	Perceptions of grey infrastructure as the only effective solution	2
<b>Governance and Institutional</b>	Silo mentality/lack of coordination mechanisms	16
	Lack of political support and long-term commitment	10
	Lack of coherence in policies and regulations/weak legal frameworks	9
	Weak enforcement of regulations, lack of transparency, and corruption	9
	Lack of local government capacity	8
	Lack of Systemic–Holistic thinking. Institutions not prepared to deal with complex problems	6
	Discrepancies in knowledge, concepts, and language between different institutions	5
	Inertia and path dependence regarding grey infrastructure	3
<b>Financial</b>	Preference for fast solutions to show political results	2
	Favor of short-term economic development strategies	8
	Lack of available financial resources and incentives	7
	Little budget allocation for NbSs	6
	Lack of involvement of the private sector	4
<b>Social</b>	Short-term donor interventions	2
	Lack of public awareness and support for NbSs	10
	Lack of participative processes/social inclusion and community involvement	7
	Opposite visions and interests from different stakeholders	6

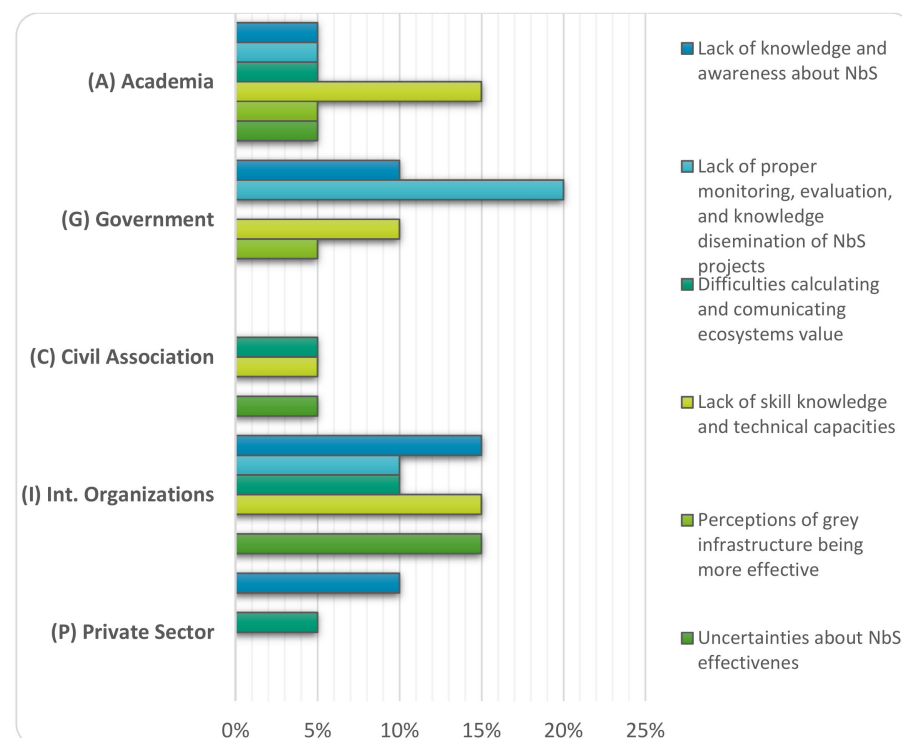


### 3.1. Main Interview Findings

Based on the literature review and the thematic analysis of interview transcripts, the main barriers for further adoption of NbSs were identified and categorized into four broad key themes: “Knowledge and Capacity”, “Governance and Institutional”, “Financial”, and “Social”. These themes are consistent with those found in previous research in different country and cultural contexts.

#### 3.1.1. Knowledge and Capacity

In line with other authors [14,43,70,71], stakeholders interviewees identified six main barriers related to the lack of knowledge and technical capacities for the further consideration and implementation of NbSs (Figure 3).



**Figure 3.** Knowledge and capacity barriers perceived per group of stakeholders. Source: Authors (2022).

#### Gaps on Knowledge

Forty-eight percent of the interviewees cited a lack of knowledge and awareness within the local communities, governmental actors, policy- and decision-makers, and the private sector, about climate change impacts, as well as the benefits of NbSs and their potential to mitigate risks. Respondents argued that most people are unaware of the different options that exist regarding adaptation and mitigation to weather-related risks other than grey infrastructure, as well as all the benefits that NbSs provide. As expressed by one expert:

*“I think that the issue is, if you do not know about all the benefits that ecosystems have and the services they provide, then you will go for the conventional grey infrastructure”*  
(I3)

The lack of specialized knowledge and technical capacities were mentioned as a key barrier in the uptake of NbSs, especially within the DRR and coastal management sectors. Three respondents referred to challenges related to the use of ecosystems as infrastructure, especially in the context of Latin America, where—as one expert indicated—the forestry sector views the problem in terms of productivity only (I1). As a result, many NbS projects are carried out in the same way as other reforestation efforts. In order for these types

of projects to successfully achieve their intended purpose, specific technical-scientific knowledge, adapted to local conditions, is needed [70]. Others indicated that this could be the result of a lack of educational programs that integrate nature-based infrastructure in the curricula (I3,G2). Most individuals working in the risk reduction and water management sectors have engineering backgrounds with a focus on grey infrastructure to provide protection from and resist hydrometeorological hazards. Most educational institutions continue to teach with that focus in mind.

Consistent with other research [72,73], stakeholders suggested there is a need for more NbS training programs adapted to water management, infrastructure, and risk management professionals, in order to increase technical knowledge capacity and raise awareness of solutions other than grey infrastructure.

#### *Monitoring and Evaluation*

Seven participants, many of whom were from the government stakeholder groups, mentioned the lack of guidelines and information regarding the proper implementation, monitoring, and performance evaluation of NbS projects as an impediment to its further consideration. Five stakeholders expressed that more economic evaluations of ecosystem services are necessary to design effective planning and implementation of NbSs. On the other hand, perceptions about the difficulties in quantifying overall ecosystem benefits were also pointed out. This apparent contradiction illustrates the knowledge gaps in previous research [43,71].

#### *Uncertainties about NbS functionality and Performance*

There are still uncertainties about the functionality and performance of NbSs in the face of extreme events. Four interviewees expressed a lack of available information on the effectiveness of NbSs beyond models or one-off projects. One respondent argued that donors, decision-makers, and policy-makers need to see results from more NbS projects “on the ground”, and a scientific quantification of the effectiveness of NbSs in risk reduction. Three other interviewees shared this perception, mentioning that there is still insufficient quantification of NbS efficacy, which gives rise to uncertainties regarding achieving the desired risk reduction benefits.

These perceptions corroborate findings from other researchers that recognize that NbSs may offer limited protection under certain types and magnitudes of hazards [12,17,34,74,75]. The effectiveness of NbSs for DRR is highly dependent on local conditions (geographical location, frequency, magnitude, and the overlap of natural hazards, ecosystem conditions, dynamics, etc.) [17,76]. Moreover, because of the dynamic nature of many ecosystems, the performance of NbSs is expected to vary over time. Social uncertainties, as well as trade-offs and the distribution of benefits and risks, must also be taken into account [13,26,77].

A better knowledge base with evidence of NbS performance from implemented projects can help reduce the level of uncertainty regarding the effectiveness of NbSs [45,48,70]. Currently, the available information in Mexico is dispersed across multiple portals and platforms from different agencies, making information-gathering a complicated and time-consuming process. Interviewees pointed out how the production of more pilot and demonstrative coastal protection NbS projects would facilitate more data generation; moreover, they stated that the systematization of lessons learned from previous projects, and their dissemination through a single platform, would help overcome this barrier. By effectively communicating the results from previous NbS projects, including evaluation and monitoring protocols, and guidelines, to a range of different stakeholders—including policy platforms and publications—awareness and interest would increase, which could lead to more funding and support for key actors [70]. Furthermore, the standardization of methods for assessing NbSs and their multi-functional performance would help build the evidence-based benefits of NbSs against grey infrastructure [73].

Three stakeholders stated that another barrier for NbSs was the lack of knowledge about their risk reduction benefits, because people still see grey infrastructure as the only real solution. One DRR practitioner said:

*“Society still has the idea that a structural work, a wall, a dam, they think that something that can be seen physically is the solution, but sometimes that is what is causing the problems” (G3)*

Another interviewee mentioned how difficult it is to convince policy- and decision-makers to invest in and favor NbSs due to the widespread belief that grey solutions are the only alternative when talking about resilience and risk management:

*“When I talk about resilience, they [decision-makers] always think about grey infrastructure, instead of green infrastructure” (P2)*

As potential solutions, formal and informal education and training programs targeting different types of stakeholder groups at all levels is another opportunity to improve awareness and knowledge about the benefits of NbSs among communities, the private sector, and policy- and decision-makers [47,48]. Nevertheless, educational efforts may not be enough, since the awareness of NbSs does not often translate into action, and grey solutions continue to be favored [47].

Hybrid measures, however, can help in moving from gray to green [78]. On the ground, NbS proposals combining green and grey infrastructure are growing in popularity in the Caribbean area and are being pushed by private–public partnerships such as the Miami Forever Bond. Approved in 2017, the Miami Forever Bond is a USD 400 million program, that has USD 192 million allocated to fund projects to combat rising sea-levels and flooding, including mangrove protection and restoration (green infrastructure) combined with marine dikes (grey infrastructure) [79]. Green infrastructure is the core of the M40 network (Mangrove 40 cities) and their municipal mangrove bond fund [80]. Recent research has shown that hybrid measures may be more attractive to an at-risk audience, and over time, they may help change the negative perceptions of NbSs (including uncertainty about their effectiveness) that currently act as barriers to the wider consideration of NbSs [81].

### 3.1.2. Governance and Institutional Barriers

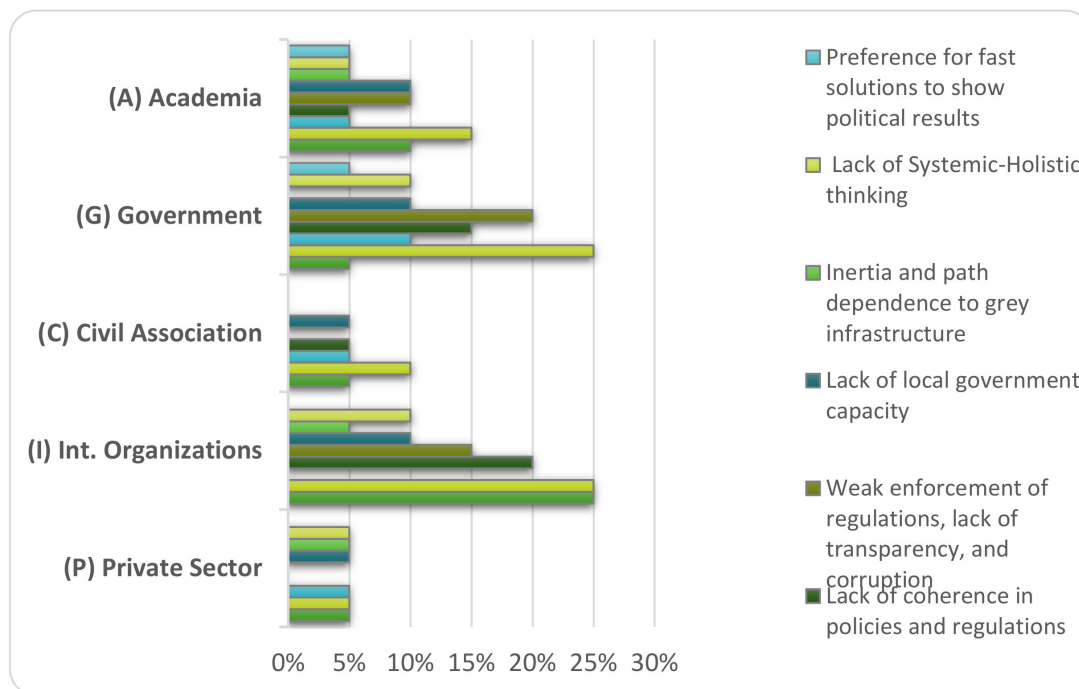
Governance and political considerations have been identified as some of the main factors affecting all other barriers to NbS adoption [71]. Working from sectoral silos, a lack of political will, weak and inconsistent legal frameworks and regulations, and a lack of transparency in decision-making and public engagement were the most frequently mentioned barriers during interviews; all of these are known barriers to NbS consideration and implementation [70,71,73,82,83] (Figure 4).

#### *Silo Mentality and lack of a common language*

When asked about governance and institutional barriers, the lack of coordination and communication between sectors (silo thinking), was by far the most common response, given by 75% of the respondents.

The lack of integration of the DRR and CCA communities, as well as the lack of a common language regarding risk, vulnerability, adaptation, and NbSs, were cited by three stakeholders (A1, G2, G3). For example, in Mexico, both the DRR and CCA sectors produce national risk and vulnerability maps to inform decision-makers, but they use different criteria and concepts for risk and vulnerability. Mexico’s National Center for the Prevention of Disasters (CENAPRED) provides guidelines and advice to states and municipalities so that they can elaborate their own risk maps [84]. In the event of a disaster, states cannot access federal funds if they do not have a risk map. State risk maps are used to create the National Risk Atlas [85]. Climate risk scenarios and vulnerability criteria are not required in these risk maps. In addition, they do not consider ecosystems in their risk calculations and guidelines, which constitutes another barrier to NbS consideration (G3). The National Institute for Ecology and Climate Change (INECC) elaborates the National Vulnerability to Climate Change Atlas [86], which uses other criteria for vulnerability assessment and does consider ecosystems. This can be a cause of confusion because the evaluation of proposals and solutions for disaster management cannot be properly made if the variables used to calculate risk and vulnerability are not the same for everyone. As one expert noted:

*“We need clarity among the institutions and among society on the understanding of the concept of vulnerability: how we measure it, how we monitor it, and how we evaluate it” (G2)*



**Figure 4.** Governance and institutional barriers perceived per group of stakeholders. Source: Authors (2022).

Stakeholders interviewed within the DRR community shared the perception that they have separated themselves from the climate change community because climate change is only one aspect of DRR, which has a multi-risk approach. Currently, the focus for hydro-meteorological hazards within the DRR sector lies more on early-warning systems and grey infrastructure projects (G3). When asked about the current use of ecosystems to manage risk inside their organization, DRR practitioners observed that:

*“There are several specialized agencies in charge of the natural environment. We do not want to duplicate functions, because that is a waste of resources, so at the end of the day we do not get involved much with the environmental part, to be honest” (G3)*

*“Climate Change is only one aspect of DRR, and there are already many dedicated efforts in the world and in Mexico for that, and also many resources” (A1)*

In Mexico, the Secretary for the Environment and Natural Resources (SEMARNAT) is responsible for public policy on climate change and is the main promoter of NbSs. Nevertheless, DRR stakeholders recognized the importance of NbSs for risk management, and the need of more cooperation and joint efforts with the environmental and climate change sectors. The issue was not considered to exclusively be a problem of institutions, but also of the general population, private sector, and even international organizations and donors.

#### *Lack of Holistic thinking*

NbSs are multidimensional and their planning and implementation must be interdisciplinary [71]. However, cross-sectoral integration is hard to achieve. A quarter of the interviewees believed the reason for this to be a lack of systemic, holistic thinking within institutions, which are not usually prepared to deal with complex problems that require multifunctional, multisectoral solutions, as in the case of NbSs. The issue was not

described as a problem exclusive to these institutions, but rather, as being pervasive across stakeholder groups.

According to some interviewees, by fostering processes of collaboration across all sectors and levels of government, more systematic mainstreaming of NbSs can be achieved. Research suggests that coordination mechanisms, bodies, and protocols are essential to overcoming silos and ensuring the effective integration of NbSs into overall disaster risk management and policies [70,87]. However, it is noteworthy that the creation of coordination bodies and multi-stakeholder platforms, as well as the budget allocation necessary for their functioning and permanence over time, require a legal framework with a clear mandate [54,88].

#### *Lack of coherence and weak legal frameworks*

More than a third of the respondents mentioned the lack of coherence in laws, policies, and regulations as important barriers to NbS mainstreaming, and agreed on the importance of having strong and coherent legal and policy frameworks. For example, in Mexico, the legal and regulatory framework governing coastal zones is fragmented and divided among different institutions, laws, and plans at different levels of government. Different management approaches are used in the same locations, with different mandates and territorial regulations for each sector. This has resulted in confusion over responsibilities regarding monitoring, and regulatory and financial compliance (e.g., private property vs. mangrove protection laws).

While some stakeholders mentioned that the legal and policy frameworks at the federal level are sometimes weak and incompatible with NbS adoption, others disagreed, arguing that they believe the legal backbone in the country is strong, especially regarding climate change. They indicated that the problem is that frameworks do not translate to the state or municipal level where there is usually a lack of resources, capacity, and training. For instance, land-use policies usually fall under municipal authority; however, they generally do not use information on risks scenarios, ecosystems, and comprehensive prevention. Little budget allocation, as well as the absence of implementation mechanisms for key policies that could encourage NbSs, is another common problem that, according to G2, “renders public policy pure demagoguery”. In this respect, national and local policies need to be aligned. Multi-level policy-making, with sectorial, multi-stakeholder cooperation can help with the harmonization and updating of legislation and existing regulations at the federal, state, and municipal levels, and across different sectors, in order to facilitate NbS mainstreaming [45,70,87].

In Mexico, the legal and policy landscape remains highly fragmented across different sectors and governmental levels [62]. Some efforts by inter-ministerial committees and coordination mechanisms exist in the country, but there is still a long way to go, especially in the coastal zone, where land-use competition, overlapping mandates and institutions, and unclear liabilities pose a challenge for the uptake of NbSs. The country has been attempting for years to create an integrated coastal management policy and a coordinating body, but without success [56]. This represents a capacity-building opportunity for Mexico through which it could develop partnerships with countries in the region that have integrated coastal zone management policies and plans in place, and acquire experience applying NbSs for adaptation and risk reduction. Transboundary actors—those who are able to communicate with the different stakeholders involved—are able to influence the commitments of local policy- and decision-makers [48]. Partnerships could support knowledge and resource sharing, institutional backing, and further collaborations [89,90].

Stakeholders indicated that the alignment of legal and policy frameworks with international commitments, such as The United Nations Conventions and Ocean Protocols (e.g., The Cartagena Protocol in the Caribbean) can play an important role in the further inclusion of NbS approaches into policy and help in gaining political support.

### *Lack of political support and corruption*

Political support and long-term commitments are vital for the successful implementation and mainstreaming of NbSs, as they can support long-term actions and policy coherence [71]. Furthermore, political backing can be instrumental to having a regulatory environment that supports NbS financing [54,91]. A lack of political support, a short-term vision, and a preference for “fast solutions” due to short governmental terms were pointed out. Forty-eight percent of stakeholders also cited corruption, a lack of transparency, and law enforcement as significant obstacles to the uptake of NbSs.

*“It is the government’s responsibility to mediate and achieve ecological balance but there is a lot of corruption in this regard, if they are paid bribes to give permits or approve projects, they’ll do it” G2*

Mexico and other Latin American countries are characterized by high levels of corruption and a lack of trust in governments. Priorities usually change with the arrival of new public administration [92,93], making long-term planning and project continuity difficult. Given the timeframe of their mandates, local governments tend to prefer short-term projects so they can show visible results [92].

Multilevel and cross-sectorial decision-making committees, involving all relevant actors, as well as local communities, can address the challenges of working with local governments by ensuring the continuity, transparency, and sustainability of NbS initiatives, which require long-term commitments [54]. In Mexico, there already are several top-down participatory governance mechanisms in place. For instance, the Advisory Council for the management of protected areas, and the Watershed Council, both seek to integrate several stakeholders in the decision-making of water management. Both governing bodies are comprised of representatives from governmental agencies, civil society, academia, private sector organizations, and landowners. The goal is to promote coordination, share knowledge, and achieve efficient and sustainable land-use and watershed management. However, the councils often must work with top-down agendas subordinate to federal-level priorities, with poor stakeholder engagement and participation, that are essential to support the design and implementation of NbSs as they increase interest, trust, and stewardship among the different stakeholders [47,70,94–96].

To identify and address key stakeholders and their interests, values, and knowledge, and to understand their motivations, strong and effective collaborative governance requires a stakeholder mapping and engagement plan as the first step [47,49]. An opportunity exists for the design of policies and plans, with the necessary conditions for the integration of multi-stakeholder and cross-sectorial decision-making committees, as a mandatory requirement for plans and projects, including local and indigenous communities. A mandatory vote and the attendance of stakeholders to validate decisions can help increase participation and trust, as well as accountability [49,96].

### *Institutional Path Dependence and Inertia*

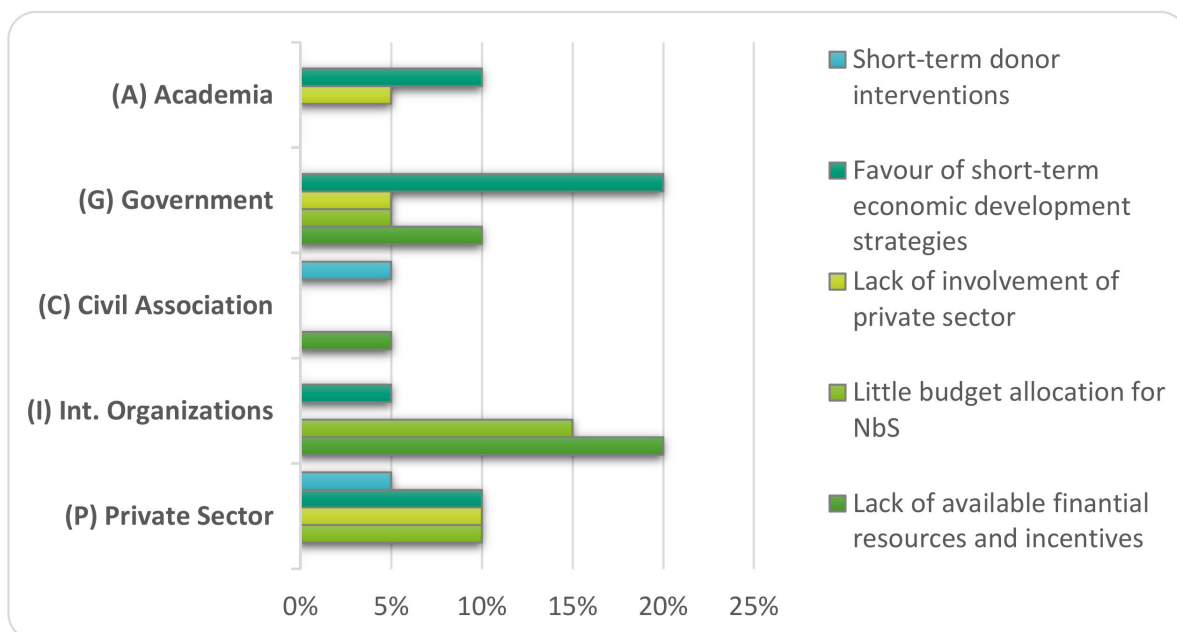
Institutional path dependence and inertia regarding grey infrastructure were cited as barriers to mainstreaming NbSs by three interviewees. A DRR expert argued that a central barrier is that in Mexico, the go-to solution is grey infrastructure since decision-makers and practitioners tend to act based on past experiences. Furthermore, there are no guidelines regarding NbSs or Green Infrastructure for reconstruction after a disaster. According to the Federal Budget and Fiscal Responsibility Law, Art. 34, following a natural disaster, cost-benefit evaluations for infrastructure investments are not required, since immediate reconstruction is prioritized [97]. This leads to rapid and often poorly executed projects, which usually do not consider risk or resilience scenarios, much less green infrastructure or NbSs, since “it is important to be easy, fast, and with political visibility” (A1).

This latest perception highlights the need for the clarification of the roles of NbSs as both an effective ex-ante disturbance prevention strategy (which is the main focus of green infrastructure), as well as an ex-post restorer of the damaged ecosystems disturbances. As such, they support the recovery process through ecosystem services and are more able to

reduce the deleterious effects of successive extreme events and long-term climate change impacts such as rising sea-levels.

### 3.1.3. Financial Barriers

Several studies recognize economic limitations, specifically the lack of funding and financial incentives, as constraints to the consideration and implementation of NbSs [70,71,98,99]. Financial limitations were mentioned by 16 out of the 20 stakeholders interviewed as key factors that hinder the uptake of NbSs (Figure 5).



**Figure 5.** Financial barriers perceived per group of stakeholders. Source: Authors.

#### *Lack of financial resources and incentives, and short-term economic development strategies*

Forty percent of interviewees mentioned that Mexico's development model—and that of the region in general—continues to be based on economic growth, in which an extractive approach is prioritized over environmentalism, which poses a significant barrier to NbSs.

Environmentalism, however, does not necessarily oppose economic growth in the Caribbean. Many countries strongly depend on the tourism sector, which directly relates to the health of their coastal and marine resources. Supporting NbSs would simultaneously improve ecosystem management and promote coastal resilience to extreme events. For example, the value of coastal protection provided by mangroves worldwide is estimated to be USD 65 billion a year in avoided losses due to storms; in addition, these ecosystems can increase local communities' incomes by up to 100% through increased marine biodiversity and tourism opportunities, which help sustain local livelihoods [80]. The inclusion of NbS strategies in development plans can be a good entry point.

Some interviewees indicated that limited budget allocations for key sectors, policies, and action plans that can encourage NbSs are also a significant barrier. It was argued that budgets not aligned with public policy could be the result of a lack of knowledge by the institutions or persons in charge of budget allocation, poor coordination, and/or corruption (misuse of resources). Furthermore, with the increasing number of disasters, there is still greater emphasis on response and recovery activities in the region rather than prevention strategies, including NbSs. This is also true in Mexico, where the budget allocated to disaster prevention in the last 10 years represented 4.11% of the budget allocated to disaster response [100].

Funding and support from development agencies and multilateral banks have been key enablers for NbS initiatives in Mexico [101]. Nonetheless, multiple challenges exist

that prevent or limit access to funds. For example, in Mexico, NbSs are not considered a form of structural protection; thus, disaster prevention funds cannot be used to implement NbS projects [101]. The inclusion of NbS as a risk reduction measure in disaster models and vulnerability maps, as well as the recognition of NbSs as infrastructure is, therefore, an imperative first step.

According to seven interviewees, there is a need to perform more cost–benefit analyses comparing green versus grey solutions in the context of coastal protection. This represents an opportunity to make a business case for NbS approaches and attract more investment and interest from the public and private sectors. This agrees with the findings of Coles et al. [102] who propose innovative financial approaches to overcome the economic constraints that usually confront NbS projects. Two interviewees also indicated that the coordination, implementation, monitoring, and maintenance of NbS initiatives require medium- to long-term financing, which is often difficult to obtain. However, it was also argued that the maintenance and monitoring of projects should be embedded in the project plan from the beginning, establishing partnerships and governance mechanisms that ensure project sustainability and funding. For example, financial commitments from public–private partnerships and local communities should be established, in which the owners or users of the land where the NbSs are being implemented (beneficiaries), value the intervention and assume responsibility for maintenance costs [99].

Raising awareness among the private sector is also an essential step for its further involvement, so it begins to view NbSs as opportunities for investment rather than additional administrative costs or charitable donations [103]. This can start “changing the paradigm that investing in nature is only a matter of altruism, and it’s in fact, a good opportunity to invest” (P1). Examples of private sector investment in mangrove conservation are starting to increase in the region under green and blue bonds (e.g., the Belizean Blue Bond) and through private–public initiatives led by Earth Security [80] where local governments are joining mangrove bond networks in which the private sector plays major roles.

Three interviewees suggested looking at the insurance sector and innovative financial instruments for NbSs as potential options that can allow for a more systematic consideration of ecosystem-based approaches for DRR. By using NbSs as a risk reduction strategy, insurance costs may be reduced; this is progressively important as the increasing frequency of disasters may significantly reduce access to insurance coverage (A1). Non-governmental actors such as landowners, tourism operators and developers, and insurance providers can influence NbS uptake considerably. For example, in the state of Quintana Roo, a partnership between hotel owners, government, academia, and The Nature Conservancy developed a coastal zone management trust to purchase insurance coverage with the reinsurer Swiss Re, which covered and recognized coral reefs as a protective barrier against storms and floods. This initiative was the first of its kind and represents an important step in the development of financial mechanisms for NbSs [104–109].

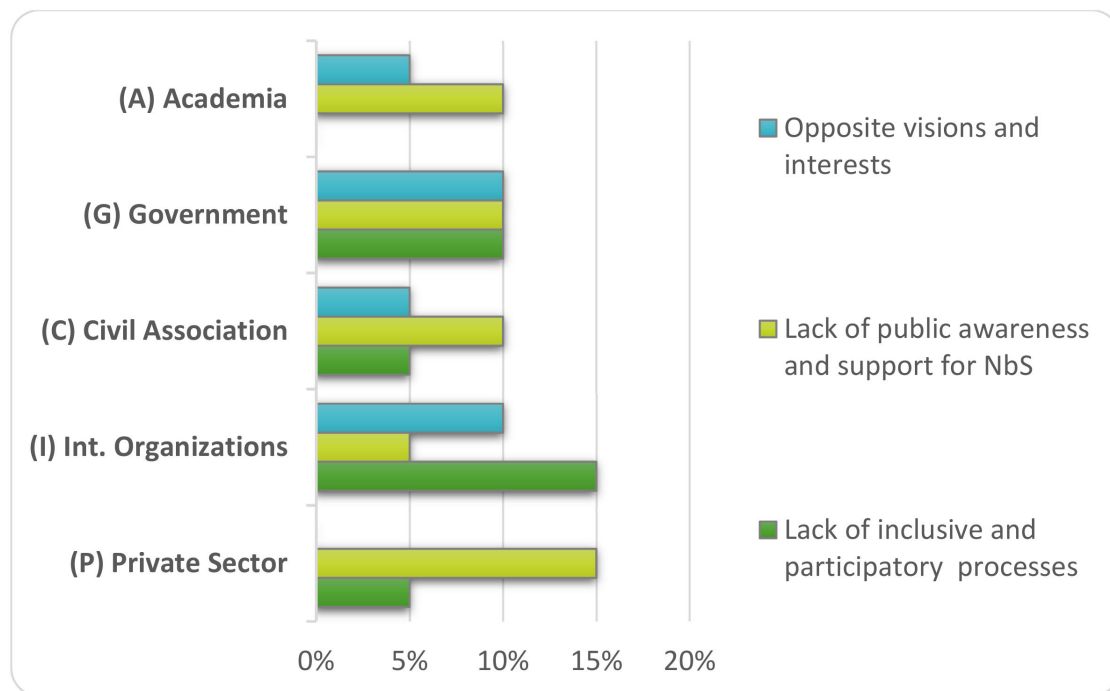
#### 3.1.4. Social Barriers

The lack of public support for NbSs and the general disinterest about environmental issues was one of the problems most commonly mentioned by participants (Figure 6).

Ten interviewees cited poor community involvement and participative processes related to NbS initiatives as a barrier to NbS implementation. They suggested that the lack of support from communities and difficulties engaging stakeholders can be mainly due to a lack of knowledge and awareness about climate change threats and NbS benefits and operations.

One common emerging idea was that people need to be able to understand climate risk as something that can affect them personally and in the short term—which, in many cases, they do not perceive it to be the case—so they are more motivated to become involved and try to find solutions. It is often difficult to demonstrate and convince people that climate change is an immediate threat and that there are solutions other than grey infrastructure that can be just as effective while, at the same time, providing them with other benefits.





**Figure 6.** Social barriers perceived per group of stakeholders. Source: Authors (2022).

Respondents also suggested that there is a lack of cooperation and dialogue among the different coastal zones' stakeholders. Differences in risk perceptions, competing interests, and different values regarding the valuation of ecosystems from different stakeholders, can hinder the type of cooperation that is crucial for the successful implementation of NbSs. As expressed by one interviewee:

*"The valuation of ecosystems at the end of the day is subjective, it does not have the same value for users who depend directly on the ecosystem as external agents in search of business regardless of the effects on the ecosystems" (G2)*

To be effective, NbSs should include community involvement starting from the earliest stages of planning and lasting throughout their implementation and maintenance [43], as people tend to feel responsible and take care of things for which they feel a sense of ownership. The perception of the stakeholders interviewed was that people in coastal communities are not always aware of the value of the many ecosystem services provided by coastal ecosystems, or do not perceive NbSs as public works, in contrast to grey infrastructure such as seawalls and dikes. The participants also recognized a disconnection between traditional knowledge in coastal communities in Mexico and ecosystem services and benefits, which could explain the lack of support of NbS approaches in some cases.

Communication, collaboration, and the co-design and coproduction of knowledge are key drivers for NbS implementation and sustainability. The empowerment of local communities can help overcome barriers and facilitate these drivers [70,87]. Understanding stakeholders' values, interests, and needs is important to successfully engage them in collaborative processes to plan and support NbS initiatives. As an example, if communities' basic needs are not being met, it is difficult for them to engage in problems that they do not see as immediate urgencies (e.g., climate change). Acknowledging the needs and priorities of all stakeholders involved, and including them in the conversation, is the first step toward stakeholder engagement [43,70,87].

#### 4. Conclusions

The objective of this study was to analyze relevant stakeholders' perceptions of the barriers to and opportunities for the integration of NbSs in risk reduction and coastal

management policies to cope with increasing extreme hydrometeorological events in the Mexican Caribbean. Our research identified 23 barriers and several opportunities for NbSs. The findings agree with previous research investigating barriers and enablers for NbS uptake in other countries and contexts. However, the current study frames these results within the unique socio-cultural context of Mexico and the region.

Overall, the information obtained from stakeholder interviews shows that the adoption and consideration of NbSs for addressing coastal disaster risk is highly dependent on appropriate supportive policies, transparency, inclusive and participatory governance, innovative financial strategies, and knowledge and awareness generation. These findings contribute to the body of knowledge about current barriers to the use of NbSs for coastal resilience in Mexico and in the Caribbean region. Considering specific country contexts, both cultural and institutional, is vital for overcoming barriers and increasing the consideration and adoption of NbSs in a more systematic way.

Based on the findings of this work, the following opportunities could be explored:

- *Education and Awareness-raising*  
Addressing knowledge and capacity barriers is critical to improve the awareness of decision- and policy-makers, as well as practitioners and end-users, about the risk reduction potential of NbSs, and their multiple benefits and costs. In this way, NbSs can be given higher priority or be more widely applied in conjunction with engineering solutions, and can be more considered within strategic planning and budgeting processes.  
In this respect, there is great potential in the region for knowledge-sharing and capacity-building, which can be achieved through partnerships with countries in the region and partners with successful experiences in coastal resilience using NbSs.
- *Technical knowledge and capacity development*  
There is a need for more professionals within the coastal management and disaster risk reduction fields with the necessary skills, methodologies, tools, and capabilities to incorporate NbSs into DRR projects. Equally important is the development of additional technical skills and knowledge for today's professionals. Some options to further explore are ongoing education and training through the creation of networks with experts in the region, where knowledge and experiences with NbSs can be exchanged and cooperation can be facilitated, as well as offering more educational programs that integrate nature-based infrastructure into curricula.
- *Review of current policies and regulations to find areas for improvement.*  
Political support is crucial for the mainstreaming and successful implementation of NbSs. To be able to gain long-term support for NbS mainstreaming and uptake, national and local policies and regulations need to be reviewed and upgraded. International political commitments related to NbSs can be translated into laws and regulations. The incorporation of NbSs into planning and budgeting processes within risk reduction, post-disaster reconstruction, coastal management, and development and climate change plans, policies, and regulations is essential for them to be truly considered as an alternative or complementary to gray infrastructure.
- *Coordination mechanisms between the different sectors and levels of government*  
Complex and multidimensional problems such as climate change and its impacts—including extreme events—require an equally multidimensional approach to solve. Collaboration between the various sectors, levels of government, and stakeholders is crucial to manage risk holistically and systematically, and to apply NbSs successfully. The creation of coordination mechanisms and multi-stakeholder decision-making bodies to foster cooperation and overcome silos should be embedded in policy with an allocated budget, to ensure cooperation and the harmonization of the different policies and regulations governing the coastal zone.
- *Business case for NbSs*  
Economic development and disasters are intrinsically linked, especially in countries such as Mexico and many others in the Caribbean, whose economies are highly

dependent on tourism. The recent COVID-19 pandemic, ecosystems degradation due to extreme climatic events, and unsustainable development for tourism have highlighted the fragility of the region in the face of processes that affect tourism revenue. Development and economic growth cannot be separated from natural capital conservation in these countries.

The facilitation of public–private partnerships and cooperation is vital for overcoming financing barriers. Innovative sources of financing such as insurance and green bonds should be further explored. As an example, the M40 initiative develops new approaches to generate public–private partnerships through the development of the world’s first nature-based adaptation fund for cities, which includes the creation of a “Municipal Mangrove Bond Fund” to obtain the financing needed in 40 of the world’s most important mangrove ecosystem hotspots, including Mexico, which hosts a quarter of the world’s mangrove forests.

Performing more cost–benefit analyses of green versus grey infrastructure (opportunity cost), as well as the economic valuation of ecosystems, could be an opportunity to make the business case for NbS approaches stronger and more attractive, attracting greater investment and interest from the public and private sectors. It is important to share and disseminate the results so that the evidence base for NbSs can grow.

- *Stakeholder engagement, inclusion, and empowerment*

A key factor for a successful NbS project is the co-creation of solutions. The inclusion and empowerment of communities and the various stakeholders from the early stages of project planning, through implementation and maintenance, can help guarantee the long-term sustainability of NbS strategies and their acceptance. The development of learning and cooperation networks, where experiences with NbSs can be shared, should be embedded in policy, so that the awareness and knowledge of all stakeholders with regard to extreme events and the multiple benefits of NbSs can grow. Likewise, understanding stakeholders’ values, interests, and needs is important to successfully engage them in collaborative processes to plan and support NbS initiatives.

- *Centralization and sharing of information and knowledge*

The co-creation of regional research projects and the sharing of experiences of “on-the-ground” projects in a single, unified platform would promote greater consideration of NbSs, not only in Mexico but at a regional level. Relevant data concerning the effectiveness of NbSs under different conditions and contexts, the results of cost–benefit analysis, ecosystem accounting, NbS implementation and monitoring methodologies, and revenue mechanisms, among others, should be shared as much as possible and under the same platform. This could promote cooperation, knowledge exchange, and a greater evidence base in favor of NbSs to achieve greater political and investment support within the region.

The transnational nature of Caribbean ecosystems should be kept in mind. While ecological systems have common ecological functioning rules, the socio-environmental context-specific nature of each country needs to be considered when designing and applying NbSs.

Further research on DRR and coastal management policies at the local level, as well as on barriers and opportunities for NbSs in other national contexts, may be helpful to determine the level of political support for NbSs in the region and to advance their mainstreaming. Our recommendation for further research is to focus on studies that consider a wider range of stakeholders, as well as an analysis on the existence and implementation of transnational policies and legal frameworks at the regional level of Mexico, Central America, and the Caribbean; they can provide a broader view of the region’s strengths and weaknesses in hurricane risk management through NbSs.

**Supplementary Materials:** The following supporting information can be downloaded at: <https://www.mdpi.com/article/10.3390/land11101701/s1>, Stakeholders’ Perceptions of Nature-Based Solutions for Hurricane Risk Reduction Policies in the Mexican Caribbean.

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