FONDO MEXICANO
PARA LA CONSERVACIÓN
DE LA NATURALEZA, A.C.
FMCN INSTITUCIÓN PRIVADA

ANNEX 2

PRE-FEASIBILITY STUDY

Sustainable Communities for Climate Action in the Yucatán Peninsula (ACCIÓN)

Abbreviations and acronyms

ADVC	Voluntarily Designated Conservation Areas (áreas destinadas voluntariamente a la conservación)
AGRICULTURA	Ministry of Agriculture and Rural Development (Secretaría de Agricultura y Desarrollo Rural)
AKK	Alianza Kanan Kay (Kanan Kay Alliance)
CBE	Community-Based Enterprises
CBD	Convention on Biological Diversity
CC	Coordination Commitee
CONABIO	National Commission for Knowledge and Use of Biodiversity (Comisión Nacional para el Conocimiento y Uso de la Biodiversidad)
CONAFOR	National Forestry Commission (Comisión Nacional Forestal)
CONAGUA	National Water Commission (Comisión Nacional del Agua)
CONANP	National Commission of Protected Areas (Comisión Nacional de Areas Naturales Protegidas)
CONAPESCA	National Aquaculture and Fisheries Commission (Comisión Nacional de Acuacultura y Pesca)
CSO	Civil Society Organization
EbA	Ecosystem-based Adaptation
EE	Executing Entity
EDF	Environmental Defense Fund
ES	Ecosystem Services
ENSO	El Nino Southern Oscillation
FAO	Food and Agriculture Organization
FMCN	Mexican Fund for the Conservation of Nature (Fondo Mexicano para la Conservación de la Naturaleza, A.C.)
FRZ	Fishing Refuge Zone
GAP	Gender Action Plan
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	Greenhouse Gas
GLCC	General Law on Climate Change (Ley General de Cambio Climático)

IBP	Impact Business Partner
INECC	National Institute of Ecology and Climate Change (Instituto Nacional de Ecología y Cambio Climático)
INMUJERES	National Institute of Women (Instituto Nacional de las Mujeres)
MAR	MesoAmerican Reef (Sistema Arrecifal Mesoamericano, SAM)
NDCs	Nationally Determined Contributions
NDVI	Normalized Difference Vegetation Index (NDVI)
OLLC	Legally Established Local Organization (organizaciones locales legalmente constituidas)
PA	Protected area (área natural protegida, ANP)
PECC	Special Program on Climate Change (Programa Especial de Cambio Climático)
PfP	Pay-for-Performance
PG	Productive group
PLAT	Local Technical Assistance Provider (proveedor local de asistencia técnica)
RFP	Request for Proposals
SAM	Sistema Arrecifal Mesoamericano (MesoAmerican Reef, MAR)
SECTUR	Ministry of Tourism (Secretaría de Turismo)
SEMA	Secretaría de Ecología y Medio Ambiente (Quintana Roo)
SEMARNAT	Ministry of Environment & Natural Resources (Secretaría de Medio Ambiente y Recursos Naturales)
SLR	Sea level rise
SPEI	Standardized Precipitation Evapotranspiration Index
SST	Sea surface temperature
tCO2e	Tons of CO_2 equivalent
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNOPS	United Nations Office for Project Services
VWS	Vertical wind shear
WRI	World Resources Institute
WWF	World Wildlife Fund

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Executive summary

The prefeasibility study of the "Sustainable Communities for Climate Action in the Yucatan Peninsula (ACCIÓN)" project outlines a comprehensive approach to enhancing climate resilience in the region. This project seeks to address both the immediate and long-term challenges posed by climate change in coastal and inland communities, emphasizing ecosystem-based adaptation (EbA) strategies. The study aims to aid informed decision-making and reinforce efforts toward developing a climate-resilient region aligned with worldwide environmental sustainability objectives. It intends to be a comprehensive justification for the ACCIÓN project and to present a well-defined rationale for enhancing climate resilience in the Yucatán Peninsula (YP), fostering beneficial impacts for its communities and the broader environment.

This document presents a pre-feasibility study aiming to collect and analyze scientific data, highlighting the significant climate challenges in the YP. The study begins by highlighting the context and baseline, detailing the climate risks, impacts, and vulnerabilities faced by the YP. These include sea-level rise, increased temperatures, shifting precipitation patterns, and the intensification of extreme weather events, which threaten biodiversity, water resources, and the livelihoods of local populations.

Alongside these climate challenges, also in Section I the study examines non-climate risks, such as unsustainable agricultural practices, deforestation, and socio-economic inequalities, which exacerbate the region's vulnerability. At the national level, the policy landscape supports climate adaptation and mitigation efforts, providing a conducive environment for the implementation of the ACCIÓN project. The legal and regulatory framework bolsters this, offering a solid foundation for EbA interventions. Moreover, FMCN's past and current projects in the region provide valuable lessons and opportunities for scaling up climate action through this initiative.

The pre-feasibility assessment, in Section II, dives into the technical, environmental, and socioeconomic aspects of the project. The technical assessment evaluates various adaptation measures, proposing nature-based solutions such as mangrove restoration, sustainable water management systems, and green infrastructure to buffer against climate impacts. The environmental and socioeconomic assessments confirm the viability of these interventions, noting their potential to improve ecosystem health while generating social benefits like job creation. A specific gender assessment highlights how the project will address gender disparities by promoting the participation of women in decision-making and livelihood opportunities.

In terms of financing Section II outlines the need for concessional financing to ensure the project's viability. The economic and financial viability analysis demonstrates that the project can generate long-term financial returns through enhanced ecosystem services, such as nature-based tourism, while providing critical adaptation benefits. Additionally, the study presents a clear exit strategy to ensure sustainability beyond the project's lifecycle, emphasizing capacity building within local institutions and communities to maintain and scale up interventions.

The project's climate rationale, in Section III, is rooted in addressing the specific vulnerabilities of the YP to climate change. The incremental cost reasoning justifies the need for additional funding to

implement adaptation measures that go beyond existing practices. Through the theory of change, the project outlines a strategic approach to achieving systemic transformation by integrating climate considerations into local development planning and fostering collaboration between public and private sectors. The project's objective and logic of action, along with its logical framework, provide a clear roadmap for implementation, detailing specific components such as EbA, capacity building, and knowledge management.

The adaptation options are expected to generate substantial impacts in terms of reducing community vulnerabilities and enhancing ecosystem resilience. Direct adaptation benefits include improved biodiversity and strengthen livelihoods.

Finally, the implementation arrangements described in Section IV emphasize stakeholder engagement and the capacity of executing entities to deliver results. The governance structure and grievance redress mechanisms are designed to ensure transparency, accountability, and inclusive participation throughout the project's lifecycle.

The document is substantiated with a comprehensive list of references and a description of the modeling methodology, ensuring depth and credibility.

In conclusion, the prefeasibility study affirms that the ACCIÓN project is technically, environmentally, and financially feasible. Its proposed interventions are aligned with regional and national priorities and are expected to produce significant co-benefits in terms of adaptation, mitigation, and sustainable development. The project is poised to make a lasting impact by building resilient communities and ecosystems in the YP.

Introduction

The Yucatán Peninsula (YP) is a territory renowned for its environmental and cultural uniqueness. This vast landscape spans 13,781,042 hectares, extending across the states of Campeche, Quintana Roo, and Yucatán. When including a 20 km wide coastal strip, approximately 3,991,205 additional hectares are added. Its coastline borders the Gulf of Mexico and the Mexican Caribbean, home to globally significant ecosystems such as the Mesoamerican Reef System (MRS), the largest transboundary coral reef and the second-largest barrier reef in the world. This territory also hosts unique ecosystems like the underground aquifer system of cenotes, caves, and canals, as well as the largest continuous tropical forest in the country.

The YP is rich in biodiversity, housing approximately 2,300 species of vascular plants, over 3,000 species of insects, 543 species of birds, 118 species of reptiles, and 60 species of bats (Álvarez & Ávila, 2020). The region is also crucial for birdlife, serving as a habitat for wintering, breeding, and resting for many migratory bird species. YP has a system of Protected Areas (PAs) covering 4,648,700 hectares of federal lands, representing 32% of the total area. Among the most notable reserves are Calakmul and Sian Ka'an, known for their vast jungles and biocultural complexity. Additionally, there are 20 state-protected areas, 3 municipal ones, and one private reserve, along with 39 Voluntarily Designated Conservation Areas (ADVC), all contributing to the protection of the region's rich biodiversity and ecosystems. The most characteristic vegetation types in the Peninsula include tropical forests, savannas, and wetlands. Regarding fauna, the region is home to species of high conservation value, such as the jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), howler monkey (*Alouatta pigra*), and several species of sea turtles, many of which are endangered.

Land use in the Peninsula is primarily distributed among agricultural areas, human settlements, secondary vegetation, and protected areas. The Yucatán Peninsula has a population of more than 5,100,000 inhabitants (INEGI, 2021), of which approximately 2,570,000 are women and 2,530,000 are men. Yucatán represents 45% of this population, Quintana Roo 36%, and Campeche 18%. Of the total, the indigenous population amounts to 404,301 women and 431,341 men (APY, 2023). Agriculture in the region is characterized by non-mechanized and seasonal practices, with predominant crops such as corn, beans, squash, and seven other varieties (TNC et al., 2023). Agricultural land use is heterogeneous: Yucatán allocates 22% of its lands to pastures for livestock consumption, Campeche 15%, and Quintana Roo 5%. According to the Ministry of Labor and Social Welfare, 19% of the population in Campeche is engaged in agricultural activities, in Quintana Roo 7%, and in Yucatán 11%. Livestock production includes sheep, pigs, goats, poultry, and turkeys, with income derived from the sale of live cattle and eggs. Wildlife in the region is mainly used for food, hunting, leatherworking, and medicine, with medicinal use being common in Mayan communities, whose survival partly depends on wild animals (APY, 2023). In addition to agriculture and livestock, beekeeping is an important economic activity and part of the identity of the Yucatán Peninsula. This region produces around 23% of the honey and 10% of the wax nationally (APY, 2023).

Approximately 40% of the Peninsula's population is of indigenous descent (1.8 million people), and more than half of the land (56%) and two-thirds of the forests are managed as ejidos or agrarian communities under Mexico's unique communal land tenure system. The livelihoods of ejidos and indigenous communities in the Yucatán Peninsula are closely tied to forests and wetlands, which provide them with food, firewood, medicinal herbs, building materials, and spiritual resources (FCPY, 2018).

As for the poverty index, the three YP states have reduced their poverty levels in the past five years, although 304,300 people still live in extreme poverty (CONEVAL, 2022). In Yucatán, 133,000 people live in extreme poverty, in Campeche 91,700, and in Quintana Roo 79,600. Yucatán is the state that has most reduced its poverty rate, from 45% in 2018 to 38% in 2022; in Quintana Roo, the percentage dropped from 31% to 27%, while Campeche remains at 45% (CONEVAL, 2022).

The three states of the peninsula produce a low level of greenhouse gas emissions (GHG) not homogenous between the three states; the biggest polluter is Campeche, producing 14.5 million tons of GHGs responsible for global warming. It is followed by Yucatán (10.9 million) and Quintana Roo (3.48 million), according to the latest measurements carried out by the state governments. The YP, a pivotal region in Mexico, faces substantial challenges due to climate fluctuations. Its native communities, unique ecosystems, and sustainable practices are especially vulnerable to these shifts. A thorough examination is essential to grasp the region's present and forthcoming climate risks, setting a foundation for well-informed resilience-building strategies.

The ACCIÓN project has been conceived in alignment with the Green Climate Fund (GCF) guidelines. The Project's overarching goal is to demonstrate an increase in the climate resilience of vulnerable communities, ecosystems, and productive systems along the YP's coastlines, primarily through Ecosystem-based Adaptation (EbA) and sustainable livelihoods.

This document presents a pre-feasibility study aiming to collect and analyze scientific data, highlighting the significant climate challenges in the YP. This effort offers essential insights to support and progress the 'Sustainable Communities for Climate Action in the Yucatan Peninsula' (ACCIÓN) initiative.

I. Context and baseline

Mexico is a megadiverse country, unique in its biological richness both continentally and in its marine-coastal areas. Additionally, it has a vast and diverse cultural wealth, resulting in a wide range of languages and cultural identities. It is highly vulnerable to the effects of climate change, ranking among the top half of the most vulnerable countries in terms of ecosystem services, human living conditions, and fresh water supply. Mexico is ranked 114 out of 192 countries in term of its exposure to multiple climate-related natural hazards (including heat and water stress, storms, hurricanes, droughts, increasing seasonality and flooding). In recent decades, knowledge about national vulnerability to climate change has advanced substantially, leading to an evolution in the treatment of information and the application of approaches for designing adaptation measures. the country is located in the southern part of North America. It is bordered in the north by the United States of America, in the south by Guatemala and Belize, and by the Pacific Ocean to the west, the Gulf of Mexico, and the Caribbean Sea to the east.

The Yucatan Peninsula is in southeastern Mexico, between the Gulf of Mexico and the Caribbean Sea, at the border with Guatemala and Belize. It comprises the states of Campeche, Quintana Roo, and Yucatan (**Error! Reference source not found.**).

Figure 1. Yucatán Peninsula three States: Campeche, Quintana Roo and Yucatán. (FMCN, 2024).

ACCIÓN will be implemented in the marine and coastal landscape of the YP, from Laguna de Términos (Campeche) to Chetumal (Quintana Roo), within a strip of 20 km onshore and 20 km offshore. A relevant portion of ACCIÓN's intervention area is under environmental protection status (federal, or subnational): a total of 41 PAs, of which 29 are Federal and 12 state-PAs. The PAs supported under ACCIÓN were selected due to their importance for helping buffer the impacts of extreme climate events, facilitate the adaptation of people and nature to new climate conditions, and contribute to climate change mitigation as a co-benefit. The selected were also selected due to very limited budget allocation, that reduce their potential to be resilient to the effects of climate change. The PAs preliminary included are: Arrecife Alacranes, Arrecife de Puerto Morelos, Arrecifes del Golfo de México – Sur, Arrecifes de Sian Ka'an, Cenote Aerolito, Costa Occ. de I. Mujeres, Pta. Cancún y Pta. Nizuc,Isla Contoy, Jacinto Pat, Jaguar, Manglares de Puerto Morelos, Playa Chenkan, Playa Delfines, Playa Ría Lagartos, Playas de Isla Contoy, Ría Celestún, San Buenaventura, Tiburón Ballena,Tulum, Uaymil and Yum Balam (Figure 2).

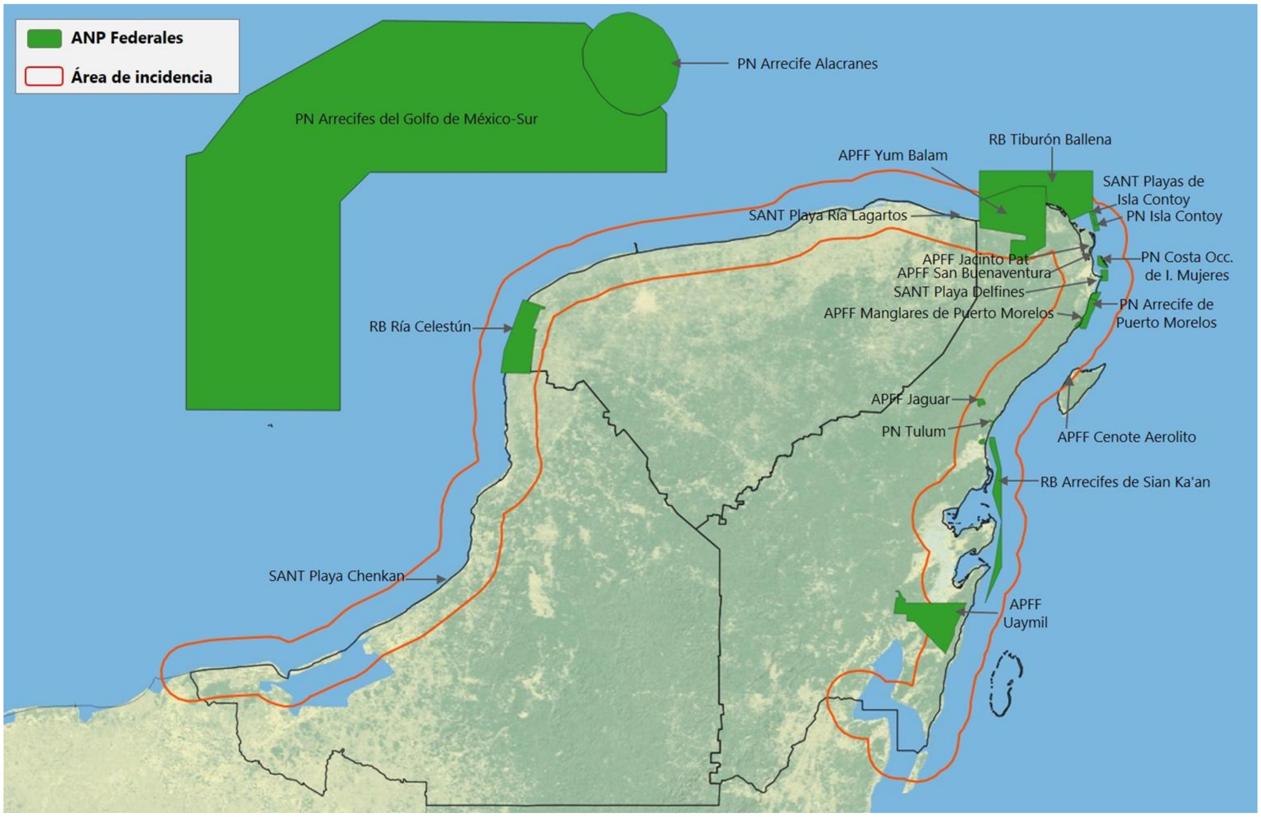

Figure 2. ACCIÓN's intervention area (FMCN, 2024).

The eligibility area of ACCIÓN is the coasts, understand as the 20 kilometers (km) inland and in the ocean from the coast, as well as all polygon of the federal Protected Areas (PAs) that are part of this this buffer. This coastal and marine landscape encompasses 5,859,301.96 hectares (ha), of which 3,253,136.99 ha are marine and 2,606,164.97 ha are terrestrial. The terrestrial zone within the selected landscape is in the transition strip between the floodable forests and mangroves, following swamps, coastal dunes, beaches, interior lagoons, and barrier islands. The marine part includes the continental platform (200 meters deep) of Campeche, Quintana Roo, and Yucatan, with coral reefs and seagrass meadows, where artisanal and coastal fishing occurs, and the islands, cays and reefs surrounding the YP.

This region was selected due to its vulnerability to climate change, the ecosystems that are key to livelihood resilience and adaptation opportunities for local communities and the global population, the existing local capacities and knowledge, combined with the potential of implementing institutions, local capacities, and inter-institutional collaboration to scale up the project's impact (**Error! Reference source not found.**).

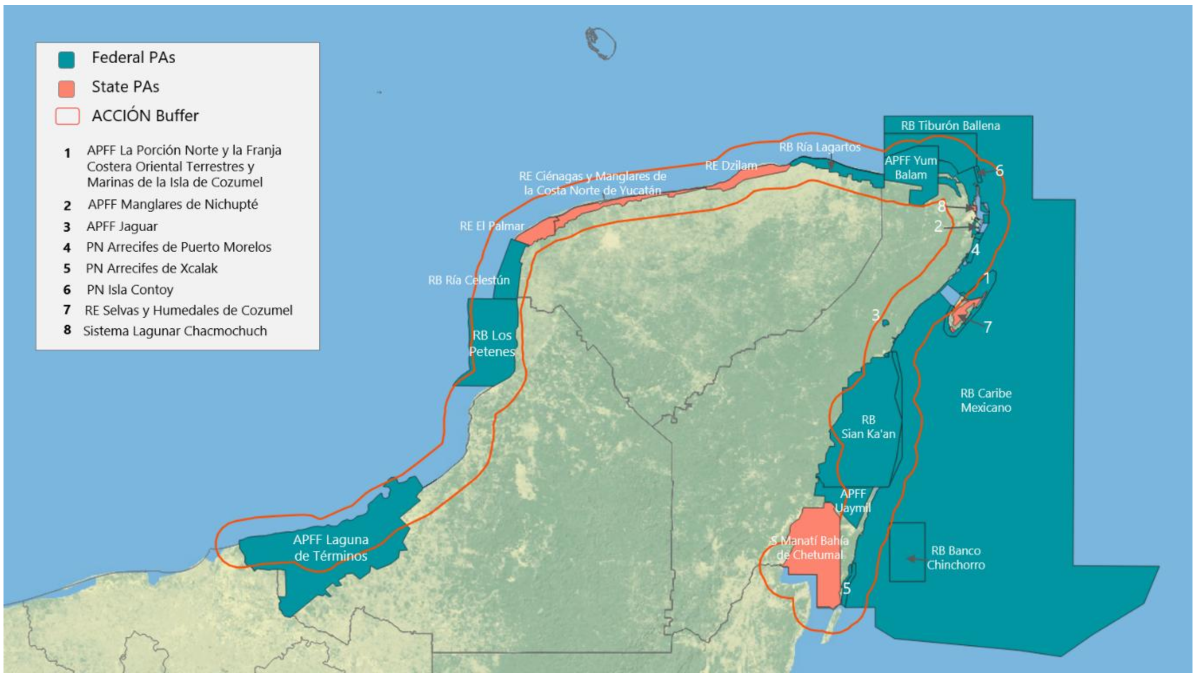

Figure 3. Natural Protected Areas in the project's intervention zone. Output 1 and 3 will focus on the buffer, while Output 2 on the Federal PAs. (FMCN, 2024)

These coastal and marine ecosystems are crucial to climate change adaptation and mitigation as they play a role in reducing vulnerability to climate change in the face of conditions such as increased extreme weather events, coastal flooding, decreased rainfall, increased temperatures, droughts that affect food production, and sea level rise with impacts on coastal ecosystems.

Geologically, the YP is composed predominantly of coralline and porous limestone rock beds, which form a landscape that rises gradually from north to south, and there are numerous sinkholes and caverns across the landscape (Britannica, 2023). It has a wide variety of diverse ecosystems, including tropical rainforests, tropical reefs, mangroves (including *petenes*), dunes, *cenotes*[1], and other ecosystems related to its limestone geography (including caves and subterranean rivers) (Cervera, 2022). The YP has one of the largest karst aquifer systems in the world, with a total area of permeable limestone covering approximately 165,000 km^2 (Adame et al., 2021).

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1 Water-filled sink holes.

As a result of the rapidly growing population, ecosystems across the YP have deteriorated in recent decades due to anthropogenic pressures and climate change. In the past 30 years, coastal areas (including mangrove forests) have been adversely impacted by tourism and urban development by constructing buildings, roads, ports, and harbors (Batllori Sampedro, n.d.). Currently, 80% of the rainforests are degraded, and only 22% of the YP's total area contains mature vegetation. Poverty rates in the YP are lower than that of its neighboring southern states but still among the highest in the country. The targeted communities for this project will be those most vulnerable to climate change's impacts —particularly low-income groups dependent on the dwindling natural resource base of the YP. The coastal target landscape comprises a total of 41 municipalities and 1,949 localities.

I.1. Climate change risks, impacts, and vulnerability

Due to the country's geographical location, topography, and socio-economic characteristics, Mexico is particularly vulnerable to the adverse impacts of climate change. In just over 100 years, land and sea surface temperatures have increased nationwide. This observed warming trend has been accompanied by an increased number of extremely warm days and a decrease in extremely cold days and freeze-overs. Moreover, more extreme hydrometeorological phenomena, such as tropical cyclones and hurricanes, are also expected (SEMARNAT and INECC, 2018).

This section describes the current situation in YP with respect to climate, extreme weather events - tropical cyclones and droughts - sea level rise and other oceanic features, as well as changes in island territories.

The geographical location of Mexico and its topography explain, to a large extent, the variety of climates that occur throughout the national territory, ranging from the warm humid to the cold Alpine, through the sub-humid, temperate, and dry in arid areas. The sub-tropical high-pressure systems of the Northern Atlantic and Northeast Pacific Oceans dominate the country's climate. There are two distinct climatic zones, namely: i) a temperate zone in the north that is generally arid, with moderate rainfall, mild to warm summers, and cool to cold winters, and ii) a tropical zone in the south, which is primarily rainy and hot (CMCC, 2021).

The country's climate varies along four distinct geographic regions (Oropeza-Pérez, 2016), as shown in **Error! Reference source not found.**. The project's target area is the coastal strip of the YP, in the southeastern region of the country, on the border with Guatemala and Belize, between the Gulf of Mexico and the Caribbean Sea, and includes the states of Campeche, Quintana Roo, and Yucatan. YP has a subtropical climate where temperatures and precipitation are generally high in the summer months (WorldData.info, n.d.).

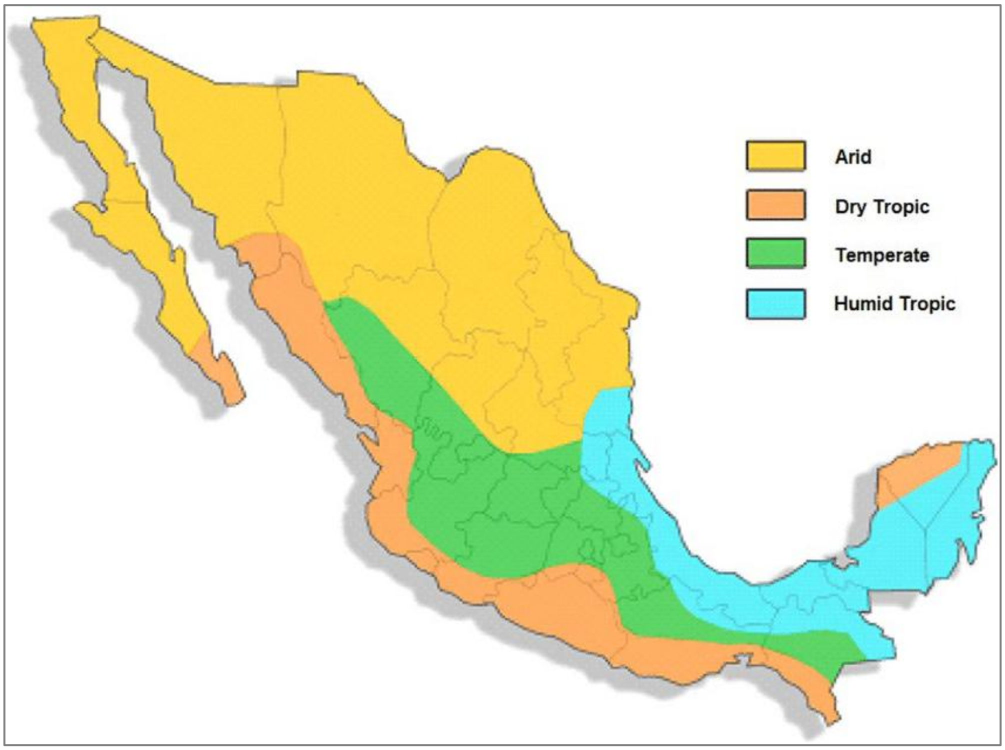


Figure 4 Mexico's four climatic region. s Source: Oropeza-Pérez, 2016.

The climate of the YP is varied but is predominantly classified as tropical, savannah (Aw) —according to the Köppen-Geiger climate classification system— in most of its central part. In the southern parts of the YP, a tropical monsoon climate prevails, with areas further southwest having a tropical rainforest climate. In the north, a relatively small area of Yucatan state itself is classified as arid, and along the entire coastline of the YP, a temperate climate with year-round rainfall and warm summers prevails (**Error! Reference source not found.**). Additional detail on the current climate of the YP is presented in section III.1 Climate rationale, including information on trends in precipitation, temperature, and tropical cyclone activity.

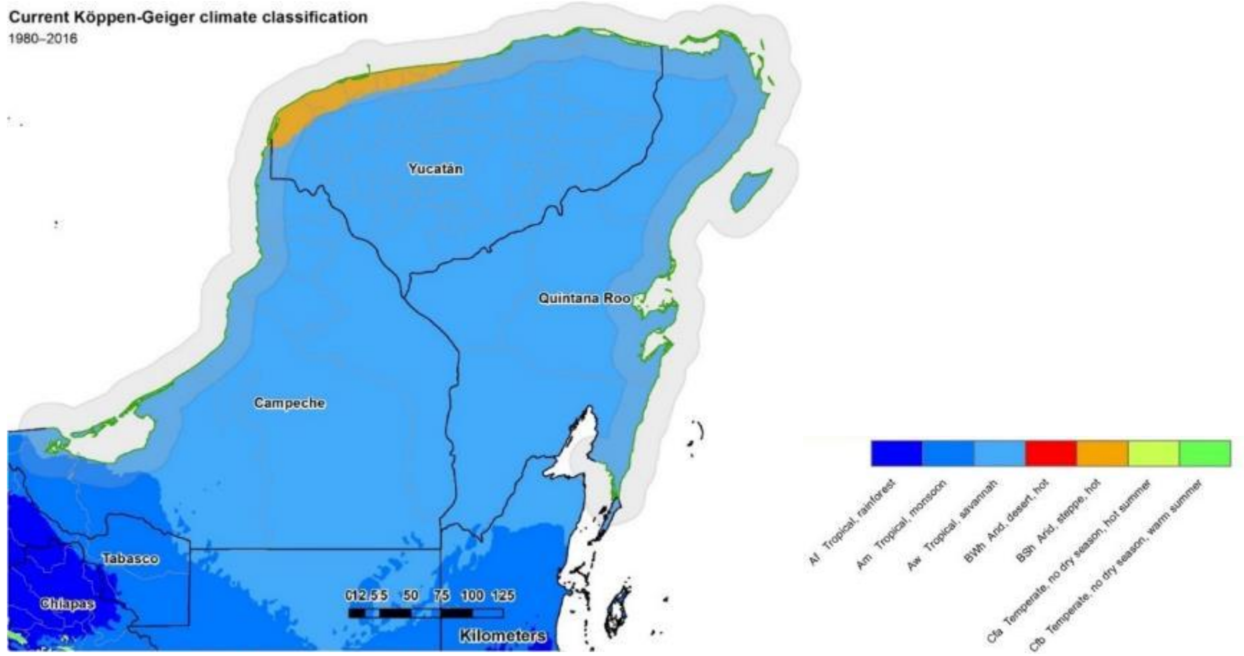


Figure 5 Current Köppen climate classification of the Yucatan Peninsula. Source: Ogier, 2023, p. 12.

Mexico's precipitation profile varies along the main climatic regions described above. One of the main effects of climate change could be an alteration of the regional thermo-hydrological cycle, accompanied by changes in runoff, as well as in water availability and storage. For example, Núñez-González (2020) found that precipitation in Mexico in the period 1960-2010 has decreased in most of the territory, showing a seasonal distribution from the annual total of 7.1% in spring, 54% in summer, 29.3% in autumn, and 8.8% in winter. The central and coastal regions of the Gulf of Mexico (rainy areas) have also shown a significant decrease of 1% in total annual precipitation. INECC studies report, based on the results of the regionalized climate change scenarios for Mexico, that a reduction in the average natural availability of water should be expected, which would be affected by greater evapotranspiration and the decrease of its quality.

The YP is located in an area with higher precipitation rates than the rest of Mexico. However, precipitation rates vary across the YP, with the eastern coastal areas of Quintana Roo and southern areas of Campeche receiving relatively more rainfall than the northern and central parts of the YP. As the rest of the country, the YP is experiencing decreasing average precipitation, and an increase in extreme rainfall and drought conditions.

In addition to the variability of precipitation in the territory, Mexico's complex topography and geographic location between two oceans make it highly vulnerable to extreme weather events, including landfalling tropical cyclones along the Pacific and Atlantic coasts, affecting more than 60% of its territory. These cyclones are associated with high wind speeds, extreme rainfall, and the associated flooding, all of which are directly impacting the most vulnerable communities in the country, including those in the YP (USAID, 2023). Additionally tropical cyclones are associated with high wind speeds, extreme rainfall, and the associated flooding (Breña-Naranjo, et al., 2015). The Yucatán Peninsula is particularly prone to the occurrence of tropical cyclones, owing to its location between two oceans and the Gulf of Mexico which is generally an area of high tropical cyclone density (Figure 6). The peninsula is disproportionately affected by the occurrence of high-intensity tropical cyclones compared with the northern coast of Mexico and areas further south.

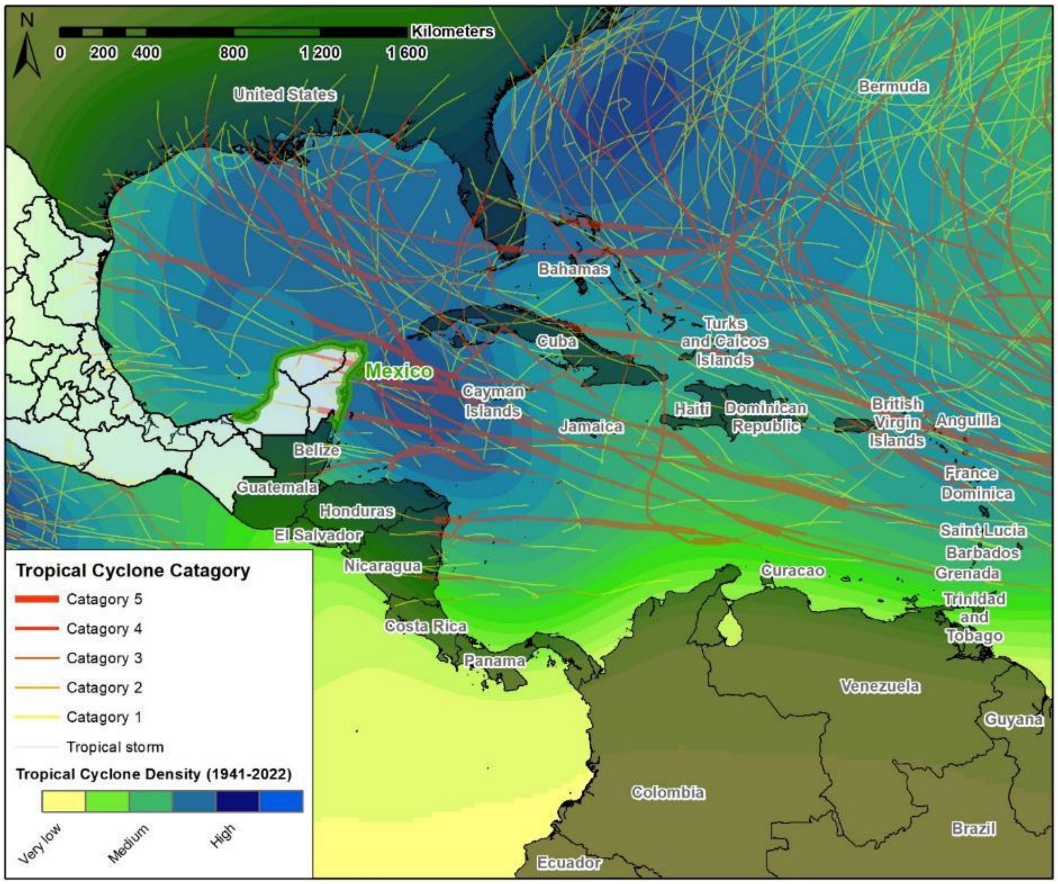


Figure 6 Tropical storm and cyclone tracks in the Gulf of Mexico and the Atlantic Ocean since 1941. Source: Ogier, 2023, p. 19.

Between 2000 and 2018, climate-related disasters —including tropical storms, floods, and droughts—, caused 86.8% of the total damage recorded in the country, resulting in an average annual cost of US$2,110 million (SEMARNAT and INECC, 2018). This is particularly evident for the YP, due to its low altitude.

The YP is one of the regions of Mexico with the highest vulnerability to climate change. Weather events of greater frequency and intensity affect tourist activities (community-based lodges, tourists' cancellations, road damages, etc.). The annual average cost of damage from coastal flooding in Mexico is nearly US$130 million. By 2080, this damage is projected to increase to US$2 billion annually. Yucatan is the state with the highest risk for coastal flooding in the country: currently, the cost of the expected annual damage in such an entity is US$67 million, and it is estimated that this may increase up to US$4 billion by 2100 (SEMARNAT and INECC, 2018). For example, the financial impact of Hurricane Wilma (2005, category V) on Quintana Roo's coast was estimated at US$1.75 billion in losses (Espadas Manrique et al., 2020; Appendini et al., 2019).

The great extension of Mexico's coasts and its location between mid and tropical latitudes favors the influence of the intertropical convergence zone during the hurricane season. From 2000 to 2017, a total of 101 tropical cyclones accounted for damages over MX$226 billion (CONAGUA, 2018), 30% more hurricanes than occurred within 1980-1999. These phenomena usually detonate torrential rains and heavy rainfall, which in turn cause river and coastal floods and landslides, affecting daily activities and resulting in loss of human life, damage to property and infrastructure, destruction of crops, and loss of livestock (Brito and Pedrozo, 2015). The National Disaster Prevention Center (CENAPRED) estimates that over the next 100 years, the number of cyclones affecting Mexico will double.

The YP is, therefore, exposed to regular floods, and given that the economic activity of the region is concentrated along the coast, it is also highly vulnerable to the impacts of sea level rise.

Historically, drought has been a regular part of Mexico's climate, particularly in the northern and northwestern parts of the country. In these areas, droughts occur approximately every 4.1 years, with a mean duration of 2.2 years (CMCC, 2021). In 2011-2013, Mexico experienced one of its worst droughts in seven decades (CONAGUA, 2019). It affected 90% of the territory (19 of the 32 states), causing over US$100 million in losses on bean yields alone (Altamirano et al., 2016), more than 1.7 million cattle died of starvation or thirst, and almost 2.2 million acres of crops withered across at least five states.

Although droughts are less common in southern regions of the country, they remain a feature of the climate and occur alongside changes in precipitation. Although the YP was historically considered a homogenous region regarding precipitation, recent studies have highlighted a high degree of climatic variability. In the YP, water stress caused by droughts directly affects vulnerable local communities through impacts on agriculture. These communities (many of which lack piped water) have reported water shortages for human use and impacts on agricultural production (Metcalfe et al., 2020).

Climate change has also adversely affected livestock productivity in the YP in recent decades. Droughts have caused a decrease in grazing, a decline in cattle fertility, and a drying of water holes and wells across the peninsula, adversely impacting food security (Metcalfe et al., 2020). Moreover, the effects of climate change on secondary agricultural activity include a reported loss in honey production because of reduced flowering of critical species due to dry conditions. In addition, dry conditions have also caused increased crop damage by wild animals and pests, with some smallholders reporting losses of up to 50% (Metcalfe et al., 2020).

Mexico's coastline is highly vulnerable to the impacts of climate change. The sea level has risen in many coastal zones of Mexico from 1901 to 2010, going from 17 to 21 centimeters (GOM, 2015). During the past 100 years, Mexico experienced sea level rise (SLR) at or above the global average, reaching more than 2 mm/year since 1990 (CMCC, 2021). The effects of rising sea levels are increasingly threatening infrastructure and investments.

The coasts of the YP are among the areas identified as vulnerable to static sea level rise with scenarios of 1 and 2 meters using digital elevation models (INECC, CICESE, 2014) (Figure 7).

Figure 7 Flood zones with a sea level rise of 1 to 2 meters. Source: INECC, CICESE, 2014.

Rising sea levels have also been observed in the waters surrounding the YP. Sea levels along the eastern coast of the YP have risen comparatively more than areas to the west, corresponding to the higher sea surface temperatures observed in this area. Alongside rising sea levels, a clear trend in ocean acidification has been observed in the waters surrounding the YP.

As coastal ecosystems continue to be affected by climate change, projections indicate that an overall negative impact can be expected on Mexico's fisheries (Cisneros-Mata et al., 2019). Under low and high emissions scenarios, fish catch potential will decrease, respectively, by 6.8% and 17% by 2050 (CMCC, 2021). Along the coastline of the YP, climate change is already causing numerous impacts. These include the spread of invasive aquatic plants such as sargassum, which reduces the tourism value of the beaches, and coastal erosion caused by SLR and storm surges. Climate change is exacerbating the impacts of unsustainable fishing practices that threaten the sustainability of these communities' livelihoods.

The islands around the YP are part of ACCIÓN. According to the Catalogue of the Mexican Island Territory of the National Institute of Statistics and Geography (INEGI, 2015) —which includes islands, cays, and reefs— some of them are popular tourist destinations known for their natural beauty, vast bird life, pristine beaches, clear waters, coral reefs, and diving and snorkeling opportunities with dolphins. These islands are, however, susceptible ecosystems and will be impacted significantly under the projected future climate scenarios (**Error! Reference source not found.**).

Table 1 Main reefs, cays, and islands of the Yucatan Peninsula

Name	Class	Latitude	Longitude	State	Municipality	Surface (km²)	Perimeter (km)
Arrecife Alacrán	Reef	22° 29' 50.490" N	89° 40' 34.644" O	Yucatan	Progreso	233.087134	476.827
Arrecife Bajo El Cojol	Reef	20° 39' 23.837" N	90° 27' 54.630" O	Campeche	Calkiní	0.513447	6.743
Arrecife Bajo Luchucun	Reef	20° 37' 33.545" N	90° 28' 16.890" O	Campeche	Calkiní	1.82211	17.296
Arrecife Bajo Luchucun	Reef	20° 38' 42.993" N	90° 27' 43.244" O	Campeche	Calkiní	0.225558	3.013
Arrecife Cayo Arcas del Centro	Reef	20° 12' 37.093" N	91° 58' 5.897" O	Campeche	Calkiní	3.060333	11.962
Arrecife Cayo Arcas del Este	Reef	20° 11' 46.264" N	91° 57' 20.751" O	Campeche	Calkiní	0.411318	4.027
Arrecife Cayo Arcas del Oeste	Reef	20° 12' 10.893" N	91° 58' 47.093" O	Campeche	Calkiní	0.362555	3.587
Arrecife Lobos	Reef	18° 28' 27.108" N	87° 19' 32.718" O	Quintana Roo	Othón P. Blanco	11.44673	47.115
Cayo Arcas del Centro	Cay	20° 12' 16.759" N	91° 57' 44.645" O	Campeche	Calkiní	0.302086	3.512
Cayo Cabo Catoche	Cay	21° 35' 45.108" N	87° 5' 2.738" O	Quintana Roo	Isla Mujeres	2.76483	32.904
Cayo Chal	Cay	19° 21' 19.509" N	87° 30' 5.664" O	Quintana Roo	Felipe Carrillo Puerto	3.36281	19.704
Cayo Chelem	Cay	18° 11' 34.780" N	87° 53' 10.895" O	Quintana Roo	Othón P. Blanco	3.04311	50.258
Cayo Contoy	Cay	21° 29' 38.945" N	86° 47' 40.773" O	Quintana Roo	Isla Mujeres	2.15076	23.443
Cayo del Centro	Cay	18° 35' 11.741" N	87° 19' 12.551" O	Quintana Roo	Othón P. Blanco	4.79592	26.05
Isla Aguada	Island	18° 49' 4.144" N	91° 27' 28.203" O	Campeche	Carmen	16.043972	35.356
Isla Arenas	Island	20° 42' 1.545" N 18° 43' 11.831" N	90° 27' 1.928" O	Campeche	Calkiní Carmen	0.824415	10.61

Name	Class	Latitude	Longitude	State	Municipality	Surface (km^2)	Perimeter (km)
Isla Blanca	Island	21° 23' 21.396" N	86° 48' 9.671" O	Quintana Roo	Isla Mujeres	6.97808	32.599
Isla Cancún	Island	21° 5' 27.071" N	86° 46' 22.049" O	Quintana Roo	Benito Juárez	7.81674	51.229
Isla Cozumel	Island	20° 26' 33.251" N	86° 54' 8.798" O	Quintana Roo	Cozumel	467.88951	158.496
Isla El Cenote	Island	19° 32' 42.409" N	87° 53' 21.934" O	Quintana Roo	Felipe Carrillo Puerto	2.69363	9.962
Isla Grande	Island	19° 25' 57.698" N	87° 41' 27.038" O	Quintana Roo	Felipe Carrillo Puerto	11.98581	17.931
Isla Mujeres	Island	21° 13' 45.879" N	86° 43' 52.384" O	Quintana Roo	Isla Mujeres	3.85675	24.493

Source: INEGI, 2015.

I.1.1. Vulnerability analysis

The climate change vulnerability assessment (CCVA) aimed at determining the areas that have the highest climate vulnerability, allowing for (i) spatial targeted intervention planning by assessing the relative vulnerability of each of the leading climate hazard types and by the critical key elements; (ii) sector level planning by looking at the vulnerability at the critical key element level; and (iii) at a high strategic level by looking at the overall combined vulnerability.

The CCVA considered the following five climate hazards, classified by the uniqueness of their adaptation interventions. These hazards are:

- Extreme temperatures, which comprise heat waves, and extreme single-day events, increase in the general temperature profiles.
- Extreme precipitation comprises changes in the number of high-volume single and consecutive-day rainfall events and changes in the 95th and 99th percentile volumes.
- Precipitation variability comprises changes in the consecutive wet and dry days, changes in the rainfall onset and cessation, changes in the year-on-year rainfall volumes, and magnitude and frequency of drought events.
- Tropical cyclones comprise changes in occurrence and event density based on vertical wind shear, and sea surface temperatures in the hurricane development region and changes in storm surge.
- Ocean impacts comprise changes in local sea surface temperatures and sea level rise, and changes in acidification, which will impact marine ecosystems. The acidification is assessed through changes in calcite, salinity, aragonite, and pH measures.

The critical key elements of social, livelihoods, and environmental sensitivities and adaptive capacities are the important themes in the YP. While there is undoubtedly synergy between these themes, they were assessed as follows:

1. Environment: considers the natural environment and includes but is not limited to forest cover and integrity, mangrove area and trends, NDVI trends, and interface with development and agriculture.
2. Livelihoods: agriculture and fishery are the livelihoods with the most significant spatial footprint and are most sensitive to projected climate changes. Other livelihoods assessed include agro-forestry and beekeeping.
3. Social aspects: considers all factors related to communities and their resilience, including population growth, poverty and inequality, and resource security.

The CCVA follows the standard approach to vulnerability (Figure 8) and is based on the most widely used definition provided by the Fourth Assessment Report of the IPCC (AR4) as "the degree to which a system is susceptible to and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity."

- Current/Projected Exposure: The potential impacts associated with significant climatic parameter variations to which a system, community, ecosystem, or livelihood may be subject.
- Sensitivity: The degree to which a system can be affected either adversely or beneficially, by current and projected climate-related stimuli
- Potential Direct Impacts: The potential disruption to an area or system as a result of climate exposure and the underlying sensitivity of the area
- Adaptive Capacity: the ability of a system or community to recover from/adapt to, changes in baseline climate variables due to beneficial factors that will moderate potential damages/consequences.
- Vulnerability: is the difference between climate impact potential and the resilience of a system or area to these changes

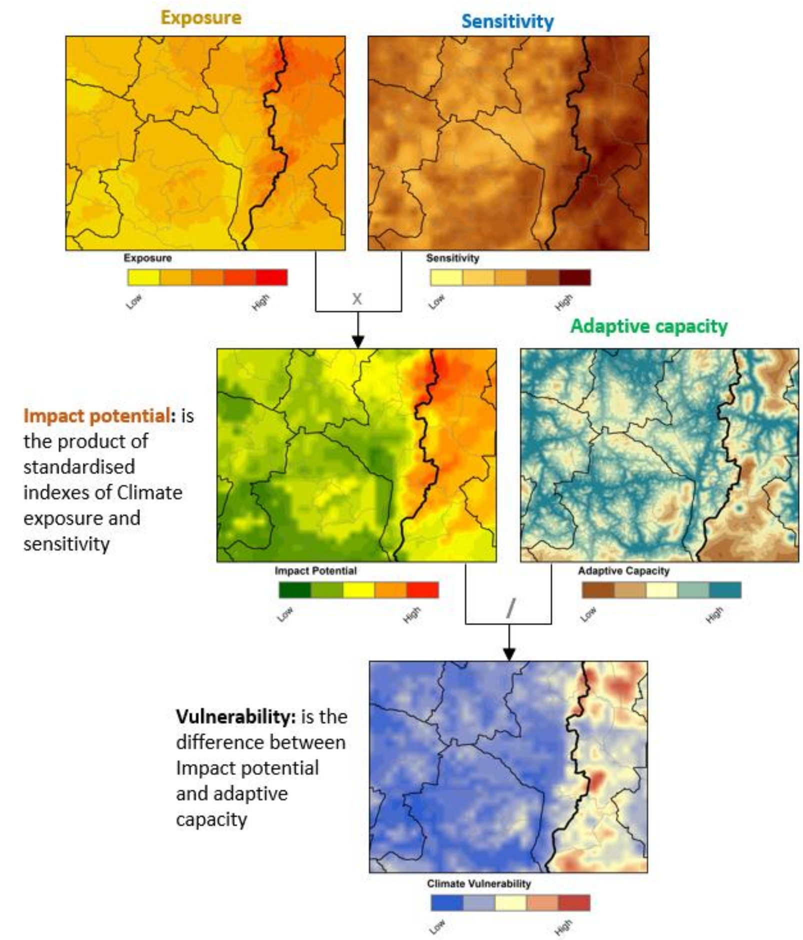


Figure 8. The standard representation of the climate change vulnerability assessment methodology

Combining the five climate hazards with the critical key elements resulted in 15 CCVAs for each climate hazard impact and for the three critical key elements. This level of detail allows for tangible intervention on the ground for specific hazards rather than for generic climate (all-encompassing) vulnerability. These 15 CCVAs are combined by element to present three sector-level vulnerabilities and are combined again to present one over all climate vulnerability. This approach allows for differential engagement with the CCVA based on the decision-makers (Figure 9).

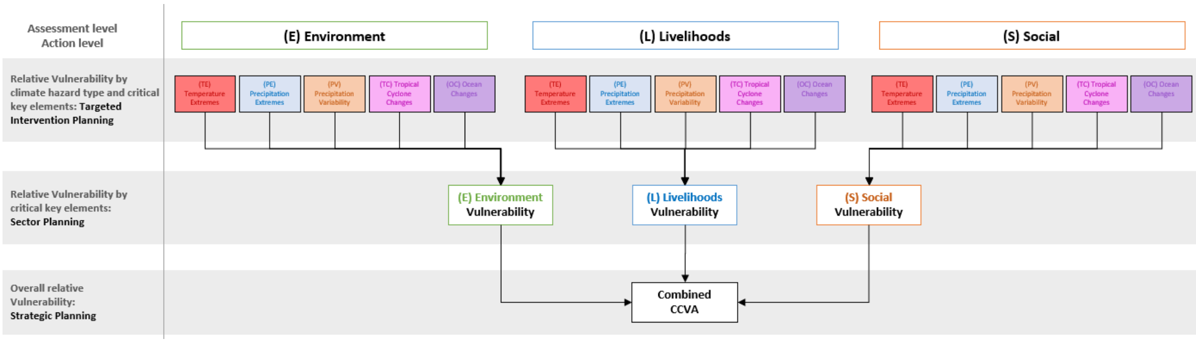


Figure 9. The different levels of CCVA output. Targeted Intervention Planning (top), Sector Planning (middle), and Strategic Planning (bottom)

On the other hand, the exposure index assesses the potential impacts associated with significant climatic parameter variations to which a system, community, ecosystem, or livelihoods may be subject. In the case of the YP, these are Extreme temperatures, Extreme precipitation, Precipitation variability and drought, Tropical cyclones, and Ocean impacts and acidification. For example, the analysis of extreme temperatures reveals that the hottest and most prolonged warm spells occur in the western part of the area, particularly from May to August. Coastal regions to the north and west, historically cooler, are experiencing notable increases in extreme heat, with more days exceeding 35°C and longer warm spells. Peak temperatures during this period range from 38°C to 45°C, depending on the location (Figure 10).

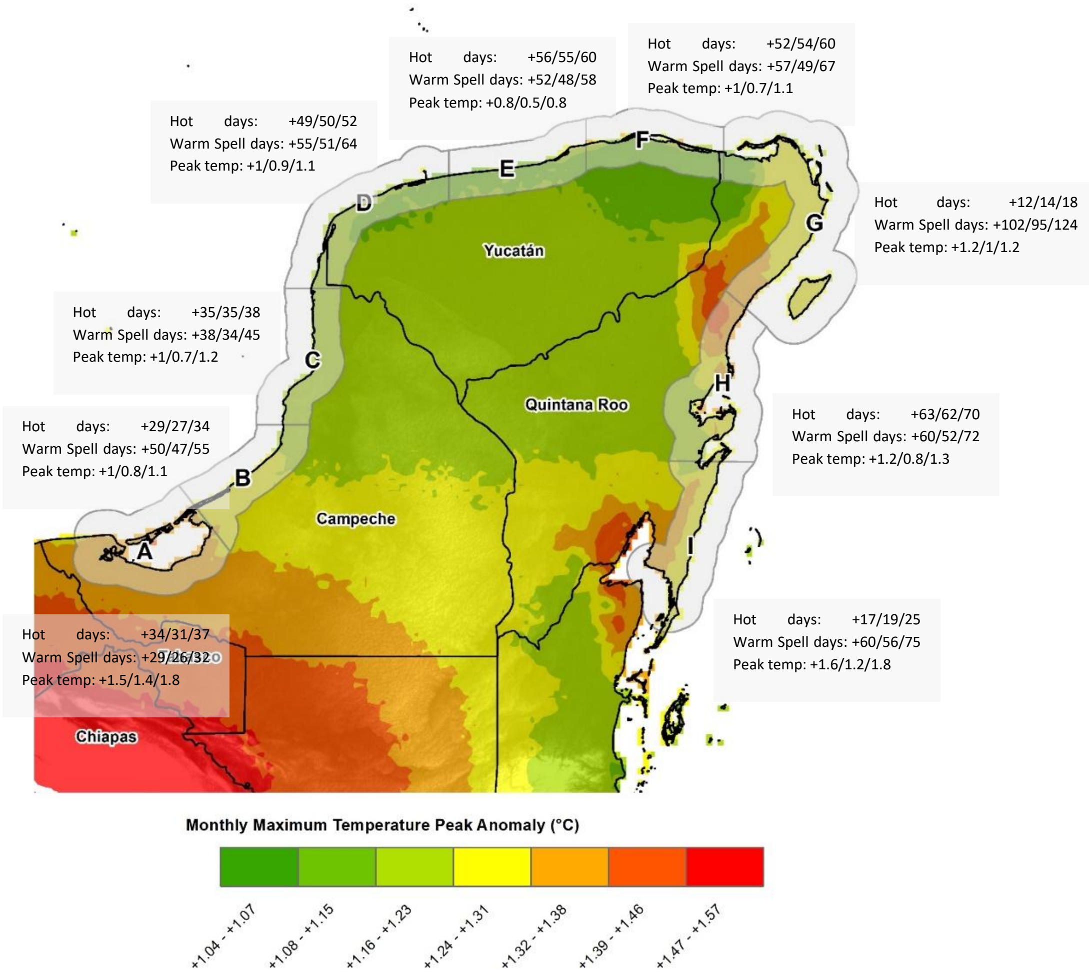


Figure 10 Monthly Maximum Temperature Peak Anomaly.

The exposure is highest generally for the hurricane/tropical cyclone hazards with several locations presenting a score of 9 or 10 for current and future scenarios. These locations are those to the northern and eastern coasts as these areas are more exposed to the higher density of cyclone events. The projected changes in extreme temperatures see increases mostly to the south western coastal areas with an increase in the number of days over 35 °C. There are some notable discrepancies in locations D, E, F and G with very high changes in the days above average plus one standard deviation in the SSP5-85 scenario. This indicates an increase in the general temperature profiles shifting towards more extreme events. The precipitation variability sees mixed exposure scores with the southwest location A seeing high values in the changes in the critical peak months impacting the high-volume months to be more extreme. The northern locations of D and E see high impacts of the changes in onset and cessation scores. This will impact the rainfed agriculture prevalent in the area. The ocean impacts are quite similar in all areas as the dynamic mixing will smooth out much of the future anomalies. There are however increases in acidification noted to the east in locations G and H. Otherwise all the scores generally increase with increased severity of climate scenarios (Table 2).

Table 2 Exposure scores over the study area per climate hazard

Climate expsoure		A				B				C			
		1985-2015	2020-2050			1985-2015	2020-2050			1985-2015	2020-2050		
			SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85
Temperature extremes	Days above 35°C	8	9	9	9	8	9	9	10	9	9	10	10
Temperature extremes	Nights > 26°C	3	5	7	9	2	2	2	4	2	2	2	3
Temperature extremes	WSDI (days)	2	3	4	5	2	4	5	6	2	4	4	5
Temperature extremes	Days above historical mean + standard deviation	3	5	6	7	4	5	6	8	4	5	7	8
Precipitation Extremes	Number of days above 20mm	8	8	9	10	6	7	7	9	6	6	6	7
Precipitation Extremes	1-Day Peak Precipitation	5	7	7	8	4	6	5	6	3	4	4	4
Precipitation Extremes	5-Day Consecutive Peak Precipitation	7	9	8	9	5	7	6	7	4	5	4	5
Precipitation Extremes	Total precipitation volume of the 95th percentile days	8	9	9	10	4	6	5	6	3	4	3	4
Precipitation variability	Changes in critical onset/cessation months	1	2	2	2	4	5	5	5	6	6	6	6
Precipitation variability	Changes in critical Peak months	9	10	10	10	7	8	8	8	6	6	6	6
Precipitation variability	SPEI average	2	6	7	9	2	6	7	8	2	6	6	7
Precipitation variability	Year on year variability range	7	8	8	8	5	8	6	5	6	6	5	5
Precipitation variability	Change in CDD and CWD	1	5	9	8	5	5	8	9	7	8	10	9
Hurricanes	Potential TC density based on VWS & SST changes	6	7	6	6	6	7	6	6	7	8	8	8
Hurricanes	Average Surge height (m)	9	9	9	9	9	9	9	9	8	8	8	8
Oceanic impacts	Average local SLR (mm)	1	5	7	8	1	5	7	8	1	5	7	9
Oceanic impacts	Average local SST (°C)	4	7	6	8	4	7	6	8	2	4	4	5
Oceanic impacts	Ocean acidification changes	1	7	7	7	1	7	7	7	1	8	9	9

Climate expsoure		D				E				F			
		1985-2015	2020-2050			1985-2015	2020-2050			1985-2015	2020-2050		
			SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85
Temperature extremes	Days above 35°C	5	6	6	6	6	8	8	8	4	6	6	7
Temperature extremes	Nights > 26°C	2	3	4	6	2	2	2	2	1	1	2	2
Temperature extremes	WSDI (days)	3	4	5	7	2	4	5	6	3	5	6	7
Temperature extremes	Days above historical mean + standard deviation	6	7	8	10	5	6	7	9	4	6	7	9
Precipitation Extremes	Number of days above 20mm	6	6	6	8	5	5	6	7	5	6	6	7
Precipitation Extremes	1-Day Peak Precipitation	4	5	4	5	4	4	4	4	4	5	5	5
Precipitation Extremes	5-Day Consecutive Peak Precipitation	4	5	5	5	4	5	4	5	4	6	5	5
Precipitation Extremes	Total precipitation volume of the 95th percentile days	3	4	3	3	3	4	3	4	4	5	4	4
Precipitation variability	Changes in critical onset/cessation months	7	7	7	7	6	7	7	7	6	6	6	6
Precipitation variability	Changes in critical Peak months	5	6	6	6	5	5	5	5	5	6	6	6
Precipitation variability	SPEI average	2	5	5	7	2	6	6	7	2	6	6	8
Precipitation variability	Year on year variability range	5	4	4	5	5	4	4	5	4	4	5	5
Precipitation variability	Change in CDD and CWD	4	7	8	9	5	7	8	9	5	6	6	9
Hurricanes	Potential TC density based on VWS & SST changes	7	8	8	8	8	9	9	9	8	9	9	9
Hurricanes	Average Surge height (m)	8	8	8	8	9	10	10	10	9	10	10	10
Oceanic impacts	Average local SLR (mm)	1	5	7	9	1	6	7	9	1	6	7	9
Oceanic impacts	Average local SST (°C)	2	4	4	5	3	5	5	6	3	5	5	6
Oceanic impacts	Ocean acidification changes	1	8	9	9	1	8	8	8	1	8	8	8

Climate expsoure		G				H				I			
		1985-2015	2020-2050			1985-2015	2020-2050			1985-2015	2020-2050		
			SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85		SSP2-45	SSP3-70	SSP5-85
Temperature extremes	Days above 35°C	1	2	2	3	5	6	7	7	2	2	3	4
Temperature extremes	Nights > 26°C	1	1	2	2	2	2	2	2	1	2	2	2
Temperature extremes	WSDI (days)	3	7	8	10	2	5	5	7	2	5	6	8
Temperature extremes	Days above historical mean + standard deviation	5	7	8	10	3	5	6	8	3	5	6	8
Precipitation Extremes	Number of days above 20mm	6	6	7	8	5	6	6	7	6	6	6	7
Precipitation Extremes	1-Day Peak Precipitation	4	6	5	6	4	5	4	5	4	5	5	5
Precipitation Extremes	5-Day Consecutive Peak Precipitation	5	6	6	7	4	6	5	5	5	6	6	6
Precipitation Extremes	Total precipitation volume of the 95th percentile days	5	6	6	6	4	5	5	4	4	5	5	5
Precipitation variability	Changes in critical onset/cessation months	5	5	5	5	5	6	5	5	4	5	5	5
Precipitation variability	Changes in critical Peak months	6	7	7	7	6	6	6	6	7	7	7	7
Precipitation variability	SPEI average	2	5	5	7	2	6	5	8	2	6	4	7
Precipitation variability	Year on year variability range	7	6	8	7	6	5	5	4	5	5	7	3
Precipitation variability	Change in CDD and CWD	3	5	2	6	3	5	5	7	4	7	7	8
Hurricanes	Potential TC density based on VWS & SST changes	9	10	10	10	9	10	10	10	8	9	9	9
Hurricanes	Average Surge height (m)	5	5	5	5	5	5	5	5	5	5	5	5
Oceanic impacts	Average local SLR (mm)	1	6	7	9	1	6	7	9	1	5	7	9
Oceanic impacts	Average local SST (°C)	4	6	6	7	4	6	6	7	4	6	6	7
Oceanic impacts	Ocean acidification changes	1	9	9	9	1	9	9	9	1	8	8	9

Climate sensitivity is the degree to which a system can be affected either adversely or beneficially, by current and projected climate-related stimuli. These tend to be functions of an area that either currently or historically make an area impacted harder or have interdependencies that may be compromised in the event of an acute climate hazard or even a prolonged chronic change to an environment. The social sensitivities tended to follow areas of the higher population as well as rural areas where health care is more limited. Locations B, D and F had the highest social sensitivity. Livelihood sensitivity is largely dependent on rainfed agriculture and the density of fishing. This sensitivity was highest in the western locations of A, B, D, E, and F. The environmental sensitivity was dictated by the forest and mangrove loss trends, as well as the health of ecosystems as noted by the NDVI analysis. The inland areas were noted to be less sensitive with the coastal area where forest and mangroves tend to have significant historical losses having a higher sensitivity. This is highest in locations B, D, E, F and H.

Table 3 Sensitivity scores over the study area per climate hazard

		A	B	C	D	E	F	G	H	I
Sensitivity	**Environmental**	1.5	6.8	2.8	5.9	6.4	6.8	2.4	5.9	3.3
Sensitivity	**Livelihood**	6.3	6.0	3.5	5.6	7.0	6.3	4.2	1.4	1.4
Sensitivity	**Social**	2.8	7.1	5	3.5	7.8	6.4	5.0	2.1	2.1

Adaptive Capacity is the ability of a system or community to recover from/adapt to, changes in baseline climate variables due to beneficial factors that will moderate potential damages/consequences. These tend to be factors that help in the recovery, so much more post-impact rather than sensitivities which tend to be pre-climate impact indicators. The adaptive capacity indicators show a lower environmental adaptive capacity in the northern areas of E and F as these are degraded and have limited forest integrity. The highest adaptive capacity scores are noted on the eastern coastline in areas of G, H, and I.

The livelihood adaptive capacity is strongly influenced by the land productivity and accessibility of the north eastern coast in areas C, D and E. Conversely, locations H and I have very low adaptive capacity and these areas are very isolated and have limited net primary productivity. The social adaptive capacity is focused in the higher density areas D (Mérida) and G (Cancún) as these have a prevalence of critical services required in the event of an acute climate hazard.

Table 4 Adaptive Capacity scores over the study area per climate hazard

		A	B	C	D	E	F	G	H	I
Adaptive Capacity	**Environmental**	4.1	3.7	5.8	4.9	1.7	1.5	7.4	5.6	7.2
	Livelihood	3.9	4.4	6.7	7.5	6.4	3.9	5.8	1.4	1.9
	Social	3.7	3.7	4.3	7.5	5.5	3.7	8.4	2.9	2.0

The climate change vulnerability assessment combined the five climate exposures of Extreme temperatures, Extreme precipitation, Precipitation variability, Tropical cyclones, and Ocean impacts with the three critical key elements of social, livelihoods, and environmental sensitivities and adaptive capacities.

This resulted in 15 CCVAs for each of the climate hazard impacts and for the three critical key elements. This is useful for developing targeted interventions to address climate issues within a particular mandate. These were combined to make critical key element-specific CCVAs to inform sectoral-level planning, allowing general mandate intervention targeting. These three CCVAs were combined again to present the overall CCVA to allow for high-level strategic planning. The primary map presented is for the SSP2-45 scenarios, but the SSP3-70 and the SSP5-85 scenarios are also presented (Figure 11).

The CCVA results are as follows:

- The CCVAs per climate hazard type and critical key elements highlight location F as the area that has the highest general vulnerability. This is a combination of being exposed to the greatest increase in tropical cyclone density, and increased ocean hazards such as acidification and varied precipitation. The variables of extreme temperatures and extreme precipitation are not very high here. Area F also has increased livelihood and environmental sensitivity and reduced capacities as it is further away from the larger population hubs.
- The locations of A and B to the southwest have high CCVA for the extreme precipitation and temperatures. There is also high livelihood and environmental sensitivity in these areas as well as reduced adaptive capacity for all the critical key elements. These areas have medium to high vulnerability.

– Location E to the east of Mérida is somewhat in the middle of all the CCVAs as it is in the interface between the high cyclone and ocean impact to the east and the higher precipitation and temperature exposures to the southwest. This area has a medium vulnerability.

– Locations G, H and I to the west coast have high exposure to the ocean and tropical cyclone impacts but also have lower sensitivities than the northern areas and have generally medium to good adaptive capacities. These areas' CCVAs are all similar and are medium to lower vulnerability.

– Locations C and D are far enough away from the enhanced impacts of the extreme precipitation and temperatures and also have limited sensitives but also low adaptive capacities. These areas seemingly have the lowest overall climate vulnerability.

Table 5 Vulnerability by climate hazard type and critical key elements

			A	B	C	D	E	F	G	H	I
CCVA per hazard and per key critical element	Temperature extremes	Environmental	6.0	5.3	4.0	3.1	6.2	8.2	1.2	5.0	2.7
		Livelihood	6.8	6.5	0.3	2.2	5.8	4.8	4.5	5.2	5.8
		Social	4.4	7.9	4.4	2.2	6.5	7.4	3.0	2.6	3.5
	Precipitation Extremes	Environmental	7.4	5.4	3.7	2.8	5.6	7.2	1.2	5.8	2.8
		Livelihood	8.0	6.5	1.0	2.3	5.0	4.3	4.0	6.0	4.8
		Social	4.9	8.3	4.1	2.0	6.2	7.0	2.8	3.2	3.2
	Precipitation variability	Environmental	6.0	2.3	2.5	4.1	5.1	9.0	2.9	5.9	4.1
		Livelihood	6.7	2.4	0.9	3.1	4.3	5.5	5.7	7.1	6.2
		Social	5.5	4.1	2.6	1.9	6.2	9.1	4.1	4.1	4.1
	Hurricanes	Environmental	2.3	3.2	3.9	4.0	6.5	9.1	3.4	6.0	3.5
		Livelihood	1.5	3.3	1.8	3.7	6.4	6.9	6.6	6.4	5.2
		Social	2.2	5.4	4.2	2.8	7.1	8.8	4.2	3.6	3.6
	Oceanic impacts	Environmental	3.3	3.8	3.5	4.0	6.9	8.9	2.8	5.8	2.8
		Livelihood	3.2	4.3	0.3	3.5	7.1	6.9	6.1	5.3	5.1
		Social	3.1	6.2	3.8	2.7	7.3	8.5	3.8	3.1	3.4

Table 6 Vulnerability by critical key elements

		A	B	C	D	E	F	G	H	I
CCVA per key critical element	**Environmental**	5	4.2	3.5	2.6	6	6.2	5.8	6.5	5.5
	Livelihood	3.7	6.6	3.9	2.2	6.8	8.5	3.6	3.1	3.4
	Social	4.6	4.2	3.7	3.1	6.4	9.2	2.1	5.3	3.3

Table 7 Overall combined vulnerability

	A	B	C	D	E	F	G	H	I
Cumulative combined relative climate change vulnerability assessment	4.6	5.6	3.7	2.8	6.4	8.3	3.8	4.6	4.0

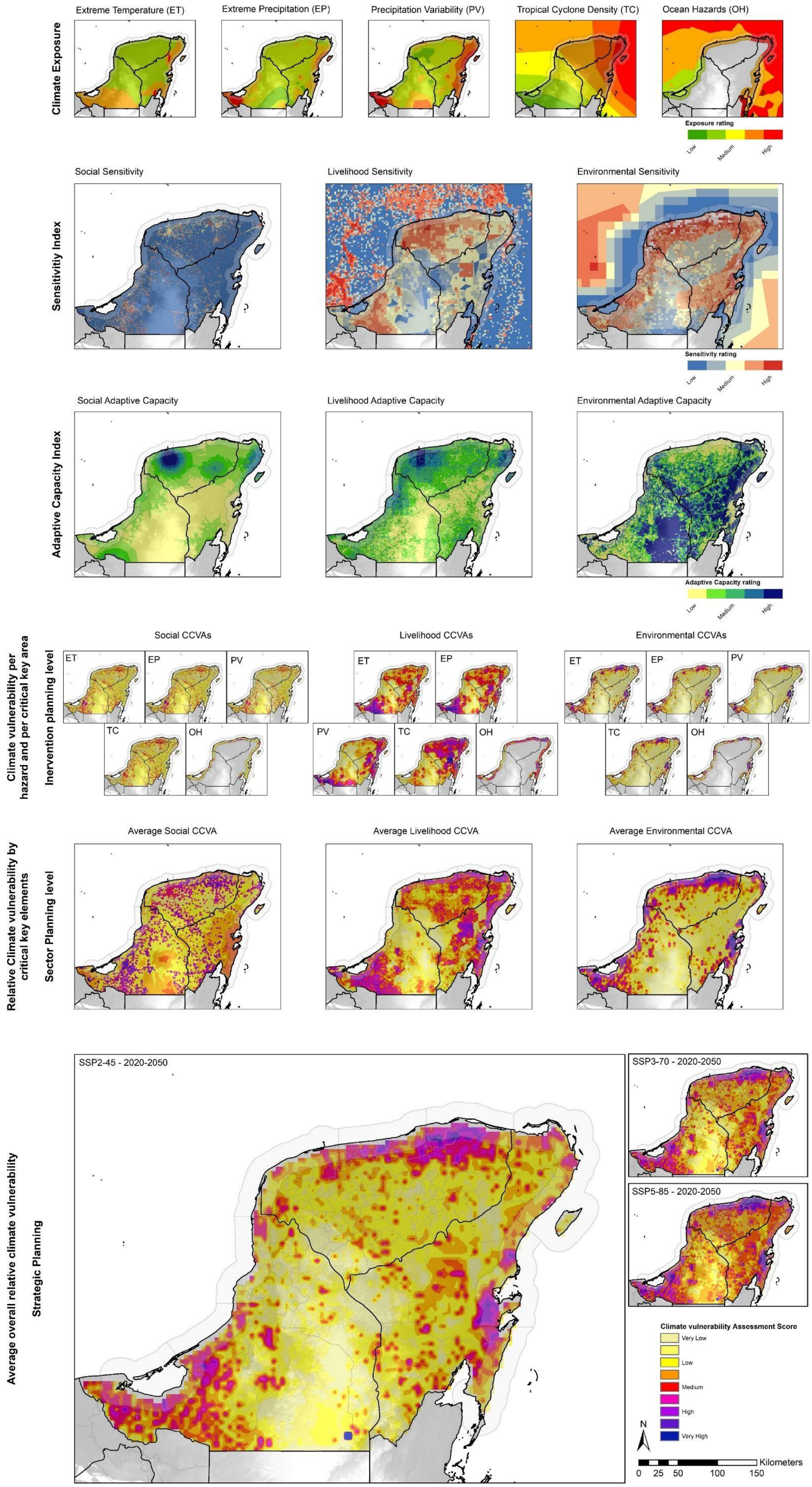


Figure 11 Components of the Climate Change Vulnerability Assessment (CCVA)- Source: Ogier, 2023, p. 105.

I.2. Non-climate risks and impacts

The coastal region of the YP is confronting a confluence of climate vulnerabilities intensified by anthropogenic activities. This investigation elucidates the synergistic effects of land-use modifications, tourism dynamics, and developmental trajectories on the exacerbation of climate-induced risks.

Land-Use dynamics and their climatic implications:

Addressing forest land use change and degradation is a priority in mitigating climate change-induced emissions. The YP currently experiences shifts in land use, whether for agriculture, urbanization, tourism, or other purposes. These changes can significantly affect local weather patterns, temperature, and precipitation. Furthermore, the transformation of natural landscapes, especially critical ecosystems like mangroves and wetlands, can reduce the coast's resilience to climatic events, including hurricanes and sea-level rise. The way land is utilized in the YP plays a crucial role in either exacerbating or mitigating the challenges posed by a changing climate. As a result of the rapidly growing population, ecosystems across the Yucatán Peninsula have deteriorated in recent decades as a result of anthropogenic pressures. In the past 30 years, coastal areas (including mangrove forests) have been adversely impacted by tourism and urban development through the construction of buildings, roads, ports and harbours (Batllori, n.d.). At present, 80% of the rainforests are degraded, and only 22% of the peninsula's total area contains mature vegetation.

CAMPECHE

The state of Campeche in Mexico, encompassing 3.95 million hectares of forests, accounts for 76.2% of its territory and boasts the highest forest cover in the country. It also contains the largest area of mangroves, covering 197,000 hectares, which is 30% of the national total. These forests and mangroves play a crucial role in carbon storage, exceeding 100 MgCl/ha. Campeche, in collaboration with the Federal Government, has declared 2 million million hectares as protected natural areas, making up 35% of its territory. This positions the state as a key player in the mechanisms for Reducing Emissions from Deforestation and Forest Degradation (REDD+), due to its significant CO2 storage capacity (BIOPASOS, 2021).

Despite these efforts, deforestation in Campeche has been increasing annually, particularly in the municipalities of Candelaria, Calakmul, Hopelchén, Champotón, and Escárcega. Over the past decade, it is estimated that around 235,000 hectares of forest have been deforested (BIOPASOS, 2021). Contributing factors include agricultural expansion, livestock farming, forest fires, irregular human settlements, urban sprawl, and the introduction of new roads, significantly impacting the state's forest areas (CONAFOR, 2014).

Furthermore, the forest sector faces environmental, social, and institutional challenges. Issues such as forest management plans, which allow the felling of smaller diameter species, and short-term interests in overexploiting forest resources, often outweigh sustainable alternatives, leading to the impoverishment of forest communities. The current institutional intervention model seems ineffective for community forestry. So far, state investments have been directed towards productive activities, without considering the development of forest social capital and the enhancement of technical-administrative capacities in local communities (ejidos) (CONAFOR, 2014).

In summary, Campeche possesses a rich forest diversity and plays a vital role in environmental conservation and carbon storage. However, it faces significant challenges in terms of deforestation and forest management, necessitating urgent attention and integrated strategies that balance economic development with environmental sustainability.

QUINTANA ROO

Quintana Roo, recognized for its extensive forests, is one of Mexico's privileged states. However, it faces significant environmental challenges due to human activities, including environmental degradation and devastation. The overexploitation and misuse of natural resources, such as soil and forests, are the main environmental threats the state confronts (CONAFOR, 2014).

About 22% of Quintana Roo's land area is designated as protected natural areas, totaling 982,185.67 hectares. Despite these protections, reports from the 1980s onwards have indicated a consistent destruction of forests due to human settlements within the state. This deforestation has gradually intensified over the years, leading to a notable reduction in forested areas (CONAFOR, 2014)

In summary, while Quintana Roo benefits from its vast forested regions, it is crucial to address the ongoing environmental conflicts and the degradation of natural resources to maintain the ecological integrity of the state.

YUCATAN

Over the past two decades, the Yucatan state has witnessed a severe deterioration of over half of its natural vegetation due to human activities. Deforestation and degradation have emerged as major challenges, threatening the sustainability of the state's territory. In 1970, the forested area spanned approximately 3,208,600 hectares, which declined to just 2,234,800 hectares by 2000, indicating an average annual loss of 1% during this period (CONAFOR, 2014).

This decline is largely attributed to the pressures of agricultural activities, such as shifting cultivation and the transformation of forests into pastures for livestock. The expansion of agricultural frontiers, driven by traditional slash-and-burn practices common in the milpa system used by low-income rural families, is a key factor in deforestation and consequent habitat fragmentation. These practices, primarily aimed at subsistence farming like maize cultivation, leave less time and space for the recovery of degraded vegetation. The issue is exacerbated by the intensive use of land, low soil productivity for agricultural purposes, lack of sustainable agricultural technologies, and the growing food requirements of the rural population living in extreme poverty, further accelerating deforestation in the region (CONAFOR, 2014).

In summary, the state of Yucatan is facing significant environmental challenges, where traditional agricultural practices and increasing human pressures are leading to rapid deforestation and habitat loss. This situation calls for urgent action and sustainable management strategies to preserve the state's ecological integrity and ensure long-term environmental sustainability.

Tourism dynamics

The YP, a key destination in global tourism, confronts the complex impact of tourism. This region experiences economic growth from tourism, but at the cost of significant ecological implications. Rapid infrastructural development in sensitive ecological zones results in heightened carbon emissions and resource consumption, increasing the peninsula's vulnerability to climate change. Tourism and urban development have also adversely impacted mangroves over the past 30 years, particularly in Yucatán State. These developments included the construction of roads, which affected water flows into mangroves, as well as harbours and ports which caused direct damage to these areas (Batllori, n.d.). While protected areas have been successful at reducing ecosystem degradation, deforestation has continued rapidly outside of these areas (TNC, 2018). The exceptionally large carbon stocks of Yucatán's mangroves are therefore also threatened, which has adverse impacts not only on their potential for adaptation but also for mitigation.

Community tourism, as outlined by Jouault, S. et al. (2022), emerges as a response, promoting sustainable development while preserving cultural and natural resources. It involves local communities in every facet of tourism planning and management, offering a platform to share their culture and lifestyle sustainably. This form of tourism provides numerous benefits, including heritage conservation, economic development, and reduced environmental impact.

Despite its advantages, community tourism in the YP faces obstacles like limited resources and training for effective tourism management and promotion. It competes with larger, well-resourced tourism businesses and has been significantly impacted by the COVID-19 pandemic. These challenges require strategic solutions to harness the full potential of community tourism in the region. Another example is that the rapid growth of tourism and commercial fishing, as well as environmental issues such as overfishing and habitat degradation, have had an impact on marine resources and ecosystems. These factors can affect the availability of fish and disrupt the delicate balance of the local ecosystem, potentially threatening the livelihoods of subsistence fishermen (Arce-Ibarra, A.M., and Charles. A., 2008).

Urban development and coastal resilience deterioration

The YP coast, renowned for its vibrant culture and rich biodiversity, is currently facing a critical challenge due to rapid urban expansion. This growth, driven by an increasing population, presents both economic opportunities and environmental risks. The burgeoning urban areas, with their rudimentary drainage systems, are particularly ill-equipped to handle heavy rainfall, significantly increasing the risk of flooding. Furthermore, these urban areas contribute to the urban heat island effect, resulting in higher temperatures in cities compared to surrounding rural areas.

Moreover, urban expansion is encroaching upon natural landscapes, thereby diminishing the coast's inherent ability to act as a protective buffer against extreme climate events. The study "Human Impact on the Spatiotemporal Evolution of Beach Resilience on the Northwestern Yucatan Coast" by Torres-Freyermuth et al. (2021) underscores a concerning trend: coastal ecosystems, which were once robust, are now increasingly vulnerable to extreme weather and rising sea levels, a sentiment echoed by Neumann et al. (2015).

Incorporating the conceptual model of the YP, this scenario emphasizes the interconnectedness of land and sea, and human activity. The model illustrates the negative feedback loops caused by habitat destruction, including mangroves, dunes, and seagrass ecosystems, which are crucial in maintaining coastal resilience. These ecosystems, along with their services and functional diversity, are crucial for the socio-economic stability of coastal communities.

Focusing on the Caribbean coastal zone, particularly Cancún and the Mayan Riviera, reveals a striking example of how urban development can transform natural landscapes into urban tourism centers. Since the 1970s, these areas have seen a substantial metamorphosis, shifting from untouched natural habitats to major urbanized tourism destinations (Figure 12). This rapid development, as shown in satellite imagery provided by UNEP, highlights the dramatic landscape changes over a short period, emphasizing the environmental and social challenges that have arisen.

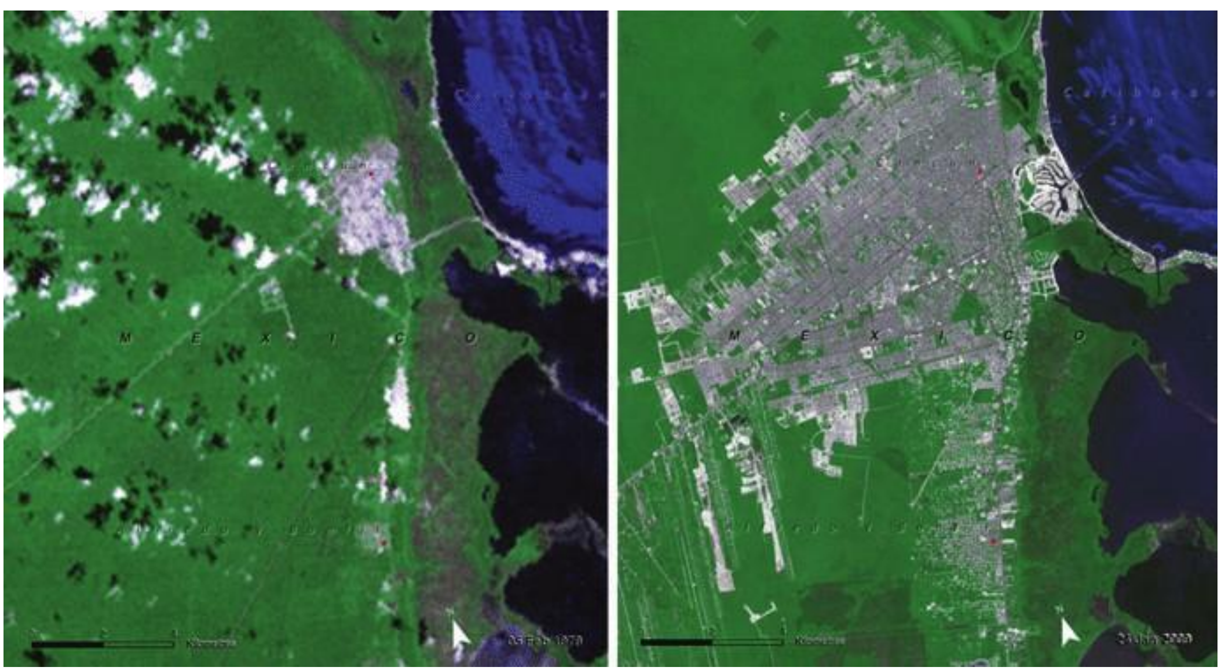


Figure 12 Urban transformation and growth in Cancún, northern Yucatan Peninsula, Mexico (February, 1979 and January, 2009. Source: Arias-González et al, 2016.

The case of Cancún, as detailed by Torres and Monsen (2005) and McCoy (2015), illustrates the economic benefits of such development, but also highlights the environmental costs, including coastal erosion and the deterioration of social and cultural capital. The region's environmental capacity is being pushed to its limits, with major concerns including deforestation, construction on coastal dunes, and the inadequate treatment of sewage.

Given these challenges, a sustainable approach to urban planning and development on the YP is imperative. Strategies must focus on balancing economic growth with the preservation of key ecosystems, implementing sustainable tourism practices, and comprehensive waste management to mitigate the adverse effects of urbanization on the coastal environment.

I.3. Policy landscape at the national level

International background

For the past two-and-a-half decades, Mexico has been an international pioneer in tackling climate change, helping to advance international negotiations under the United Nations Framework Convention on Climate Change (UNFCCC).

The Government of Mexico (GoM) introduced a General Climate Change Law in 2012 to (i) support the transition to a competitive, sustainable, and low-carbon economy; (ii) reduce climate vulnerability of the population and ecosystems; and (iii) assign the relevant federal competences. Other cross-sectoral instruments include the National Climate Change Strategy, the National Strategy for Reducing Emissions from Deforestation and Forest Degradation (ENAREDD+), a 2015 Law on Energy Transition, and Mexico's National Strategy on Biodiversity. These represent innovative environmental policies and have shown highly positive results in curbing deforestation and reducing poverty, an example for other countries globally.

In December 2010, Mexico adopted the Cancun Agreements at the 16th Conference of the Parties (COP16) to establish a framework for Reducing Emissions from Deforestation and Forest Degradation (REDD+) and promote the conservation, sustainable management of forests and enhancement of forest carbon stocks. A breakthrough of the Agreements is the guidelines established to carry out REDD+ activities in a manner that safeguards essential rights and guarantees.

In December 2011, Mexico embraced the Durban Outputs at the 17th Conference of the Parties (COP17) for (i) the renewal of the Kyoto Protocol, (ii) the funding and design of the work program for the Green Climate Fund, which would allocate US$ 100 billion per year by 2020 to developing countries for climate change adaption, and (iii) the reduction of global greenhouse gas emissions to apply to all countries, not only developed nations. A prominent result of COP 17 was the guidelines for social and environmental safeguards to extend to all countries' mitigation, adaptation, and emissions reduction actions.

In September 2015, Mexico accepted the 2030 Agenda for Sustainable Development, its cross-cutting principles and 17 Sustainable Development Goals (SDGs), a roadmap to comprehensively achieve the world's main aspirations in terms of social justice, inclusive economic growth, and environmental protection, including those that contribute to the reduction of vulnerability and adaptation to climate change.

In December 2015, Mexico also signed the Paris Agreement to limit the increase in global average temperature to 2°C by the end of the century and reduce the impacts of climate change. By ratifying the Agreement in September 2016, Mexico committed to contributing to its fulfillment through a series of mitigation and adaptation goals, condensed in its Nationally Determined Contribution (NDC).

In November 2022, Mexico submitted its updated NDCs and increased its mitigation targets, aiming for a 35% reduction in greenhouse gas (GHG) emissions and 51% of black carbon by 2030. This commitment implies reaching zero deforestation by 2030. The updated NDC includes the continued implementation of the country's National Strategy for Reducing Emissions from Deforestation and Forest Degradation (ENAREDD+) (UNDP, 2023).

National scope

Mexico has taken proactive steps in international commitments, but also in national actions to address the challenge of climate change and the transition to a low carbon emission economy.

The cost of climate change in Mexico

Mexico is one of five countries in the world that is projected to experience the highest increases in poverty due to climate-induced extreme events (52% increase in rural households, 95.4% in urban households, change in poverty due to once-in-30-year-climate extreme) (Ahmed et al., 2009). In Mexico, there have been losses of human lives and high economic and social costs associated with climate change impacts. In 2023, climate change-related disasters in Mexico cost a total of US$12 billion, including all climate-related disasters: storms, extreme temperatures, floods, wet mass displacement, droughts, and wildfires (stadista, 2024). Without urgent action, heatwaves will last 4005% longer – driving 34% longer agricultural droughts. Based on historical information and in a scenario of inaction in Mexico and the world, if the average temperature increases by 1.0 °C, the reduction in the national GDP per capita growth would be between 0.77 and 1.76 percent. The costs of inaction for 2014-2030 have been estimated to be around 143 billion dollars. However, implementing 30 NDCs mitigation measures in 8 sectors of the economy is estimated at approximately 126 billion dollars, and implementing appropriate mitigation actions could save 17 billion dollars (INECC, 2018).

Greenhouse Gases Emissions

The National Inventory Report (INEGYCEI for its Spanish acronym) in the 6th National Communication to UNFCCC was updated in 2015 using 2006 IPCC methodologies. According to the INEGYCEI of 2015, direct GHG emissions in the country, without considering absorptions, reached 700 million tons of CO2 equivalent (MtCO2e), of which vehicle transportation contributes the most (22.8%), followed by electricity generation (20.3%), livestock (10.1%), and waste emissions (6.6%). Between 1990 and 2015, total GHG emissions increased by 57%

at an average annual growth rate (AAGR) of 1.8%. However, deceleration has been observed in recent years: from 2010 to 2015, emissions increased by 5%, and the AAGR was 0.9%, whereas from 2005 to 2010, emissions grew by 12.9% with an AAGR of 2.5%. Emissions per capita were 3.7 metric tons of CO_2e in 2015, below the world average of 4.4 metric tons of CO_2e (Figure 13).

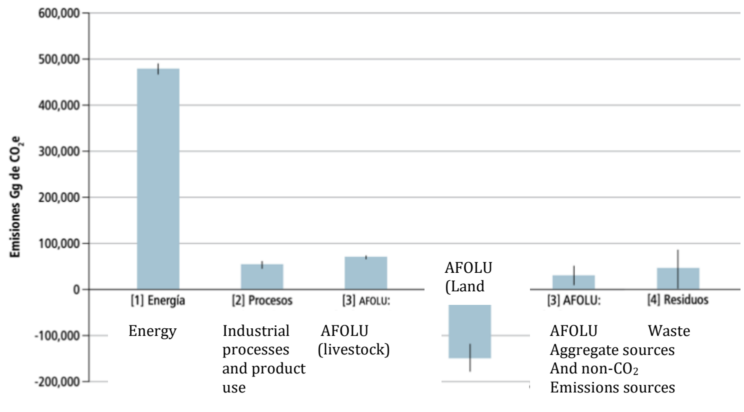


Figure 13 Mexico´s 2015 net emissions by sector (uncertainty depicted as a vertical line in each bar). Source: SEMARNAT and INECC, 2018.

Mexico has 162.1 million hectares of forest, covering 82.3% of the country. Over the last decade, an estimated 3.5 to 5.5 million hectares have been lost, contributing to habitat fragmentation, loss of ecosystem services and forest livelihoods, and climate change (Goldstein et al., 2016). The most significant drivers of deforestation are land-use change for agriculture and livestock (82%), illegal logging (8%), forest fire and disease (6%), and other causes such as hurricanes and natural disasters (2%). In 2015, the Agriculture, Forestry, and Other Land Use (AFOLU) sector presented a balance of -46,286.57 Gg of CO2eq. From these emissions, aggregate sources and non-carbon emission sources corresponded to 31,491.90 Gg of CO2eq (63.19%), followed by livestock with 70,567.60 Gg of CO2eq (4.78%), and Land by -148,346.07 Gg of CO2e (19.46%) (SEMARNAT and INECC, 2018).

Land use, land-use change, and forestry (LULUCF) are priorities for Mexico's climate strategies and actions. Halting land-use change and promoting reforestation/restoration have both mitigation and adaptation impacts. Increasing vegetation cover acts as a carbon sink and reduces vulnerability to hydrometeorological phenomena.

National climate change policy instruments

General Law on Climate Change (GLCC)

In April 2012, Mexico issued its General Law on Climate Change (GLCC) as its main policy instrument to reduce greenhouse gas (GHG) emissions and regulate the national mitigation and adaptation policy in compliance with the commitments made at COP16 and COP17. Its objectives are to (1) reduce the vulnerability of the population, ecosystems, and infrastructure; (2) minimize risk and damage considering the current and future scenarios; (3) identify the vulnerability and capacity; (4) establish mechanisms for immediate attention; and (5) facilitate and promote food security. The law sets a target for a 30% reduction in GHG emissions below "business as usual" (BAU) by 2020 and a 50% reduction by 2050, concerning those issued in the year 2000 (baseline).

The GLCC establishes two main climate-planning instruments:

National Climate Change Strategy (ENACC)

In 2007, Mexico formulated its first National Climate Change Strategy (ENACC, Spanish acronym). The ENACC identifies opportunities for emissions reductions voluntarily, as well as measures for the development of necessary national and local capacity for response and adaptation. In 2013, Mexico reaffirmed the ENACC providing a long-term vision for the country with a time horizon of 10, 20, and 40 years. Its main strategic adaptation axes are to: (1) reduce vulnerability and increase the resilience of the social sector; (2) reduce vulnerability and increase the resilience of strategic infrastructure and productive systems; and (3) conserve and sustainably use ecosystems and maintain the environmental services they provide. The ENACC defines the objectives and specific actions for mitigation and adaptation every six years, so it is in the process of being updated.

Special Program on Climate Change (PECC)

In 2009, Mexico published its first Special Program on Climate Change (known in Spanish as PECC), containing its long-term climate change agenda for the country, together with medium-term goals for adaptation and mitigation.

In 2014, Mexico published the PECC 2014-2018 establishing the targets, strategies, actions, and goals to address climate change by defining priorities in terms of adaptation, mitigation, research and assignment of responsibilities, coordination of actions, and results. It is strongly linked to the National Development Program and the sectoral development programs of the Ministries of State. Its two objectives for Mexico´s adaptation to climate change are to: (1) reduce vulnerability and increase the resilience of the population, the productive sectors and strategic infrastructure; and (2) conserve, restore and sustainably manage ecosystems, guaranteeing their environmental services for mitigation and adaptation to climate change.

The third PECC 2021-2024 has as the main priority to "reduce the vulnerability to climate change of the population, ecosystems and their biodiversity, as well as productive systems and infrastructure by strategically promoting and strengthening adaptation processes and increasing resilience". One of the strategies is to focusing the resilience of "biodiversity, terrestrial, freshwater, coastal and marine ecosystems".

Nationally Determined Contributions (NDCs)

The Nationally Determined Contributions (NDCs) are countries' self-defined national climate pledges for reducing GHG. In 2015, Mexico became the first country to present its intended NDCs to the UNFCCC, including climate adaptation goals and actions, leading up to the adoption of the Paris Agreement. The commitments Mexico assumed in its NDCs align with the objectives, priorities, and mandates established in the GLCC.

Mexico's first NDCs have two components: one dedicated to mitigation and the other to adaptation. The mitigation portion includes two types of measures: unconditional and conditional. The goal was to unconditionally reduce GHG emissions by 22% with the country's resources and conditionally by 36% if Mexico can obtain additional international support.

In November 2022, Mexico submitted its updated NDCs and increased its mitigation targets, aiming for a 35% reduction in GHG emissions by 2030. Only if external support is secured, Mexico commits to a GHG reduction of 40% by 2030, increasing its previous conditional target of 36%. The unconditional and conditional targets for reduction in black carbon emissions by 2030 remain at 51% and 70%, respectively (UNDP, 2023).

The adaption components include new multisectoral approaches such as blue carbon (carbon dioxide removed from the atmosphere by coastal marine ecosystems). These components are organized in five areas: (A) prevention and attention to negative impacts on the human population and the territory; (B) resilient production systems and food security; (C) conservation, restoration, and sustainable use of biodiversity and ecosystem services; (D) integrated management of water resources with a climate change approach, and (E) protection of strategic infrastructure and tangible cultural heritage (UNDP, 2023).

Under the adaptation component, Mexico is committed to improving resilience and reducing vulnerability to extreme hydro-meteorological phenomena and long-term environmental degradation processes. To reach the adaptation priorities, Mexico committed to strengthening the adaptive capacity of at least 50% of Mexico's most vulnerable municipalities, protecting the population through early warning systems and risk management, and achieving a zero rate of deforestation by the year 2030. Table 8 includes the adaptation areas related to the ACCIÓN Project.

Table 8 Adaptation measures for the implementation of Mexico´s NDC. Those measures with which the project contributes are marked in bold.

NDC Area	Adaptation Measures
(A) Prevention and attention to negative impacts on the human population and the territory	• **Increase the resilience of 50% of the most vulnerable municipalities in the country.** • Implement comprehensive adaptation strategies that strengthen resilience in human settlements. • **Strengthen early warning systems and prevention and action protocols to face hydrometeorological and climatic hazards at all levels of government.** • Incorporate criteria for adaptation to climate change in planning, territorial, and disaster risk management instruments in all sectors and levels of government. • **Strengthen financial instruments for disaster risk management and attention through the integration of adaptation criteria to climate change.** • Implement strategies to reduce health impacts related to diseases exacerbated by climate change. • Identify and address the forced displacement of people due to the negative impacts of climate change.

NDC Area	Adaptation Measures
(B) Resilient production systems and food security	• **Promote sustainable production and consumption practices**, the conservation of genetic resources, and the recovery of biocultural landscapes. • **Incorporate the risk of climate change into the productive sectors' value chains and investment plans.** • Contribute to preventing and caring for pests and diseases of domesticated animal species and vegetable crops, facilitated, and exacerbated by climate change. • Strengthen environmental policy instruments and implement actions to ensure protection from potential impacts of climate change on native crops relevant to agriculture and food security. • **Promote financing mechanisms that allow us to face the negative impacts of climate change in the primary sector.**
(C) Conservation, restoration, and sustainable use of biodiversity and ecosystem services;	• Achieve a zero net deforestation rate by 2030. • Strengthen environmental policy instruments and implement actions to conserve and restore continental ecosystems, increase their ecological connectivity, and promote their resilience. • **Strengthen instruments and implement actions for biodiversity conservation and restoration in marine, coastal, and freshwater ecosystems, as well as promote the increase and permanence of carbon reservoirs.** • Promote actions to prevent the establishment, control, and eradicate invasive species, diseases, and pests, whose impacts are exacerbated by the effects of climate change. • Design and implement actions that contribute to combating desertification and soil conservation. • **Strengthen environmental policy instruments and implement actions to conserve and restore islands and increase their resilience.** • **Implement conservation and restoration actions for the seas and oceans to promote their resilience to climate change.**

National Adaptation Plan (NAP)

In 2018, Mexico began the formulation of its National Adaptation Plan (NAP) (SEMARNAT-INECC, 2018). In conjunction with INECC and SEMARNAT, Mexico submitted a proposal to the Readiness and Preparatory Support Program of the Green Climate Fund (GCF) for obtaining funding for its NAP.

The NAP will define how the NDCs will (a) reduce the vulnerability of society and ecosystems from the effects of climate change through the promotion of adaptive capacity and resilience and (b) integrate the adaptation to climate change approach into policies, activities, and relevant programs (new and existing ones) in all sectors and at different levels, as appropriate, as established in the COP 16 and COP 17 (SEMARNAT-INECC, 2018).

NATIONAL DEVELOPMENT PLAN 2019-2024

The National Development Plan 2019-2024 (PND) sets objectives and strategies to combat climate change and reduce greenhouse gas emissions. Its Cross-cutting Axis 3, "Land and sustainable development," states that all public policy must consider, among its different considerations, the vulnerability to climate change and strengthening the resilience and capacities of adaptation and mitigation, particularly if it impacts the most vulnerable populations or regions. Among others, the PND proposes:

- To strengthen the capacity of adaptation to climate change of populations, ecosystems, and strategic infrastructure under a human rights-based approach and climate justice, incorporating traditional knowledge and technological innovation.
- To promote the sustainable use of natural resources, soil, and water, considering the effects of climate change on agricultural production, aquaculture, and fisheries.
- To develop programs of reforestation and ecosystem protection for the conservation, sustainable management, restoration, and connectivity of natural ecosystems in rural areas to facilitate adaptation to climate change, since the restoration helps to reduce various impacts, including floods and soil erosion, and promotes the adaptation of flora and fauna and crops to climate change.
- To stimulate investment in mitigation and adaptation to climate change and enable the conditions to foster the transfer of other international and private financial flows in favor of its combat.
- To support productive inclusion through climate change mitigation and adaptation activities based on the productive vocation and the knowledge of the territories with a medium- and long-term vision.

STATE PROGRAMS ON CLIMATE CHANGE

The participation, concurrency, and coordination of the three government levels (federal, state, and municipal) are critical for consolidating Mexico's national policy on climate change. Federal entities (states) have the responsibility to develop their climate change programs for formulating, conducting, and evaluating their climate change policy, following the national policy, and including diagnoses of current and future vulnerability and adaptive capacity to climate change and defining actions for adaptation to climate change with indicators for monitoring and evaluation.

Campeche, Quintana Roo, and Yucatan state governments have formulated their Climate Change Action Plans consistent with the National Climate Change Strategy and the Special National Climate Change Programme. They also have prepared their state-level Strategies for Reducing Emissions from Deforestation and Forest Degradation, aligned with the National Strategy for Reducing Emissions from Deforestation and Forest and Forest Degradation (ENAREDD+). These policy instruments provide a congruent framework that facilitates coordination and exchange of information and allows joint investment in community projects.

I.4. Legal and regulatory framework

Table 9 Regulatory framework at national level

Mexican Constitution	Includes economic, social, and cultural rights of the Mexican people and calls for a federal government that takes an active role in promoting those rights. Article 4. The Mexican State has the obligation to guarantee to all persons a healthy environment for their development and well-being. Article 25. The Mexican State has to ensure that national development is integrated and sustainable.
General Law on Climate Change	Establishes key elements to encourage adaptation of Mexico's natural and human systems to climate change. It lays the general foundations for regulating greenhouse gases emissions and compounds; regulating climate change mitigation and adaptation actions; reducing the vulnerability of the population and ecosystems to the adverse effects of climate change; conserving forest land uses and preventing its degradation and deforestation; promoting the efficient and sustainable use of energy resources; and in general, transitioning to a green economy. Federal, state, and municipal authorities will all be responsible for meeting concrete goals, such as the development of risk maps, urban development programs that consider climate change, and a subprogram for the protection and sustainable management of biodiversity to face climate change.

General Law of Ecological Balance and Environmental Protection (LGEEPA)	Addresses a broad range of environmental matters including water, air and ground pollution, resource conservation and restoration, and environmental enforcement. Article 2. It is of public utility the formulation and implementation of actions towards mitigation and adaptation to climate change. Articles 5, 7, and 8. The federal, state, and municipal authorities are responsible for the formulation and implementation of actions towards mitigation and adaptation to climate change. Article 15. There shall be incentives to whoever protects the environment, promote, or perform actions on mitigation and adaptation to climate change, and take advantage of natural resources in a sustainable manner. Article 23. The federal authorities, the federal entities, and municipalities, in its sphere of competence, must avoid human settlements in areas where populations are exposed to natural disasters resulting from the adverse impacts of climate change. Article 39. The competent authorities shall promote topics on ecology, sustainable development, mitigation, adaptation and reducing vulnerability to climate change, protection of the environment, knowledge, values, and skills in the various educational cycles, especially at the basic level, as well as in the cultural formation of children and youth. Article 41. The Federal Government, the federal entities, and municipalities shall promote scientific research, technological development, and innovation that make it possible to determine the vulnerability, as well as measures to mitigate and adapt to climate change. This law also regulates in its transitory articles the development of the National Atlas of Vulnerability to Climate Change.

General Law for Sustainable Forest Development	Seeks to regulate and promote the conservation, protection, restoration, production, organization, and management of Mexico's forests to secure sustainable forest development. Article 2. To promote actions to comply with international treaties on climate change, biological diversity, and others. Article 3. Among its specific objectives are: – To promote the design and application of measures of prevention, mitigation, and adaptation to climate change. – To promote sustainable forest management to maintain and increase the gains of carbon, reduce emissions from deforestation and forest degradation, as well as reduce vulnerability, and strengthen resilience and adaptation to climate change. – To establish, regulate and implement the actions for mitigation and adaptation to climate change, following the General Law on Climate Change, the international treaties to which the Mexican State is a party and other applicable legal provision. – To design strategies, policies, measures and actions to achieve a zero percent loss of carbon, according to the General Law on Climate Change and the National Climate Change Strategy, and its incorporation into the planning instruments of forest policy, considering sustainable economic development of forested regions and community forest management. Articles 10, 11, and 13. The federal, state, and municipal authorities are responsible for developing actions that contribute to climate change adaptation and mitigation, as well as to combating desertification and degradation of forest land. Article 47. The data included in the National Inventory of Forestry and Soils (INFyS) will be the basis for the development of programs and climate change adaptation and mitigation strategies. It facilitates the implementation of the REDD+ mechanism, taking a critical step towards ensuring that local communities who sustainably manage their forests receive economic benefits derived from any future carbon payment scheme.

Law on Sustainable Rural Development	Promotes the sustainable rural development in the country, ensuring an adequate environment and the rectory of the State and its role in the promotion of equity, including planning and organization of agricultural production, industrialization and commercialization, and the other goods and services, and all those actions aimed at raising the quality of life of the rural population. Article 116. To establish a financial system for sustainable rural development with multiple modalities, instruments, institutions, and agents, which allows producers in all strata and their productive organizations and social enterprises to adapted, sufficient, timely, and accessible financial resources to successfully develop their economic activities. Preference will be given to small producers and economic agents with a low income, within areas of the country with lower economic and social development, with profitable productive projects or that are highly generators of employment, those who employ technologies for mitigation and adaptation of climate change, as well as the integration and strengthening of social banking.
General Law of National Assets (LGBN)	It regulates the State's ownership of property and its use and exploitation. Article 6. The following are subject to the regime of public domain of the Federation: [..] III. The insular platforms under the terms of the Federal Law of the Sea and, as the case may be, of the international treaties and agreements to which Mexico is a party. IV. The bed and subsoil of the territorial sea and inland marine waters. V. The federal maritime-terrestrial zone. [..] IX. Land naturally or artificially reclaimed from the sea, rivers, streams, lakes, lagoons, or estuaries of national property;

Federal Law of the Sea (LFM)	Establishes the jurisdiction of the States over marine areas. Article 3o. The Mexican marine zones are: a) The Territorial Sea b) Inland Marine Waters c) The Contiguous Zone d) The Exclusive Economic Zone e) The Continental Shelf and the Insular Platforms; and f) Any other area permitted by international law. In the zones enumerated in the preceding Article, the Nation shall exercise the powers, rights, jurisdictions, and competencies established by this same Law, in accordance with the Political Constitution of the United Mexican States and international law. [..] Article 25. The width of the Mexican Territorial Sea is 12 nautical miles (22,224 meters), measured in accordance with the provisions of this Law and its Regulations.
General Wildlife Law (LGVS)	It establishes that the sustainable use of timber and non-timber forest resources and of species whose total livelihood is water, will be regulated by the forestry and fishing laws, respectively, except in the case of species or populations at risk. Article 60 TER. The removal, filling, transplanting, pruning, or any work or activity that affects the integrality of the hydrological flow of the mangrove; of the ecosystem and its zone of influence; of its natural productivity; of the natural carrying capacity of the ecosystem for tourism projects; of the nesting, reproduction, refuge, feeding and frying areas; or of the interactions between the mangrove, rivers, dune, adjacent maritime zone and corals, or that causes changes in the ecological characteristics and services, is prohibited. Exceptions to the prohibition referred to in the preceding paragraph shall be made for works or activities intended to protect, restore, research or conserve mangrove areas.
NOM-022-SEMARNAT-2003	Establishes the specifications for the preservation, conservation, sustainable use, and restoration of coastal wetlands in mangrove zones.

Table 10 Regulatory framework at subnational level

Campeche: Ecological Equilibrium and Environmental Protection Law of the State of Campeche

Quintana Roo: Law of Ecological Equilibrium and Environmental Protection of the State of Quintana Roo	
Yucatan: Environmental Protection Law of the State of Yucatan. Law of Climate Change of the State of Yucatan	

I.5. FMCN's projects for scaling-up

Since 1994, the Fondo Mexicano para la Conservación de la Naturaleza (FMCN) has been at the forefront of conservation efforts in Mexico. Through its unwavering commitment, the FMCN has funded 2,163 projects, involving an investment of over US$177 million. This significant financial support has been pivotal in safeguarding 229 unique species.

The success of ACCIÓN's growth strategy can be attributed to the invaluable lessons and experiences drawn from various projects, notably the FINANP and FANP initiatives. Initiated in 1997, the FANP represents a successful partnership between FMCN and CONANP. This collaboration has led to the conservation of diverse habitats across Mexico, effectively protecting over 25 million hectares and benefiting numerous communities.

On a similar note, the upcoming FINANP initiative, set to begin its field activities in 2023, represents a significant step forward in the realm of conservation. Spearheaded by the FMCN and supported by key partners such as CONANP and IUCN, the goal of FINANP is straightforward: to enhance and ensure the long-term sustainability of Mexico's protected areas. With substantial funding in place, this initiative underscores Mexico's dedication to preserving its rich natural resources for the generations to come.

The YP is particularly rich in biodiversity with ecosystems including coastal forests, wetlands and mangroves. Anthropogenic stressors such as unsustainable agricultural practices, deforestation, mining, and urbanization have exacerbated the impacts of climate change, in particular storm surges, flooding and droughts across this region. Numerous local and regional projects have been implemented to reduce the impacts of climate change on ecosystems and local communities. ACCIÓN will endeavor to promote synergies, avoid duplication of efforts, and optimize the use of resources with these diverse initiatives (Figure 14).

The projects detailed below showcase FMCN's accomplishments, expertise, and insights gained in the YP. These invaluable lessons will be seamlessly integrated into the design and execution of ACCIÓN.

Programa de Liderazgo en el Sistema Arrecifal Mesoamericano-SAM (Leadership Program in the Mesoamerican Reef System ject, L-SAM)

The Leadership Program in the Mesoamerican Reef System (L-SAM) primarily aims to nurture young talent from the four countries that make up the Mesoamerican Reef System (SAM):

Mexico, Belize, Honduras, and Guatemala. Through this initiative, participants are endowed with technical skills, leadership abilities, and networking opportunities, enabling the launch of projects focused on the conservation and sustainable utilization of marine and coastal resources.

LESSONS LEARNED

- Ensuring participant continuity in the program is enhanced by reducing the weekly time commitment.
- Encouraging more peer feedback spaces and practical exercises has been crucial for enhancing participant learning.
- The establishment and strengthening of a leadership network are pivotal to the program's impact, although it requires continuous activation and fortification.

Leveraging the insights garnered from the L-SAM initiative, the ACCIÓN project aims to cultivate a curriculum that emphasizes adaptability, experiential learning, and the fortification of a cohesive, collaborative network. The imperative of customizing educational frameworks to facilitate active engagement, integrating ongoing feedback mechanisms, and underscoring the intrinsic value of a synergistic leadership network stands paramount. Consequently, ACCIÓN is tasked with devising programs that judiciously balance participants' temporal constraints and intrinsic needs, while concurrently fostering a vibrant and interconnected leadership ecosystem.

Kaanbal Suut

This initiative was launched in 2021 by FMCN, supported by The David and Lucile Packard Foundation and is currently operated by Sureste Sostenible. Its primary objective is to strengthen organized civil society groups in the YP to further the conservation and sustainability of natural resources. By implementing an innovative design that considers the context of the COVID-19 pandemic and socioeconomic and environmental challenges, the project offers training that integrates the critical needs identified by regional organizations. The focus is on four main modules: Strategic Planning, Talent Management, Financial Sustainability, and Communication.

LESSONS LEARNED

- Virtuality is essential, especially in pandemic contexts, to maintain the training and collaboration of organized groups.
- The integration of needs identified by regional organizations into training ensures a relevant and effective approach.
- Intergenerational linkage within the Kaanbal Suut Community is valuable for knowledge exchange and collaboration.

The lessons derived from Kaanbal Sut emphasize the importance of adaptability and relevance in training and education. For ACCIÓN, this signifies the necessity of a modular design that integrates real and emerging needs, highlights the efficacy of virtual training, and promotes intergenerational interaction. Furthermore, the importance of strengthening collaboration and the leadership network is underscored, ensuring that programs are designed considering participants' time and specific needs.

Alianza Kanan Kay

Alianza Kanan Kai is a cross-sector collaboration aimed at consolidating responsible fishing management in the YP to restore biodiversity and productivity of small-scale fisheries. This consolidation is achieved through the implementation of Fishing Refuge Zones (FRZs), areas designated to allow the reproduction and recovery of marine species. The FRZs benefit not only marine biodiversity but also the economic and social well-being of communities that rely on fishing. The Alliance coordinates efforts between fishing cooperatives, organizations, the government, and other key stakeholders to achieve its goals.

LESSONS LEARNED

- Community Process: It is essential to be respectful of the time and process of each community for the acceptance and socialization of new management tools. Community ownership of these resources and methods is vital for their success.
- Cross-sector Coordination: Working in sync with authorities, cooperative members, and other players is crucial, especially in matters of regulation, surveillance, and combatting illegal fishing.
- Coordinated Actions: The lack of coordinated actions among different actors is a common challenge in many regions. Collaboration and coordination have proven to be essential for the effectiveness of interventions.

In the design of the ACCIÓN project, lessons from past experiences are strategically applied to optimize Outputs. Firstly, building on the lesson of valuing community processes, the ACCIÓN project emphasizes the importance of socialization and community ownership of management tools. With this in mind, considerable time and resources are channeled to ensure communities not only understand but fully embrace and integrate the FRZs and other related instruments. Furthermore, recognizing the necessity of cross-sector coordination from past learnings, the project endeavors to create robust collaborations with both the authorities and fishing cooperatives. This is concretely seen in the implementation of community surveillance initiatives designed to curb illegal fishing. Finally, cognizant of past challenges arising from miscoordination, the ACCIÓN project draws on a 12-year journey of enhancing collaboration among varied stakeholders. This long-term dedication is manifested in the project's expansion strategies and its emphasis on promoting unified efforts to achieve shared goals.

Mar+Invest

The MAR+Invest initiative, led by MARFund, is a groundbreaking mixed-financing mechanism designed to promote a sustainable ocean-based economy in the Mesoamerican Reef System (SAM). It primarily aims to support the health and resilience of the coral reef ecosystems and the communities they support. This initiative invests in market-driven solutions that positively impact these ecosystems. Its main goal is to create, develop, and expand opportunities that address and reduce the various threats to the coral reefs, placing importance on backing businesses and projects that focus on the long-term challenges facing the SAM.

LESSONS LEARNED

- The health and stability of the Mesoamerican Reef System constantly face threats, making it essential to prioritize effective and actionable solutions.
- There is a noticeable lack of projects in the region that can be linked to the market and have a beneficial impact on the reef; many of these projects are still in their early stages of development.
- The success of the SAM Leadership Program underscores the importance of capacity building and nurturing leadership skills in the realm of conservation.

Informed by MAR+Invest's insights, the ACCIÓN project addresses SAM's challenges through a strategic framework emphasizing four key interventions. Leveraging MAR+Invest's best practices, ACCIÓN focuses on nurturing market-driven projects benefiting the reef. Additionally, emphasizing leadership and capacity-building, ACCIÓN integrates training to equip leaders for future conservation challenges.

Taab Ché

The Taab Ché Project is centered on establishing a comprehensive portfolio of financial and market-driven incentives. Its primary objective is to leverage the benefits gained from incorporating carbon credits into the voluntary market. This initiative is designed to significantly support and advance the conservation and restoration of mangrove ecosystems in the YP. Through this endeavor, the project aims to emphasize the value of these vital coastal habitats, ensuring their preservation and revival for the region's ecological and economic future.

LESSONS LEARNED

- Embrace a Multidisciplinary Outlook: Successfully executing projects of this nature requires a holistic approach. Stakeholders should be well-versed across various fields, from biology to politics. A diverse knowledge base ensures comprehensive solutions and optimal results.
- Forge Strong Local Collaborations: Building and maintaining partnerships with local entities, like CONANP and research hubs such as CINVESTAV, is paramount. These alliances enrich the project with rigorous scientific insights, fortifying its foundation and enhancing its credibility.
- Customize for the Locale: Recognizing and adapting to the unique intricacies of a region is essential. Our success in the YP stemmed from understanding its distinct character and needs, emphasizing the importance of tailoring strategies to local conditions.

Building on the insights gained from the Taab Ché project, ACCIÓN intends to adopt a comprehensive strategy. It will bring together experts from different areas to tackle both environmental and community-related challenges. From the beginning, ACCIÓN will focus on building strong relationships with local groups and research organizations. This will help the project use local knowledge and the latest research to make its work more effective. Also, ACCIÓN will spend time understanding the specific needs of the area it's working in. By doing thorough studies and working closely with local people, it hopes to create plans that work well and last a long time. By using these lessons from the past, ACCIÓN hopes to create projects that really fit what the community needs and benefit from teamwork across different fields.

Integrated Coastal Watershed Conservation in the Context of Climate Change Project (C6)

The Coastal Watersheds Conservation in the Context of Climate Change project (C6) was initiated with the goal of promoting integrated management of coastal watersheds to support biodiversity, climate change mitigation, and sustainable land use in the Gulf of Mexico and Gulf of California. Key partners included prominent national institutions such as CONANP, CONAFOR, INECC, and FMCN. Financial support was provided by the World Bank through a Global Environment Facility (GEF) grant, amounting to US$ 39.52 million. Running from 2014 to 2019, the project emphasized five components: strengthening protected areas, advancing sustainability within watersheds, developing Integrated Watershed Actions Plans (IWAPs), fostering inter-institutional collaboration, and providing technical assistance and training.

LESSONS LEARNED

- Landscape Approach: The C6 project underscored the value of a comprehensive landscape approach in watershed ecosystem management. This approach embraced a full view of watersheds and involved all stakeholders in maintaining and using the territory.
- Community Engagement: Through initiatives such as environmental monitoring, the project highlighted the significance of community involvement in the sustainable management of watersheds. This fostered a sense of pride and ownership among local communities.
- Sustainability and Long-term Vision: The establishment of endowment funds showcased the importance of long-term financial planning for conservation projects. These funds, by accruing interest, ensure continuity in conservation and livelihood efforts.

Incorporating insights from the C6 project, the ACCIÓN project will emphasize three primary strategies. First, ACCIÓN will embrace a comprehensive approach, utilizing the landscape methodology to provide a holistic view of conservation and restoration activities, aiming to create strong links across different ecosystems and stakeholder groups. Secondly, the project will focus on community-centric methods, valuing and integrating local knowledge, while actively promoting community participation to ensure results that are sustainable in the long run. Lastly, understanding the pivotal role of consistent and prolonged interventions, ACCIÓN is keen on leveraging financial tools such as endowment funds or similar structures to guarantee the continuity and longevity of its endeavors.

Development, Financing Community Forest Enterprises (EmFoCo)

The EmFoCo project, aimed to empower community forest enterprises (EFC) in various Mexican states, including Campeche, Jalisco, Oaxaca, Quintana Roo, and Yucatan. Given that a significant portion of Mexico's forests lies in collective properties and supports over 12 million people, there was a pressing need to bolster these communities' entrepreneurial capabilities. Implemented between 2013 and 2019, the project focused on crafting financial products tailored to each EFC and enhancing essential business skills, ensuring that their operations were environmentally friendly, financially sound, and socially equitable.

LESSONS LEARNED

– Customized Solutions: Developing financial products tailored to the specific needs of each EFC significantly enhanced their profitability and competitiveness.

– Engaging the Private Sector: Involvement of the private sector in forestry projects, particularly in financial support, can be transformative and set precedent for future initiatives.

– Comprehensive Support: Beyond financing, holistic support in terms of management standards, business evaluation tools, and technical assistance is crucial for the sustainable success of community forest enterprises.

Incorporating insights from EmFoCo, ACCIÓN will prioritize tailored strategies, ensuring that solutions are specifically crafted to meet the unique needs of its target communities or organizations. Building on EmFoCo's success in partnering with the private sector, ACCIÓN will also champion such collaborations, tapping into their expertise and resources for improved results. Beyond just financial assistance, ACCIÓN is committed to providing a comprehensive package of tools, training, and resources, aiming for long-term sustainability and profitability in community operations.

Integral to the framework of ACCIÓN is Component 4, which focuses on managing the accumulated lessons learned from past projects. This management is not just a retrospective exercise; it actively involves coordinating with key stakeholders and aligning with pivotal projects in the region, as illustrated in the following coordination map. This approach ensures that the insights and strategies developed over the years are not only preserved but also effectively utilized to enhance current and future conservation efforts.

Figure 14 Complementary projects and synergies with ACCIÓN. Source: FMCN, 2024

In addition, main ongoing projects active in the YP complementary to ACCIÓN are presented in the table below (Table 11).

Table 11 Overview of selected projects related to ACCIÓN and potential complementarities

Project details	Description	Complementarities with ACCIÓN
GBFF/GEF: MEx30x30 (2025-2030)	MEx30x30 aims to help Mexico advance toward the Global Biodiversity Framework 30x30 target through long-term sustainable financing for the existing national protected areas. This is the first GBFF project executed and will be transformative by improving the efficiency of all the existing PAs by catalyzing substantial progress towards Mexico's 30x30 target.	ACCIÓN will support the recently approved GBFF-financed MEx30x30 Project, a long-term financing mechanism following the Project Finance for Permanence (PFP) approach. MEx30x30 will co-finance ACCIÓN. (**Component 2, Output 2.1. and Component 4**)
Kalan	This project aims to contribute to the conservation of 30% of its territory by 2030 by having effective management of federal, state and voluntary natural protected areas in the south-southeast of Mexico, and to strengthen FMCN institutionally to scale impact.	This project will co-finance ACCIÓN to scale impact in YP region by increasing the efficiency of 14 PAs. (**Component 2, Output 2.1**)

Project details	Description	Complementarities with ACCIÓN
Alianza Kanan Kay (AKK)	AKK's objective is to consolidate responsible fishing management in the YP to restore the biodiversity and productivity of small-scale fisheries through the implementation of Fishery Refuge Zones (FRZs), designated to allow the reproduction and recovery of marine species. The FRZs benefit marine biodiversity and the economic and social well-being of communities that rely on fishing. AKK coordinates efforts between fishing cooperatives, organizations, the government, and other key stakeholders to achieve its goals since 2012.	ACCIÓN scale-up AKK to support FRZs and other fisheries management tools as an EbA option. **(Component 1, Output 1.1; Component 4, Output 4.1**)
Kaanbal Suut	The Kaanbal Suut Program was launched in 2021 by FMCN with the support of the Packard Foundation to strengthening organized groups in the PY to promote their success in advancing conservation impacts, sustainability of natural resources and socio-environmental development in a strategic manner. Since 2022, the Program is operated by SSAC. The Program strengthens the capacities, leadership skills and networking opportunities of various organized groups (civil associations, alliances, collectives, cooperatives, societies and networks) that are leading socio-environmental projects in Campeche, Quintana Roo and Yucatan.	Leveraging the insights of this initiative, ACCIÓN is tasked with devising programs facilitating stakeholders' active engagement while boosting a vibrant, collaborative leadership network. (**Component 1, Output 1.1, Component 4, Output 4.2,**)
The Mesoamerican Reef System Leadership Program (L-SAM)	Since 2011, L-SAM has trained 139 leaders and incubated more than 70 conservation projects in the Mesoamerican Reef System (SAM): Mexico, Belize, Honduras, and Guatemala.	Throughout the implementation of ACCIÓN, L-SAM will function as a platform to enhance the skills in the PY for creating and executing impactful conservation projects. (**Component 4, Output 4.2**)
MAR+Invest initiative	This initiative finance by the Global Funds for Coral Reefs (GFCR) is a groundbreaking mixed-financing mechanism designed to promote a sustainable ocean-based economy in the Mesoamerican Reef System (MAR). This initiative invests in market-driven solutions that positively impact the health and resilience of the coral reef ecosystems and the communities they support, placing importance on backing businesses and projects that focus on the long-term challenges facing the MAR. FMCN and SSAC are local partners of the Mesoamerican Reef Fund (MAR Fund).	ACCIÓN will ensure to incorporate the lessons learned of the successful blended finance initiative. . **(Component 3, Output 3.1, Output 3.2., Output 3.3.)**

ACCIÓN will serve as a basis for the Climate Action and Blue Finance Project for the Mesoamerican Reef Region, which is currently under design and is expected to be financed by the GCF, with the International Union for the Conservation of Nature (IUCN) as AE and MAR Fund as the main Regional Executing Entity (EE), and FMCN and SSAC as co-EE. For more information related to complementary projects and synergies with ACCIÓN, see **Annex A** of this document.

II. Pre-feasibility assessment

II.1. Environmental and socioeconomic assessments

II.1.1. Environmental context

The coastline of Mexico is highly vulnerable to the impacts of climate change. The effects of rising sea levels pose a severe threat to infrastructure and investments, while tropical cyclones and extreme weather threaten the lives and livelihoods of local communities that depend on coastal zones for their survival (NDC Partnership, 2018). For the YP coastal communities, natural systems like coral reefs, beaches and wetlands provide the first line of defense against climate change effects. A healthy coral reef effectively serves as a natural breakwater, protecting coasts from erosion and flooding. In fact, coral reefs can reduce up to 97% of total wave energy, before it hits the shore, reducing both the effects of storm surge and daily erosion (Ferrario, et al., 2014).

The coastal ecosystems that will most strongly be impacted by future climate change will be wetlands (91% of the total), followed by mangroves, beaches, and dunes. As coastal ecosystems continue to be affected by climate change, projections indicate that an overall negative impact can be expected on Mexico's fisheries (Cisneros-Mata et al., 2019). While some species will experience productivity increases, approximately 84% of species studied in one analysis showed potential negative impacts in terms of catch potential under future climate change. Under low and high emissions scenarios, fish catch potential will decrease by 6.8% and 17%, respectively by 2050 (CMCC, 2021).

Along the coastline of the YP, climate change is already causing numerous impacts. These include the spread of invasive aquatic plants such as sargassum which reduces the tourism value of the beaches as well as coastal erosion caused by SLR and storm surges.

The coastal-marine region of the YP comprises the transition zone between flooded forests, mangroves, marshes, coastal dunes, beaches, islands, and the marine ecosystems of coral reefs and seagrass meadows.

Topography

The topography of the YP is characterized by being an extensive plain, with an average altitude of around 30 meters above sea level. In general, the peninsula has a relatively flat surface, with some reliefs and slight elevations in its terrain, which occur due to the geological formation of the region. In some areas of the state of Yucatán, you can find small hills and plateaus, such as the Sierra de Ticul, the Sierra de Chenes, Cerro Benito Juárez with 210 meters above sea level (masl), it is the highest altitude between the plain and the hills. In the north of the state of Campeche, there are small hills and elevations, such as the Sierra de Balam-Tok, the Sierra de los Tuxtlas and the Sierra de las Flores. In the northern region of the state of Quintana Roo, there are some elevations and hills, such as the Sierra de Cozumel and the Sierra de Akumal, while in the southern region you can find the Sierra de Sian Ka'an. These small elevations do not exceed 150 meters above sea level.

The peninsula also has an extensive network of underground rivers, cenotes and caverns, which are the product of the dissolution of the limestone that makes up much of the region's soil. These geological formations are important for water recharge and tourism.

Hydrography

The YP is classified as a regional unit called “Yucatan Peninsula Aquifer”. And it includes four hydrogeological units: Cerros y Valles, Yucatán Peninsula, X'pujil and Cozumel Island (CONAGUA, 2012).

In the administrative sense, the three states: Campeche, Quintana Roo and Yucatán make up the Hydrological-Administrative Region XII Yucatán Peninsula (CONAGUA, 2018), with a total territorial extension of 144,220.59 km2, and which contains the hydrological regions 31, 32 , 33 and a part of the region 30 (CONAGUA, 2020).

The YP has edaphic and geological characteristics that, in conjunction with conditions of high rainfall and low topographic slope, favor infiltration and make the YP an area of groundwater recharge almost in its entirety (except in the southern and coastal parts). This is akin to imagining its territory as a kind of sponge.

This can help us understand the dynamics of flow in the aquifer: Rainwater infiltrates the subsoil in large volumes that move at very low speeds radially from the areas of highest precipitation, located south of Xpujil, towards the coasts, dispersing towards the northwest, northeast, and north where the natural discharge of the aquifer occurs, feeding the estuaries and coastal lagoons.

A key part of the groundwater, characteristic of the YP and with a strong cultural and spiritual connection dating back to pre-Hispanic times, are the numerous cenotes (dzoonot, from the Maya, hole in the ground), poljes, uvalas, and cave systems. The highest concentration of cenotes is found in Yucatán, and one of the most important is Xtacumbilxunaán, in Campeche.

In the region, four aquifers have been identified with a total volume of 3,008.9 hm^3. The degree of pressure between recharge and exploitation is less than 40%, so it is considered low. The "Península de Yucatán" aquifer has the highest water availability (CONAGUA, 2021). The highest aquifer recharge is recorded in the CONAGUA Planning Units: Oriente Yucatán and Candelaria Campeche.

Coral reefs

Coral reefs are a diverse, fragile, and indispensable ecosystem for coastal zones and for global climate regulation. Among their main characteristics of socio-environmental importance are: they are a fundamental shelter for biodiversity, areas of food generation for humans, sites of high recreational and spiritual value, and their potential to mitigate climate change. The Healthy Reefs for Healthy People Initiative conducted a 2022 assessment of the Reef Health Index and identified 60 sites in the YP. Of these, 33% have critical health, poor in 38%, fair in 20%, good in 7% and very good in only 2% (Healthy Reefs, 2022). This system is part of the

Caribbean reefs that have more than 70 species of corals and nearly 500 species of fish (Arrivillaga and Windevoxhel, 2008).

These reefs provide essential ecosystem services: on the one hand, they are necessary for sustaining significant fishery resources that are exploited in the region, such as the queen conch, lobster, and octopus; additionally, the reefs are one of the main tourist attractions in the region and are the predominant economic activity.

Healthy and functional coral reefs make an important contribution to both climate change mitigation and adaptation. Hurricanes comprise an important component of coral reef ecology. Depending on their intensity, they can contribute to reef dynamics by means of fragmenting coral colonies and favoring recruitment. However, in some cases, the damage can be so severe that complete reef regeneration will not be possible (Perez-Cervantes, 2021).

The resilience of coastal communities is indisputably related to the quality of coral reef ecosystems, whether for the habitat that hosts different species of commercial importance, for the landscape functions that attract tourism, or for the climate benefits it provides as an important carbon sink (RRN, n.d.; UN, n.d.).

In the case of the geographic analysis proposed for ACCIÓN, reefs in a better state of conservation are of special interest, as well as those in a deteriorating state. In this way, the strongest poles of the livelihood activities and EbA measures proposed by the project are addressed. As a result of the work conducted by Barco AC (2023) as part of the PPF, the vulnerability of coral reef ecosystems in the project's area of interest was assessed based on four coral health indicators: coral cover, fleshy macroalgae cover, biomass of herbivorous fish, and commercial fish. The study results, which collected data from 205 sites (Figure 15), conclude that, in general, the Banco de Campeche presents a better condition, although some areas such as Cozumel also stand out for their reef health.

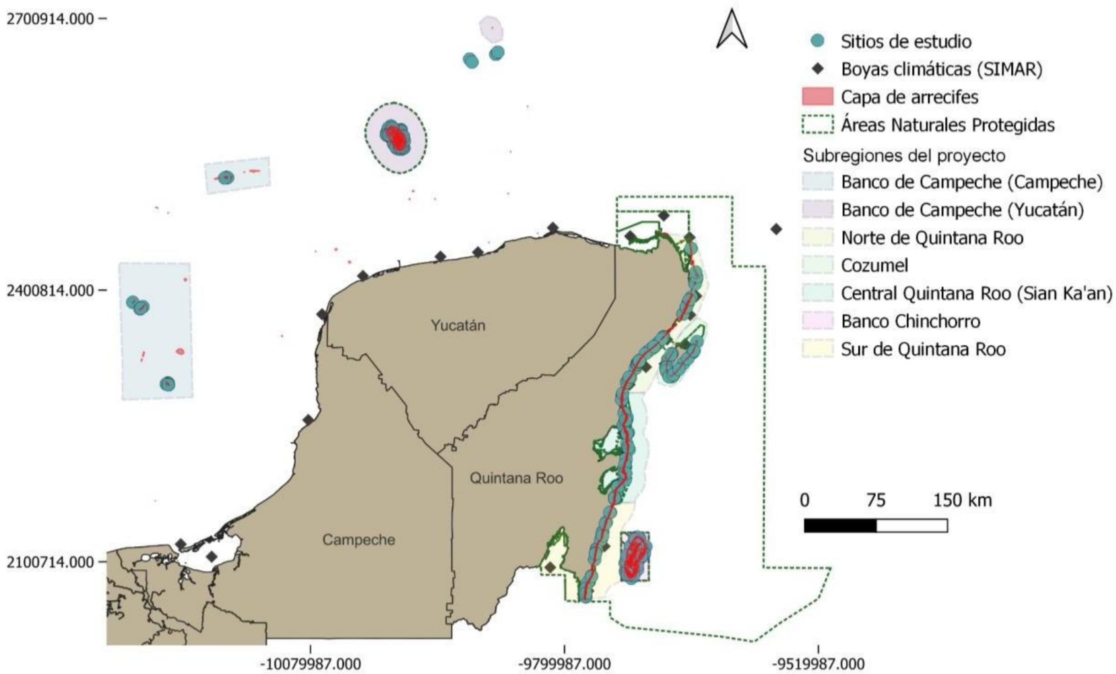


Figure 15 Study area with coral reef ecosystems. Source: Barco AC, 2023.

Regarding coral cover, statistical analyses showed an increase up to 2018 and a significant decrease in 2021. Fleshy macroalgae showed a notable increase starting from 2006. Herbivorous fish biomass experienced a significant decrease starting in 2006 and 2009, while commercial fish biomass did not show significant differences.

Seagrasses

Seagrasses can be found in coastal lagoons, estuaries, estuaries, estuaries, and the coastal zone. It has been demonstrated that these ecosystems, in addition to storing carbon in the sediments in which they are found, also connect with a flow between other communities, such as coral reefs or the deep sea. They counteract erosion, reduce the impact of hurricanes and storms, are habitat for charismatic species for tourism (e.g., seahorses, manatees, and sea turtles). In the context of climate change, they are a key community for carbon sequestration.

Seagrasses are important areas for the reproduction and feeding of fish and invertebrates that are key to fisheries (McArthur and Boland, 2006; Herrera et al., 2019). Some studies indicate that seagrasses constitute the third ecosystem with the highest economic value per hectare, estimating an annual value of up to US$34,000 per hectare, higher than other emblematic ecosystems such as corals (Short et al., 2011; Constanza et al., 2014; Herrera et al., 2019).

Among their main threats in the region are dredging and construction of docks and piers, oil infrastructure, human settlements, tourism, unregulated fishing, and aquaculture practices (changes in nutrient loads and increased turbidity), as well as hurricanes and extreme weather events (SIMAR, 2023).

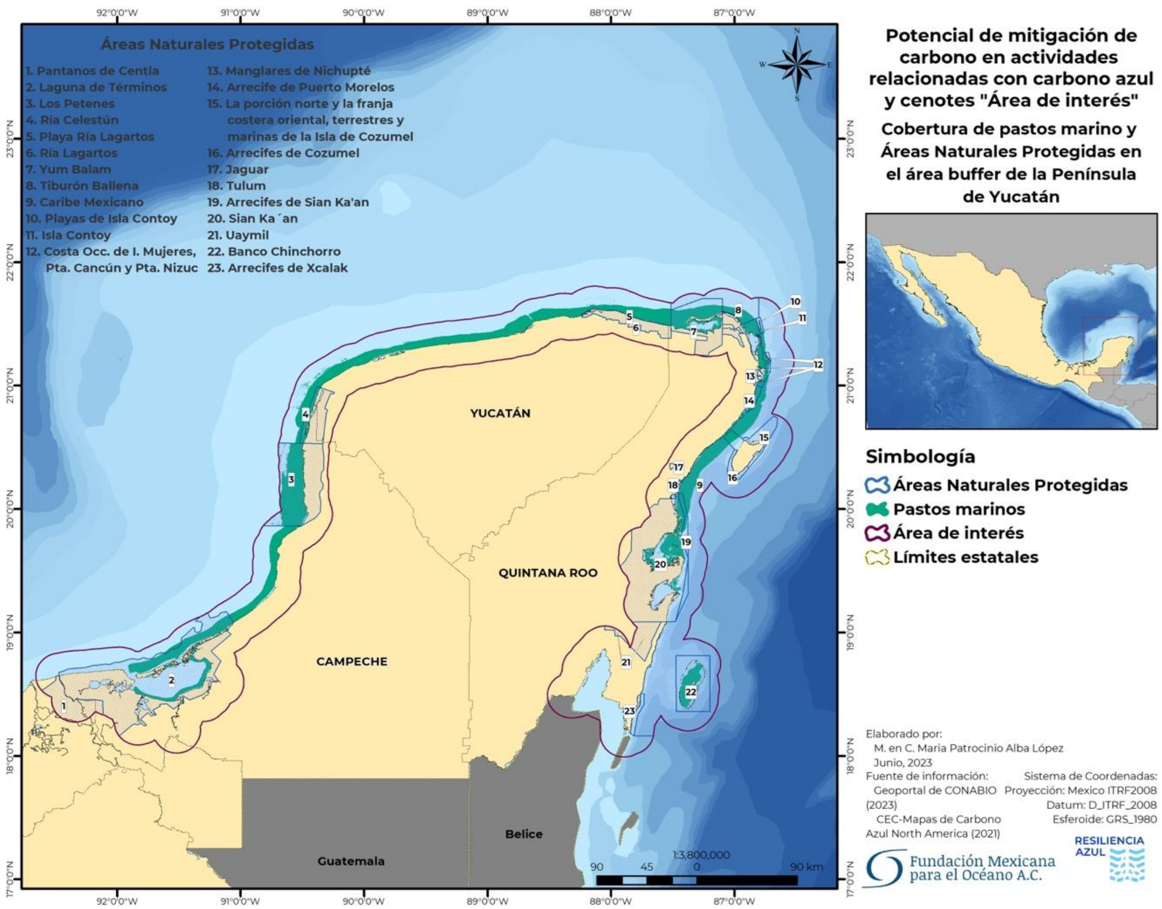


Figure 16 Seagrasses: distribution and areas in Protected Natural Areas. Source: Resiliencia Azul A.C. 2023.

Based on the analysis conducted (CEC, 2021), within the ACCIÓN area, a seagrass area of approximately 1,086,120.43 hectares is reported. Of this, 635,758.03 hectares are distributed within the marine area of 15 Protected Natural Areas (ANP), primarily in the Mexican Caribbean, Los Petenes, and Laguna de Términos (Figure 16).

Coastal dunes

Dunes have a habitat-forming and topographic diversity function that helps coastal zones increase their resilience to erosion. Coastal dunes are among the ecosystems most at risk of disappearing in the region due to climate change. Coastal erosion processes constitute a severe threat. Sea level rise will cause a decrease in the extent (and eventual loss) of beach and dune ecosystems; affect nesting sites for reptiles and birds and change the composition and structure of flora and fauna populations. The increase in the intensity and frequency of extreme meteorological events will alter the dynamics of beaches and dunes, including the destruction of the physical structure, which will be reflected in changes in the population dynamics of species and an increase in genetic erosion.

In the YP, Ovando et al. (2020) identify that "coastal dune vegetation is present in 81% of the Peninsula's beach coastline, except in some natural areas occupied by mangrove and lagoon systems, as well as by urban settlements due to the establishment of ports and summer developments (Flores and Espejel, 1994), they are considered a system of fixed dunes in which sedimentation is controlled by vegetation (Eskuche, 1992; Rust and Illenberg, 1996; Torres et al, 2010). The dune communities of this region present functional characters of plant species that allow them to withstand conditions of high temperature, low water availability and high salt exposure (Martínez et al., 2014, Munguía-Rosas et al., 2019).

Among their main threats are urban expansion, particularly the development of hotel infrastructure (UNDP, 2023). Ovando et al. (2020) evaluated climate scenarios of impact, vulnerability, and adaptation for five dune vegetation species (*Cakile edentula, Ernodea littoralis, Scaevola plumieri, Suriana marítima, Tournefortia gnaphalodes*) by 2080. All of them substrate fixers, with high dominance values. They found that E. littoralis and T. gnaphalodes, would be the species with the least potential impact from climate change. S. marítima is the species that would lose the most cover (part of the few shrub species in the pioneer zone that fix substrate and are a refuge for birds).

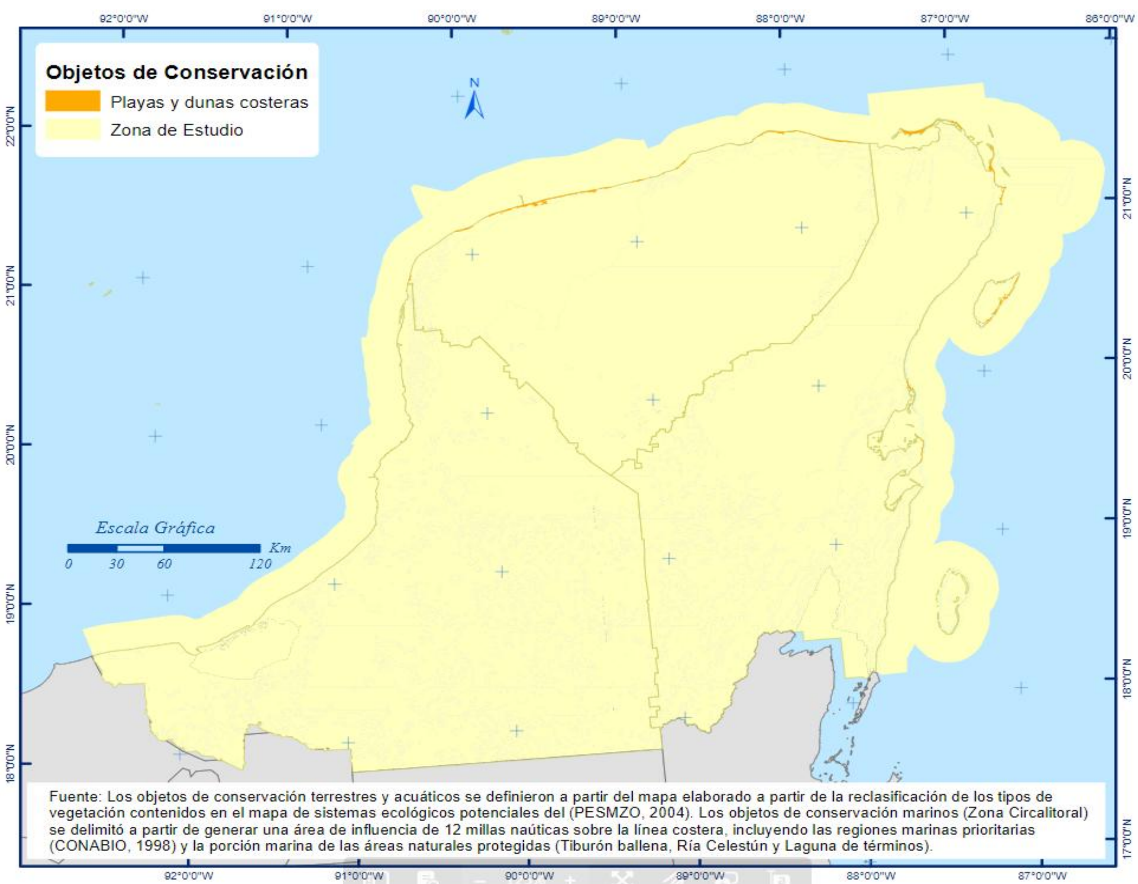


Figure 17 Distribution of beaches and dunes in the YP as of 2018. Source: Alianza de la Península de Yucatán, 2023 using data from CONABIO 1998; PESMZO, 2004.

Mangroves

Mangroves function as carbon sinks, protection against storms or storm surges, provide sedimentation services and detention of mean sea level rise and breeding grounds for fish, refuge for biodiversity (Blue Resilience, 2023). These ecosystems also provide multiple services to local communities, including coastal protection, a breeding ground for species of commercial interest, and scenic beauty for tourism.

Mangroves are extremely productive forest characterized by high carbon storage especially below ground, with total carbon stocks three to five times higher than other ecosystems such as boreal and tropical forest (Donato, et al., 2011; Fourqurean et al., 2012). The average carbon stock reported for the YP mangrove is 348.90 ± 21 Mg Corg Ha-1; the average in the region shows the highest reservoir of organic carbon for Mexico with an estimation of 148.2 Tg (Herrera-Silveira et al., 2020). Regardless of the multiple valuable environmental services provided by this ecosystem there is a sustained deforestation.

Mexico is the fourth country with the largest extension of mangroves in the world. According to the most recent information from the National Commission for the Use and Knowledge of Biodiversity (CONABIO), 905,086 ha were registered in 2020. Of this extension, 60% is located in the YP (Campeche, Quintana Roo, and Yucatan), and of this percentage, 90% corresponds to territories zoned within NPAs. This is why this region is a hot spot of carbon storage and sequestration covered by 544,169 hectares of mangrove (CONABIO, 2020).

It is estimated that for the area of interest of the ACCIÓN project in YP, the mangrove cover has an approximate area of 528,619.83 ha, of which 3,161.99 ha correspond to disturbed mangrove, while for other wetlands 412,040.58 ha are registered (CONABIO, 2020). According to the integral connectivity index of the Mexican Mangrove Monitoring System (SMMM) within the site of interest, 54% of the surface area has a “very high” connectivity value, the largest surface area is in the "very high" connectivity value (CONABIO, 2020); “high” connectivity, the largest area, with 285,024.83 ha, "very low" connectivity with 91,995.07 ha, with 17% and 14% (71,220.52 ha) with "medium" connectivity.

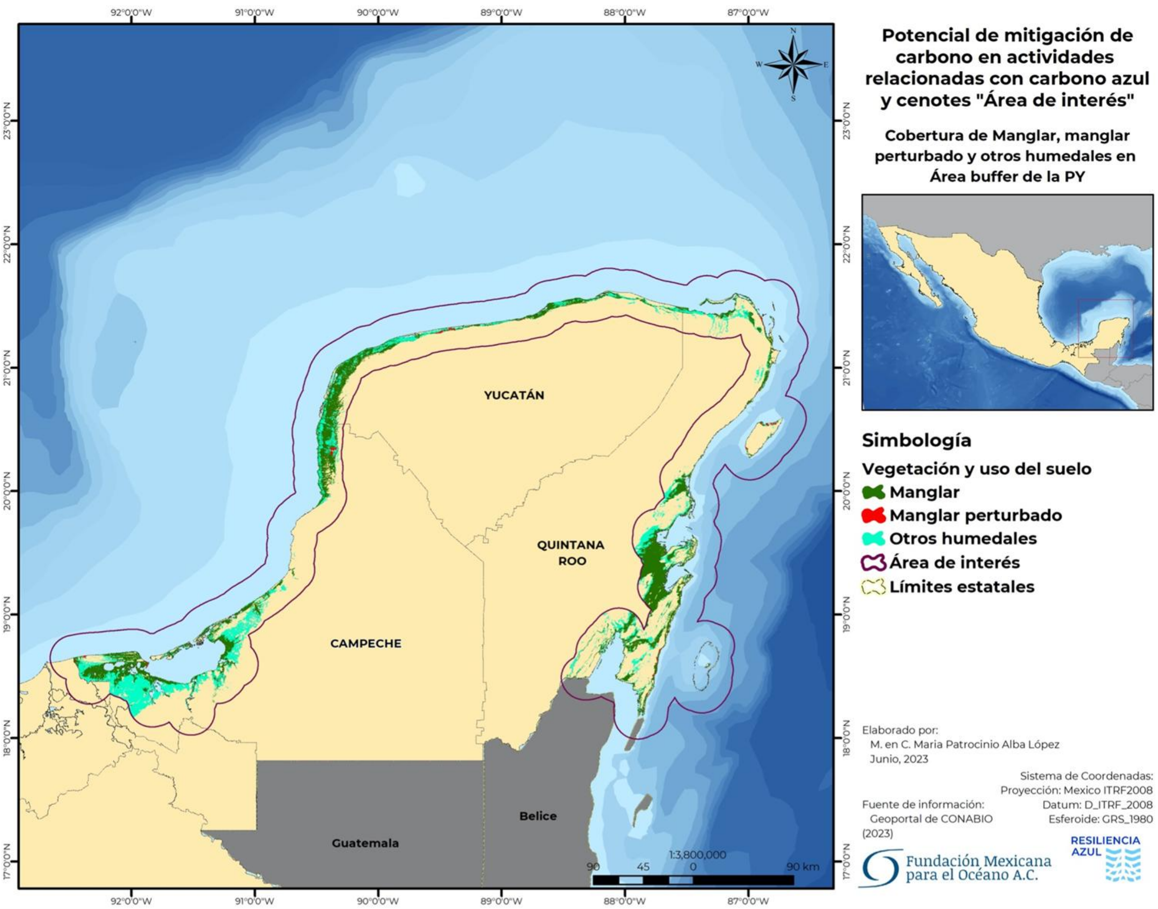


Figure 18 Mangrove cover, disturbed mangrove, and other wetlands in the ACCIÓN area. Source: Resiliencia Azul A.C. 2023

Cenotes

Cenote is the name used to designate any underground space with water and a connection to the outside. Cenotes are complex aquatic systems generated by the dissolution of carbonates and other minerals in the rock, so geologically they are also called dissolution lakes (Monroy-Ríos, 2016). Beddows et al. (2007) estimate that there are more than 7000 cenotes in the YP. Cenotes are important for conservation of resources, climate, and local tourism.

The term cenote is of Mayan origin "Tso'ono'ot or d'zonot", meaning “cavern with water”. Currently the term cenote is used to designate any underground space with water and a connection to the outside. Cenotes are complex aquatic systems generated by the dissolution of carbonates and other minerals in the rock, so geologically they are also called dissolution lakes (Monroy-Ríos, 2016).

Karstification process (dissolution of carbonate rocks) in cenotes can capture large amounts of CO_2 and transform it into dissolved inorganic carbon (DIC), regulating atmospheric CO_2 on short time scales. The measurement of both processes, 1) atmospheric CO_2 capture by DIC generation and 2) CO_2 release into the atmosphere by accelerated karstification by anthropogenic compounds, is essential to characterize the areas in which it is happening and thus be able to apply measures to conserve the first process and to mitigate the second.

Samples analysis demonstrate the fact that the discharge of anthropogenic nitrogen and sulfur from agriculture, livestock and urban wastewater in Yucatan could have a great impact on the chemical compositions of karst groundwater.

The results show affectation on acceleration and decrease to the karstification process related to the CO_2 sink capacity for cenote's sites evaluated. Sites conditions: with a full accelerated karstification and a significant decrease of the CO_2 sinking capacity are linked to the discharge of anthropogenic nitrogen and sulfur from agriculture, livestock and urban wastewater in Yucatan having a pronounced impact on the chemical compositions of karst groundwater.

Anthropogenic sulfuric acid and/or nitric acid involved in carbonate weathering in karst systems could affect the global carbon cycle since karst areas. Role of anthropogenic sulfuric acid and/or nitric acid in carbonate weathering should not be ignored in the global carbon cycle, especially where fertilizers are heavily used, or in areas with sewage discharges, or even zones that have reported acid rain presence.

There are records of 101 cenotes in the ACCIÓN implementation area, which represent only 1.5% of the total number of cenotes in the Yucatán Peninsula (Figure 19). However, to date, there are few or no studies available on most of them (PHR 2020 - 2024). The estimated annual mitigation potential for these 101 cenotes is 12,000 tC/year (Resiliencia Azul A.C., 2023).

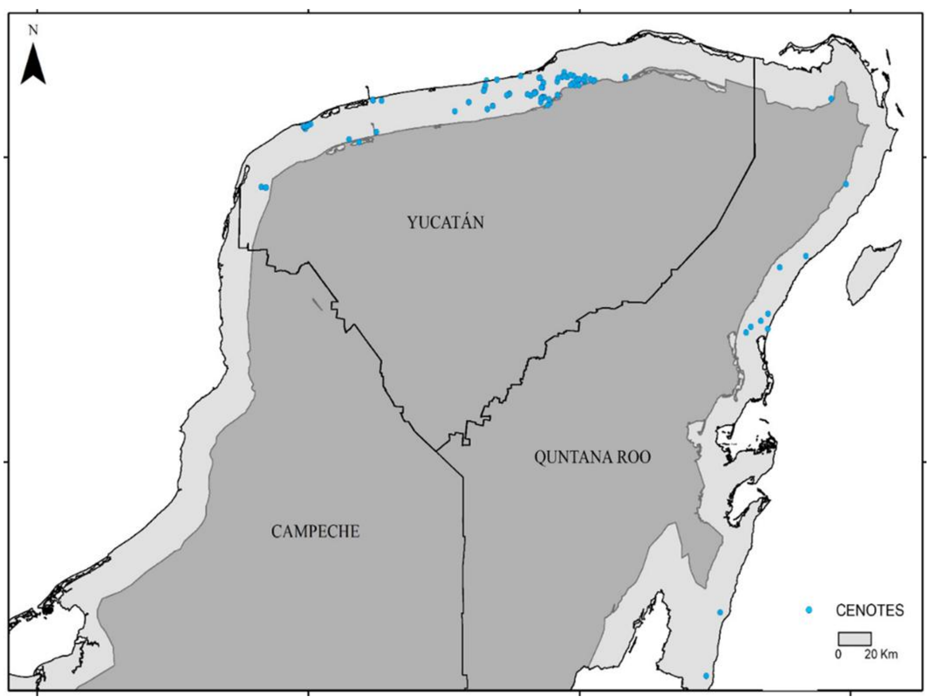


Figure 19 Cenotes in the ACCIÓN area. Source: Resiliencia Azul A.C. 2023

Forests

The forests in the project's area of interest consist of tulares, savannas, and coastal wetlands and are a barrier to extreme weather events. These forests, as ecosystems, have a certain adaptation to the continuous onslaught of hurricanes and tropical storms. Since 1990, fire has posed a serious threat to the forests of the eastern portion of the YP. Due to the increase in temperature, alterations in rainfall distribution, and the general tendency for rainfall to decrease, flora and fauna populations may be directly and indirectly affected in their phenology and biotic interactions. Population changes will impact the structure and functioning of biotic communities, ecological integrity, and ecosystems' material and energy cycles; this could favor the expansion of invasive species. The increase in CO_2 concentration will cause changes in the photosynthetic capacity of plants, favoring the productivity of some species and limiting that of others. The increase in the frequency of extreme hydro-meteorological events favors the accumulation of combustible material and, therefore, a greater probability of fires that reduce ecosystem connectivity.

Forested areas are an important source of resources for coastal communities, whether for the production of furniture, firewood or handicrafts. Their importance for increasing the resilience of coastal populations is related to their potential to mitigate carbon dioxide emissions, as well as their ecological functions of water purification. They also play an important role as areas that make possible the development of beekeeping.

The distribution of forests in the intervention area of the ACCIÓN project is as follows: in Campeche, wetlands account for 31% of the territory, while 54% corresponds to forest lands. ; in Quintana Roo, 25% corresponds to wetland areas and 69% is made up of forest land; and in Yucatan 21% corresponds to wetlands and 61% forest land (CONAFOR,2024).

It is possible to assess the vulnerability of forests by identifying the impact of urban expansion, interactions related to local demographics, ecological integrity of ecosystems and the impact of invasive species. On the other hand, an increase in the frequency of extreme hydrometeorological events favors the accumulation of combustible material and, therefore, a greater probability of fires that reduce ecosystem connectivity (FMCN,2022).

II.1.2. Regionalization and key conservation areas

It is key to identify areas that have already made significant progress in ecosystem conservation and restoration, local governance, territorial planning, and sustainable production (Arriaga, L., 2009). For this reason, data related to sustainable production activities and EbA measures projected by ACCIÓN are analyzed: Priority Regions (terrestrial, marine, hydrological, and important for bird conservation), Protected Natural Areas, RAMSAR Sites, and Fishing Refuge Zones.

Natural Protected Areas

The YP has 59 Protected Natural Areas (PAs) that total 12,867,194.32 hectares. Of these, 3,710,954 ha are in the ACCIÓN target area, with 27 federal and 12 state areas, that represents 66% of the marine ha and 34% of the terrestrial ha.

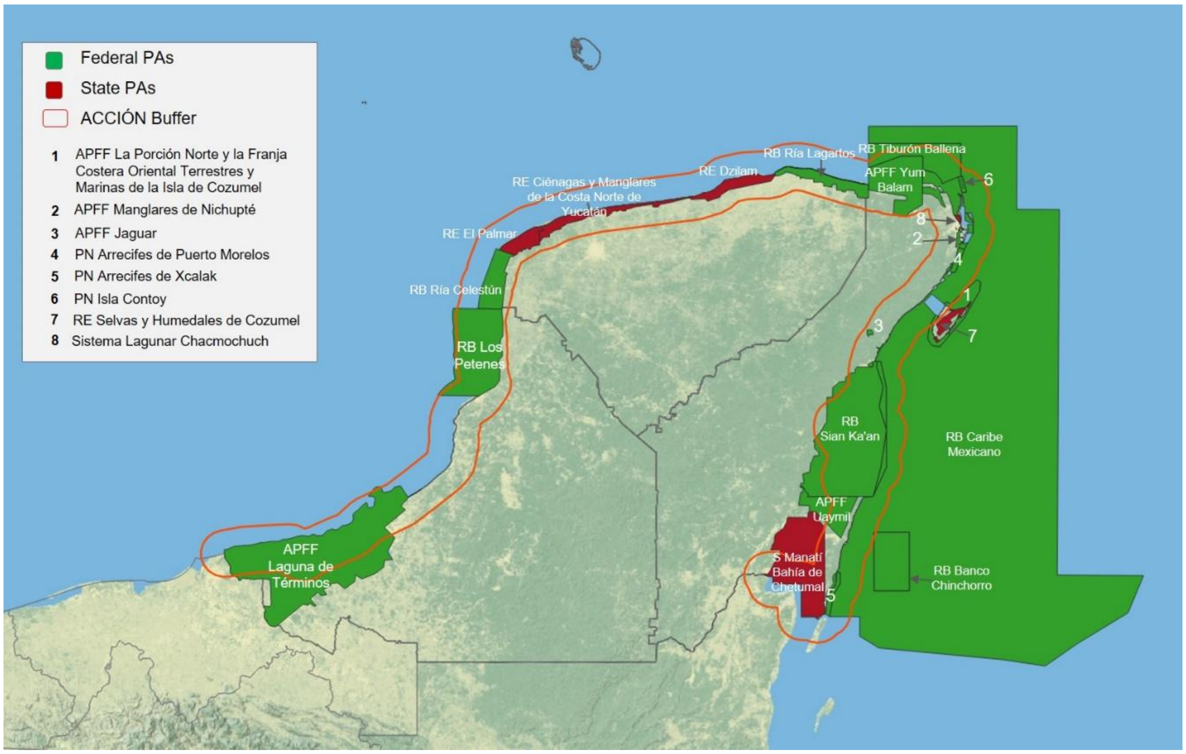


Figure 20 Natural Protected Areas in the ACCIÓN zone. Source: INEGI, 2020 and CONANP, 2024.

The federal Protected Natural Areas with the largest extent are the Mexican Caribbean, Laguna de Términos, Sian Ka'an, and Los Petenes. In the case of state-protected areas, the Manatee Sanctuary of Bahía de Chetumal stands out above the rest.

Table 12 Protected Areas of the Yucatan Peninsula

PA	Management Category	Total Area	Terrestrial Area	Marine Area
Arrecife de Puerto Morelos	National Park	9,066.63	37.74	9,028.89
Arrecifes de Cozumel	National Park	11,987.88	82.28	11,905.60
Arrecifes de Sian Ka'an	Biosphere Reserve	34,927.16	1,361.00	33,566.16
Arrecifes de Xcalak	National Park	17,949.46	4,521.84	13,427.62
Banco Chinchorro	Biosphere Reserve	144,360.00	585.79	143,774.21
Caribe Mexicano	Biosphere Reserve	5,754,055.36	28,589.50	5,725,465.87

Cenote Aerolito	Flora and Fauna Protection Area	10.2	10.2	0
Costa Occ. de I. Mujeres, Pta. Cancún y Pta. Nizuc	National Park	8,673.06	0.61	8,672.45
El Palmar	Biosphere Reserve	49,605.40	40,163.30	9,442.10
Isla Contoy	PN	5,126.26	230	4,896.26
Jacinto Pat	Flora and Fauna Protection Area	16.65	16.65	0
Jaguar	Flora and Fauna Protection Area	2,249.71	2,249.71	0
La porción norte y la franja costera oriental, terrestres y marinas de la Isla de Cozumel	Flora and Fauna Protection Area	37,829.17	5,733.21	32,095.96
Laguna Colombia	Parque Ecológico Estatal	1,526.68	1,526.68	0
Laguna de Chankanaab	Parque Natural	11.7	11.7	0
Laguna de Términos	Flora and Fauna Protection Area	706,147.67	547,278.71	158,868.96
Laguna Manatí	Zona Sujeta a Conservación Ecológica, Refugio Estatal de Flora y Fauna	201.29	201.29	0
Los Petenes	Biosphere Reserve	282,857.63	100,866.53	181,991.10
Manglares de Nichupté	Flora and Fauna Protection Area	4,257.50	4,257.50	0
Manglares de Puerto Morelos	Flora and Fauna Protection Area	1,103.00	1,103.00	0
Pantanos de Centla	Biosphere Reserve	302,706.63	302,706.63	0
Parque Kabah	Parque Urbano	37.94	37.94	0
Parque Lagunar de Bacalar	Parque Ecológico Estatal	5.35	5.35	0
Playa Chenkan	Sanctuary	39.56	39.56	0
Playa Delfines	Flora and Fauna Protection Area	4.88	4.88	0
Playa Ría Lagartos	Sanctuary	827.36	827.36	0
Playas de Isla Contoy	Sanctuary	10.75	10.75	0
Reserva Ecológica Ombligo Verde	Zona de Preservación Ecológica Municipal	4.14	4.14	0
Reserva Estatal Ciénegas y Manglares de la Costa Norte de Yucatán	State Reserve	54,776.70	54,776.70	0

Reserva Estatal de Dzilam	State Reserve	69,039.30	51,526.60	17,512.70
Ría Celestún	Biosphere Reserve	81,482.33	61,926.57	19,555.76
Ría Lagartos	Biosphere Reserve	60,347.83	60,347.83	0
San Buenaventura	Flora and Fauna Protection Area	37.91	37.91	0
Santuario del Manatí Bahia de Chetumal	State Reserve	276,605.62	276,605.62	0
Selvas y Humedales de Cozumel	State Reserve	19,703.29	19,703.29	0
Sian Ka'an	Biosphere Reserve	528,147.67	375,011.87	153,135.80
Sistema Lagunar Chacmochuch	Zone Subject to Ecological Conservation, State Flora and Fauna Refuge	1,897.22	1,897.22	0
Tiburón Ballena	Biosphere Reserve	145,988.14	0	145,988.14
Tulum	National Park	664.32	664.32	0
Uaymil	Flora and Fauna Protection Area	89,118.15	89,118.15	0
Xcacel-Xcacelito	State Ecological Conservation Area, Sea Turtle Sanctuary	354.17	354.17	0
Yum Balam	Flora and Fauna Protection Area	154,052.25	52,307.62	101,744.63
Total		8,857,813.92	2,086,741.72	6,771,072.21

Important Bird and Biodiversity Area (IBA)

Important Bird and Biodiversity Area (IBA) are spaces evaluated by experts with the goal of serving as a tool for decision-making sectors by establishing prioritization criteria and resource allocation for conservation. In the YP, there are 16 IBAs, 2 of which are located only in the central part of the Peninsula and not in the coastal area. In total, there are 7 endemic species in the YP: Cozumel Thrasher (*Toxostoma guttatum*), Cozumel Emerald (*Cynanthus forficatus*), Cozumel Vireo (*Vireo bairdi*), Mexican Scissor-tailed Hummingbird (*Doricha eliza*), Yucatan Wren (*Polioptila albiventris*), Yucatan Wren (*Campylorhynchus yucatanicus*), and Cinnamon-rumped Seed-eater (*Sporophila torqueola*) (CONABIO, 2015).

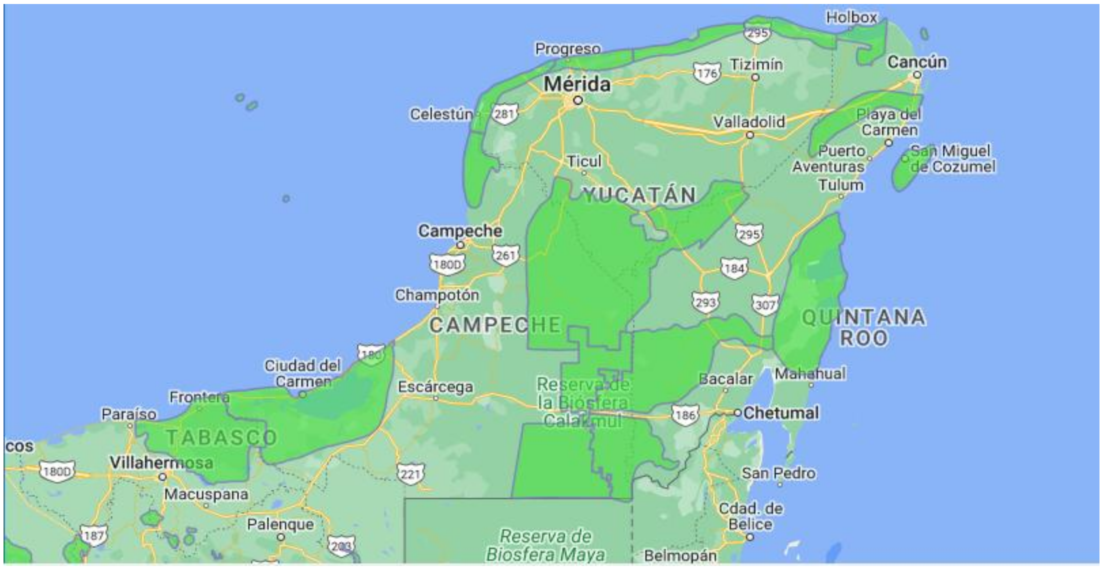


Figure 21 Regionalization of IBAs in the Yucatan Peninsula. Source: CONABIO, 2022

Table 13 Table IBA and the species inhabiting them by state (CONABIO, 2015)

State	IBA	Number of Bird Species	Endemic Species
Campeche	Laguna de Términos Calakmul Islas de la Sonda de Campeche Los Petenes Sierra de Ticúl-Punto Put Humedales Costeros del Norte de la Pen. de Yucatán	452	4 species Mexican Scissor-tailed Hummingbird (*Doricha eliza*) Yucatan Wren (*Polioptila albiventris*) Yucatan Wren (*Campylorhynchus yucatanicus*) Cinnamon-rumped Seed-eater (*Sporophila torqueola*)

Quintana Roo	Sierra de Ticúl-Punto Put Isla Contoy Corredor Central Vallarta-Punta Laguna Isla Cozumel Sian Ka'an Sur de Quintana Roo Yum-balam Humedales Costeros del Norte de la Pen. de Yucatán Corredor Calakmul-Sian Ka'an Uyumil C'eh	473	7 species Cozumel Thrasher (*Toxostoma guttatum*) Cozumel Emerald (*Cynanthus forficatus*) Cozumel Vireo (*Vireo bairdi*) Mexican Scissor-tailed Hummingbird (*Doricha eliza*) Yucatan Wren (*Polioptila albiventris*) Yucatan Wren (*Campylorhynchus yucatanicus*) Cinnamon-rumped Seed-eater (*Sporophila torqueola*)
Yucatán	Sierra de Ticúl-Punto Put Arrecife Alacranes Ría Celestún Ichka' Ansijo Reserva Estatal de Dzilám Ría Lagartos Humedales Costeros del Norte de la Pen. de Yucatán	366	4 species Mexican Scissor-tailed Hummingbird (*Doricha eliza*) Yucatan Wren (*Polioptila albiventris*) Yucatan Wren (*Campylorhynchus yucatanicus*) Cinnamon-rumped Seed-eater (*Sporophila torqueola*)

Ramsar Sites

Ramsar Sites are areas designated under the Ramsar Convention, an international treaty aimed at the conservation and sustainable use of wetlands worldwide. In the YP, 24 sites have been declared.

Ramsar Sites

1. APFF Yum Balam
2. Parque Nacional Isla Contoy
3. Manglares de Nichupté
4. Parque Nacional Arrecife de Puerto Morelos
5. Manglares y Humedales de la Costa Norte de Isla Cozumel
6. Parque Nacional Arrecifes de Cozumel
7. Playa Tortuguera: X´cacel X´Cacelito
8. Reserva de la Biósfera de Sian Ka´an
9. Parque Nacional Arrecife Alacranes
10. Reserva Estatal El Palmar
11. Reserva de la Biósfera Ría Celestún
12. Reserva de la Biósfera Los Petenes
13. Playa Tortuguera Chenkán
14. APFF Laguna de Términos
15. RB Pantanos de Centla
16. PN Arrecifes de Xcalak
17. RB Banco Chinchorro
18. Humedal de Importancia Especialmente para la Conservación de Aves Acuáticas Reserva Ría Lagartos
19. Dzilam
20. Reserva Estatal Ciénagas y Manglares de la Costa Norte de Yucatán
21. Anillo de Cenotes
22. Otoch Ma´ax Yetel Kooh
23. Laguna de Chihankanab
24. Parque Estatal Lagunas de Yalahau

Fishing Refuge Zones (ZRP)

The **Fishing Refuge Zones (ZRP)**, managed by CONAPESCA (2019), are defined as "delimited areas with the purpose of conserving and contributing, naturally or artificially, to the development of fishery resources through their reproduction, growth, or recruitment, as well as preserving and protecting the surrounding environment."

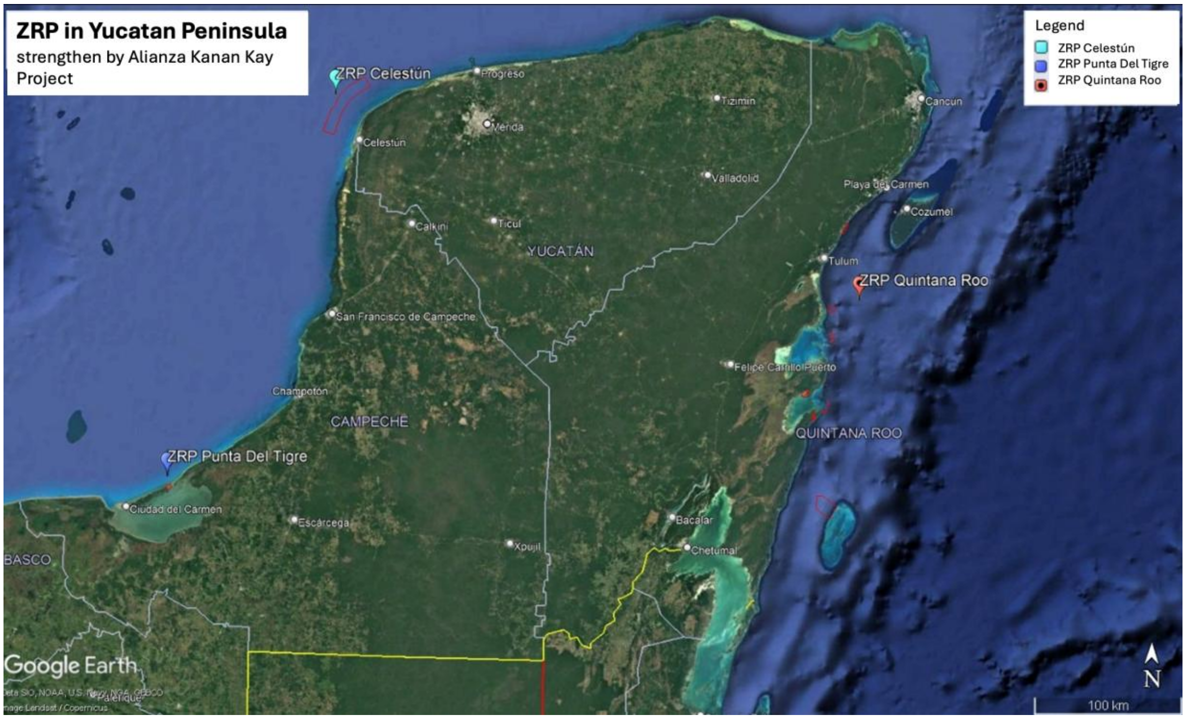


Figure 22 ZRP in the YP supported by Alianza Kanan Kay

The most recent update, published in the DOF on December 11, 2019, lists:

Seven ZRPs in the YP, 6 in Quintana Roo and 1 in Yucatan. In total, they protect 51,876 hectares; however, 4 of them have since expired, leaving 3 active ZRPs (2 in Quintana Roo and 1 in Yucatan), covering 46,620 hectares and protecting 23 different species:

1. Queen conch (*Lobatus gigas*)
2. Caribbean spiny lobster (*Panulirus argus*)
3. Spotted spiny lobster (*P. guttatus*)
4. White grunt (*Haemulon album*)
5. Dog snapper (*Lutjanus jocu*)
6. Great barracuda (*Sphyraena barracuda*)
7. Mutton snapper (*Lutjanus analis*)
8. Hogfish (*Lachnolaimus maximus*)
9. Nassau grouper (*Epinephelus striatus*)
10. Black grouper (*Mycteroperca bonaci*)
11. Grouper (*Cephalopholis spp.*)
12. Snook (*Centropomus undecimalis*)

13. Bonefish (*Albula vulpes*)
14. Dog snapper (*Lutjanus jocu*)
15. Crevalle jack (*Caranx hippos*)
16. French grunt (*Haemulon flavolineatum*)
17. Atlantic Spanish mackerel (*Scomberomorus maculatus*)
18. Red grouper (*Epinephelus morio*)
19. Red octopus (*Octopus maya*)
20. Caribbean spiny lobster (*Panulirus argus*)
21. Sea cucumber (*Isostichopus badionotus*)
22. King mackerel (*Scomberomorus cavalla*)

Great barracuda (Sphyraena barracuda)

Table 14 Fishing Refuge Zones (DOF, 2019)

Satate	Sites	Zones	Ha	Validity
Quintana Roo	Canal Nizuc	1 (Permanent total)	8.158	April 25, 2023
	Banco Chinchorro	1 (Permanent total)	12257	June 1, 2024
	Punta Herrero	1 (Permanent total)	163.34	August 28, 2024
Yucatán	Celestún	1 (Permanent total)	34200	October 3, 2024

II.1.3. Socio-economic context

The project's intervention area covers three states: Campeche, Yucatan, and Quintana Roo. The area of influence includes 58.3% of the municipalities in the state of Campeche, 90.9% in Quintana Roo, and 22.6% in Yucatan. The coverage area is 1,703 localities in 41 municipalities that have a coastal zone throughout the YP; 27% of the localities are in Campeche, 53% in Quintana Roo and 20% in Yucatan. According to the National Institute of Statistics and Geography (INEGI), a locality is an occupied place with one or more inhabited or uninhabited houses, recognized by a name given by law or custom. By population size, they are divided into urban (more than 2 500 inhabitants) and rural (less than 2 500 inhabitants). On the other hand, a municipality is a political-administrative territorial division of a federative entity.

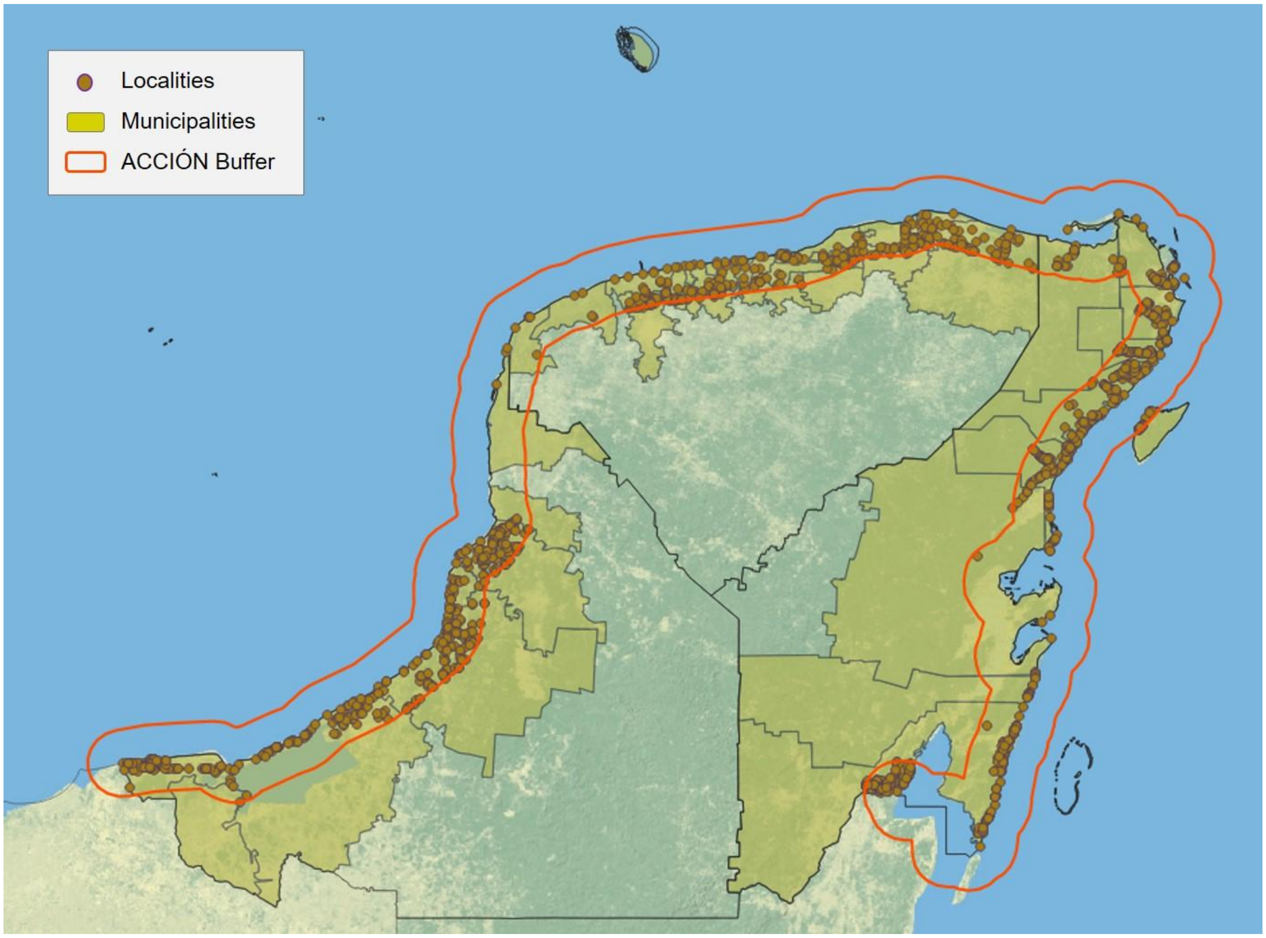


Figure 23 Municipalities and Localities of ACCIÓN. Source: INEGI, 2020

Table 15 Coverage by municipality and localities

	State Total		Coverage of the project		% Coverage	
State	Municipalities	Localities	Municipalities	Localities	Municipalities	Localities
Campeche	13	2,762	7	462	54%	17%
Quintana Roo	11	2,207	10	907	91%	41%
Yucatan	106	2,434	24	334	23%	14%
Total	130	7,403	41	1,703	32%	23%

Demographics

The total population of the three states of the YP is approximately 5.1 million (2020)[2].

The state of Campeche has a population of 928,363 inhabitants, which is equivalent to 0.7% of the country's total population. Considered by gender, 50.8% are women and 49.2% are men. According to place of residence, 75% of the population lives in urban areas, and 25% resides in rural areas.

The state of Quintana Roo has a population of 1,857,985 inhabitants, which is equivalent to 1.5% of the country's total population. Considered by gender, 50.4% are women and 49.6% are men. According to place of residence, 90% of the population lives in urban areas, and 10% resides in rural areas.

The state of Yucatan has a population of 2,320,898 inhabitants, which is equivalent to 1.6% of the country's total population. Considered by gender, 49.1% are women and 50.9% are men. According to place of residence, 86% of the population lives in urban areas, and 14% resides in rural areas.

The targeted communities for this project will be some of those who are most vulnerable to the impacts of climate change –particularly low-income groups who are dependent on the dwindling natural resource base of the peninsula. The coastal communities in the region have populations that depend heavily on fisheries, tourism, and some agriculture and forestry activities for their livelihoods. These activities are closely tied to the health of the coastal ecosystems, including coral reefs, mangroves, and beaches. However, poverty and social marginalization are prevalent in many coastal municipalities, with over 50% of the population living in patrimonial, capability, or nutritional poverty. The poorest and most socially disadvantaged communities tend to be located in remote, hard-to-access areas. Around 20% of the population in Yucatán speaks Maya, 10% in Quintana Roo, and 8% in Campeche, making it the second most spoken indigenous language in Mexico. Disadvantages in education for women due to a quadruple burden of poverty, indigeneity, rurality, and gender make them especially vulnerable, and do not allow them to compete fairly in the labor market, especially for adult women, most of whom have not completed primary education. The targeted coastal landscape has a total population of 2,309,480 inhabitants, of which 49.84% are men and 49.95% women. 90% of the population lives in urban cities with more than 10,000 inhabitants, 96% of the population live in 40 localities of more than 2,500 people, and 4% live in many rural communities with less than 2,500 inhabitants. It is estimated that approximately 17% live in indigenous households, and only 3.5% speak an indigenous language, mostly Mayan (INEGI 2020).

2 DataMexico. Yucatan. < https://www.economia.gob.mx/datamexico/es/profile/geo/yucatan-yu>/..

Table 16 Population in the intervention zone

State	Municipality	Localities in the intervention area	Total population	Female population	Male population	Indigenous language-speaking population
Campeche	Calkini	1	968	465	503	105
	Campeche	109	273,650	142,346	130,759	9,406
	Carmen	194	223,110	112,881	109,710	2,480
	Champoton	131	50,014	25,143	24,563	1,716
	Palizada	4	34	10	14	0
	Tenabo	10	160	60	78	14
	Seybaplaya	18	15,297	7,642	7,608	426
Quintana Roo	Cozumel	24	84,795	42,392	42,340	6,101
	Felipe Carrillo Puerto	14	634	256	354	405
	Isla Mujeres	84	22,320	10,889	11,252	1,449
	Othon P. Blanco	365	186,151	94,811	90,497	9,976
	Benito Juarez	52	910,081	451,474	458,470	59,878
	Lazaro Cardenas	21	5,014	2,409	2,564	299
	Solidaridad	127	333,355	162,970	169,607	25,797
	Tulum	142	38,174	18,008	19,819	6,083
	Bacalar	15	47	7	5	2
	Puerto Morelos	63	19,479	9,470	9,864	1,207
Yucatán	Baca	4	11	0	0	0
	Buctzotz	3	498	234	259	193
	Cansahcab	1	10	0	0	0
	Celestun	8	8,387	4,152	4,228	380
	Chicxulub Pueblo	8	4,490	2,213	2,262	300

	Dzemul	11	3,622	1,820	1,791	676
	Dzidzantún	17	8,345	4,113	4,189	429
	Dzilam de Bravo	19	2,936	1,449	1,452	93
	Dzilam Gonzalez	31	6,240	3,044	3,125	589
	Hunucma	4	2,083	1,019	1,059	106
	Ixil	9	4,186	2,083	2,093	399
	Merida	37	13,844	6,837	6,939	2,695
	Mococha	1	439	211	228	43
	Motul	9	1,778	840	922	408
	Panaba	18	851	400	404	277
	Progreso	20	66,008	33,024	32,966	2,606
	Río Lagartos	29	3,969	1,917	1,975	355
	San Felipe	23	2,118	1,009	1,060	119
	Sinanche	9	3,206	1,552	1,639	597
	Telchac Pueblo	8	3,512	1,794	1,702	347
	Telchac Puerto	2	1,915	961	952	183
	Temax	1	43	21	22	18
	Tizimin	56	5,525	2,664	2,731	1,678
	Yobain	6	2,215	1,105	1,107	360
Total			**2,309,480**	**1,153,685**	**1,151,098**	**138,195**

The age ranges of the population, across the localities in the coverage area, it is notable that the majority of both the female and male population is characterized by being young. Campeche has the highest number of females in the 30 to 34-year range, Quintana Roo in the 25 to 29-year range, and Yucatán in the 5 to 9-year range. In the case of the male population, it is concentrated in Campeche mostly in the ranges from 5 to 9 years up to 20 to 24 years; in Quintana Roo in the 25 to 29-year range, and in Yucatán in the 15 to 19-year range.

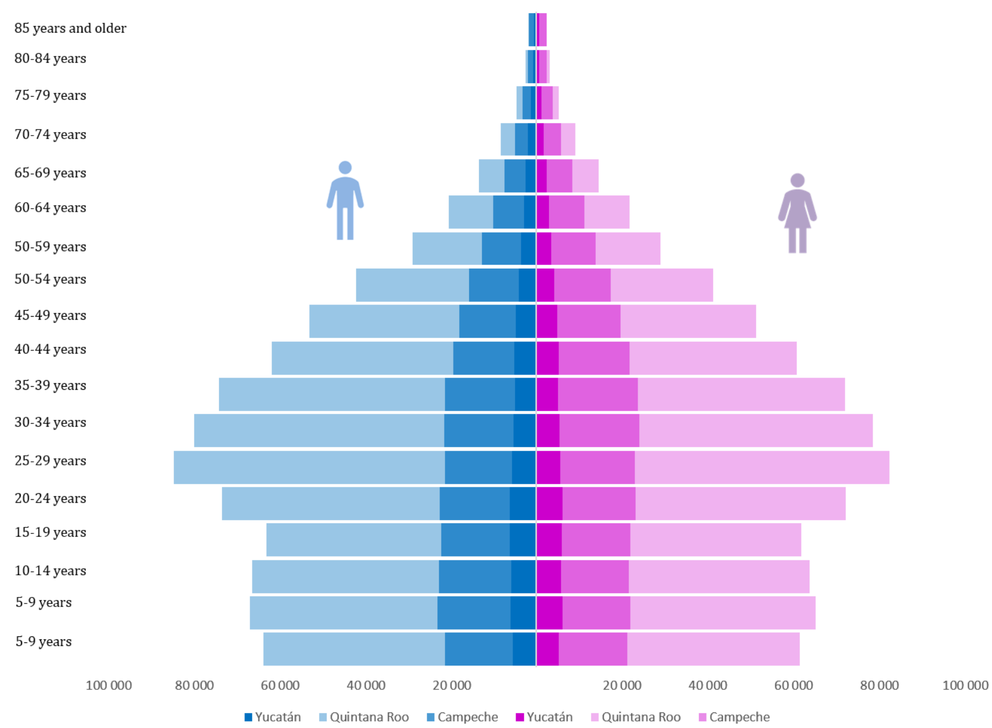


Figure 24 Age of the population in the ACCIÓN localities. Source: INEGI, 2020

Land tenure

Information about social land tenure is available at the federal entity level through the Comprehensive System for Cadastral and Registry Modernization (SIMCR) of the National Agrarian Registry (RAN). There are 753 ejidos in the Yucatán Peninsula: 274 in Campeche, 254 in Quintana Roo, and 225 in Yucatán. It is notable that the percentage of female representatives is very similar across the three states, not exceeding 15% of the positions, which is the maximum limit in Quintana Roo.

Common-use ejidal lands constitute the economic support for communal life within the ejido and consist of those lands not designated by the assembly for the settlement of the population nucleus, nor have they been divided into parcels. Of the three states in the Yucatán Peninsula, Campeche has the most common-use lands within the project intervention zone (RAN, 2023).

Table 17 Communal land

Project intervention zone	
State	**Communal land**
Campeche	25%
Quintana Roo	14%
Yucatán	17%
Total	**8%**

Education

In the Campeche State, the average schooling is 9.6 years, approximately the first year of high school, and the literacy rate is 96.1%. In Quintana Roo, the average years of formal education is 10.2, slightly more than the first year of high school, and the literacy rate is 89.9%. In the Yucatan state, the average schooling is 9.6 years, approximately reaching the first year of high school, and the literacy rate is 94.3%.

In terms of education, at the state level, Quintana Roo has the lowest number of illiterate population with 2.27% and Yucatan the highest in the region with 4.55%. When observing these data broken down by gender, it is observed that the male population of the three states presents lower illiteracy percentages than the female population, with Quintana Roo being the entity that has the lowest illiteracy percentage with 1.9%. This represents a gap of about two percentage points higher illiteracy among women in any of the states, which could be a challenge to improve any of the opportunities for women's development.

At the level of the localities in the project intervention zone, educational gaps persist with respect to the national and state averages. In other words, the coastal communities of the three states have lower levels of schooling than other areas in the region (INEGI, 2020).

Table 18 Average years of schooling

National level	State level			Localities of the intervention zone		
	Campeche	Quintana Roo	Yucatán	Campeche	Quintana Roo	Yucatán
9.7	9.6	10.2	9.6	7.5	8.9	8.3

Welfare and health

In terms of health, Campeche is the state with the highest percentage of population affiliated to medical services in the localities of the project intervention zone with 77.78%, followed by Yucatan with 72.63% and Quintana Roo with 72.39%. The information on the availability of services in housing located in the localities that are part of the project's intervention area is presented below in Table 19.

Table 19 Availability of services by state

State	State level			Municipality level			Locality level		
	Water	Energy	Drain	Water	Energy	Drain	Water	Energy	Drain
Campeche	95.36%	98.0%	94.2%	96.11%	98.4%	95.9%	96.4%	98.6%	98.0%
Quintana Roo	96.98%	97.7%	96.7%	97.00%	97.7%	96.9%	97.1%	97.9%	97.8%
Yucatan	98.46%	98.7%	92.0%	98.67%	99.1%	96.5%	97.8%	98.5%	94.0%
Total	**97.35%**	**98.2%**	**94.2%**	**97.40%**	**98.3%**	**96.6%**	**97.0%**	**98.1%**	**97.6%**

Source: INEGI, 2020

It is important to mention that the availability of potable water in the homes recorded in the census refers to the existence of infrastructure, but not the quantity or duration of supply. In many of the communities in the area of influence there is availability of the hydraulic network, but the supply is limited to certain hours per day, although no problems of permanent shortage were perceived. Employment, economic activities and livelihoods.

On the side of the Gulf of Mexico (west coast of YP), the economic activities focus on fishing and oil, while secondary activities include trade, services, transport, communications, and apiculture. On the side of the Caribbean (east coast of YP), the economy of Quintana Roo depends strongly on tourism (alternative and sun-and-beach).

All along the coast, the fishing sector is key for the regional economy in the YP and it focuses on species of high commercial value, such as lobster, octopus and queen conch. The value of fishing production in the YP represents about 10% of the national production (SIAP, 2017). In addition to coastal fishing and tourism, other key economic activities include sport fishing, handicraft production, apiculture, salt exploitation, Wildlife Conservation Management Units, and agriculture, mainly Mayan milpa (traditional agroforestry).

Specifically, the communities within the potential Natural Protected Areas (PA) are predominantly economically dependent on small-scale fishing and tourism. Approximately 11,533 fishers and 299 fishing cooperatives carry out their activities within an NPA, either because they live in the inside localities, are members of fishing camps within the zone, or move to do temporary or fixed jobs. Small-scale fishing is the main economic activity for 15 of 19 localities in NPA. In localities such as Atasta and Isla Arenas in Campeche, fishing employs 80% of its economically active population. In general, tourism is the second most important economic activity for the localities and there are about 39 alternative tourism cooperatives working in the zone.

The relationship between the livelihoods and coastal and marine ecosystems in the passages in Campeche, Quintana Roo and Yucatan is close and interdependent. Transition zones between coastal ecosystems and marine ecosystems, where the influence of both is combined, are important for the biological diversity and productivity of coastal and marine ecosystems and are also vital for the livelihood and economic development of local communities.

Predominant activities include fishing and aquaculture, coastal tourism, marine resource extraction, and other livelihoods related to coastal and marine ecosystems. These livelihoods can have impacts on coastal and marine ecosystems if not managed sustainably. Overfishing, pollution, overfishing, habitat degradation and other impacts can have negative consequences on the health and productivity of coastal and marine ecosystems.

It is important to note that women, rural communities, and indigenous peoples in the region play crucial roles in economic activities related to coastal and marine ecosystems, such as fishing and harvesting marine resources. However, they often face inequalities in terms of access to resources, economic opportunities, and decision-making in natural resource management.

Information on the Economically Active Population (EAP) in the localities of the project area shows a trend in which Quintana Roo has the highest percentage with 81.3%, probably due to its higher tourism and service activities compared to the other two states, followed by Campeche with almost 75% and Yucatan with 74.3%. Data disaggregated by sex reveals that the male EAP is between 20% and 25% higher than the female EAP, with the gap widening in Yucatan (Figure 25).

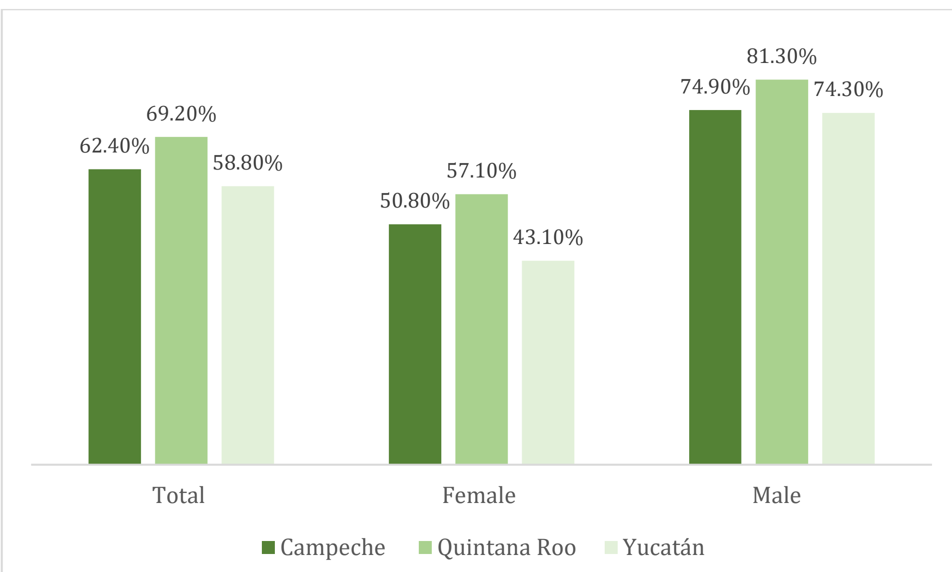


Figure 25 Economically active population by gender at locality level. Source: INEGI, 2020

As for the employed population, the same trend as the EAP is observed, with the highest percentage in the localities of Quintana Roo with 68%, followed by Campeche with 61.2% and Yucatan with 58%.

Table 20 Employed population by gender and sector of economic activity

Economic activity sector	Campeche			Quintana Roo			Yucatán		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Primary	27.4%	3.5%	18.4%	5.9%	0.9%	3.9%	13%	2.2%	8.4%
Secondary	24.3%	13.7%	20.3%	20.6%	7.3%	15.3%	31.8%	20.4%	27.0%
Tertiary	47.6%	82.5%	60.8%	73.3%	91.8%	80.7%	54.9%	77.2%	64.4%
Not specified	0.7%	0.3%	0.5%	0.2%	0.1%	0.1%	0.3%	0.1%	0.2%

Source: National Survey of Occupation and Employment, population aged 15 years and older (INEGI, 2023).

In Mexico, the National Council for the Evaluation of Social Development Policy (Coneval, 2020) measures multidimensional poverty by considering the following dimensions: Educational gap; Access to healthcare; Access to food; Access to social security; Housing quality and space; Basic housing services; and Social cohesion. According to this source, in 16 municipalities within the project's intervention area, more than 50% of the population is living in poverty. Five are in Quintana Roo, eight in Yucatán, and three in Campeche (Table 21).

Table 21 Multidimensional poverty

State	Municipality	Poverty	Extreme poverty	Moderate poverty
Campeche	Calkiní	62.8	17.8	45.1
Campeche	Campeche	32.5	4.7	27.8
Campeche	Carmen	35.4	7.6	27.7
Campeche	Champotón	57.2	12.1	45.1
Campeche	Palizada	59.9	13.7	46.1
Campeche	Seybaplaya	n.d.	n.d.	n.d.
Campeche	Tenabo	53.9	10.6	43.3
Quintana Roo	Bacalar	73.5	24.1	49.3
Quintana Roo	Benito Juárez	37.9	6.2	31.7
Quintana Roo	Cozumel	39.6	5.1	34.5
Quintana Roo	Felipe Carrillo Puerto	81.1	31.7	49.4
Quintana Roo	Isla Mujeres	50.3	8	42.3

Quintana Roo	José María Morelos	80.8	25.1	55.7
Quintana Roo	Lázaro Cárdenas	65.7	20	45.6
Quintana Roo	Othón P. Blanco	43.8	9.7	34.1
Quintana Roo	Puerto Morelos	42.7	8.7	33.9
Quintana Roo	Solidaridad	37.3	4.3	33.1
Quintana Roo	Tulum	61.8	18.8	43
Yucatán	Baca	39.9	4.3	35.6
Yucatán	Buctzotz	76.4	17.8	58.6
Yucatán	Cansahcab	53.8	9.5	44.3
Yucatán	Celestún	85	25.2	59.8
Yucatán	Chicxulub Pueblo	53.2	9.7	43.5
Yucatán	Dzemul	46.2	5.9	40.2
Yucatán	Dzidzantún	54.6	11	43.6
Yucatán	Dzilam de Bravo	49.4	7.4	42
Yucatán	Dzilam González	76.9	20.1	56.8
Yucatán	Hunucmá	65.3	14.9	50.4
Yucatán	Ixil	59.7	11.1	48.6
Yucatán	Mérida	25.7	2.9	22.7
Yucatán	Mocochá	28.4	3.2	25.1
Yucatán	Motul	50.6	10.3	40.3
Yucatán	Panabá	75.5	18.1	57.3
Yucatán	Progreso	42.1	6.3	35.8
Yucatán	Río Lagartos	27.4	4.3	23.1
Yucatán	San Felipe	32.2	3.4	28.8
Yucatán	Sinanché	65.5	11.2	54.3
Yucatán	Telchac Pueblo	56.4	13.9	42.5
Yucatán	Telchac Puerto	42.5	8.3	34.2
Yucatán	Temax	77.9	21.1	56.8
Yucatán	Tizimín	71.8	24.5	47.4
Yucatán	Yobaín	42.3	7.5	34.9

In the three states, the municipalities within ACCIÓN's intervention area exceed the national average (8.5%) in terms of the percentage of the population living in extreme poverty. The coast of Quintana Roo has the highest level at 14.7%, followed by Yucatán at 11.33%. Campeche is the best positioned of the three, with 9.5%. This means that in the project's area of interest, significant social and economic deprivations persist, limiting people's access to the minimum resources necessary to meet their basic welfare needs.

Main economic activities

AGRICULTURE AND AGROFORESTRY

The YP region maintains large forest extensions in a good state of conservation within socially owned lands. To the south, there are several federal protected natural areas, including the Calakmul and Sian Ka'an biosphere reserves. Forest land use change and degradation due to unsustainable use are priority issues that must be addressed in order to reduce GHG emissions.

The pressure of agricultural activities, such as shifting cultivation of rainfed crops, mainly maize, and the conversion of forests to pasture for cattle ranching, are the main drivers of change that cause deforestation and habitat fragmentation. The increasingly intensive use of land leaves less time and space for the natural recovery of degraded vegetation and is associated with low soil productivity for agricultural purposes, a lack of sustainable technification of good agricultural practices and increased food requirements due to the demographic growth of the rural population living in poverty (CONAFOR, 2014).

It is important to prioritize strategies for the conservation and recovery of forest areas in order to contribute to the achievement of global objectives in the fight against climate change. To this end, it is necessary to strengthen multi-stakeholder capacities to articulate actions that reduce climate vulnerability, as well as to define strategies to conserve forests and reforest areas in order to increase their carbon sequestration capacity.

Small-scale agriculture and agroforestry, dating back to at least 2000 B.C. (Pool et al, 2007), play significant roles in the YP, contributing to local food production, livelihoods, and the preservation of traditional farming practices. While the region's fertile soils, favorable climate, and diverse ecosystems support a range of agricultural activities, small-scale and subsistence farmers are considered particularly vulnerable to climate change impacts in the region as they are experiencing intensification of climate variability, in combination with non-climatic forces which negatively impact the production of maize and other staple crops (Mardero et al., 2018).

The indigenous Maya people practiced extensively rather than intensive agroforestry by hunting and gathering in combination with *milpa* horticulture (Schneider et al., 2017) (a form of agroforestry with high cultural significance) (Pool et al., 2007). *Milpa* is a rotational farming system that involves the cultivation of multiple annual crops, including maize, beans, squash, and chilli peppers in a single plot and can also include the integration of fruit trees into a fallow forest, beekeeping, and maintenance of forest corridors for hunting, wood, and conservation of native species (Varns et al., 2028). The cultivation of these annual crops is complemented by a series of managed and enriched intermediate stages of short-term perennial shrubs and trees, culminating in the re-establishment of mature closed forest on the once-cultivated plot (Meso-American Research Center, 2010; FAO, 2022).

The establishment of tree species like mahogany, cedar, or *ramón* alongside food crops, provides shade, improves soil fertility, and diversifies income sources through the sale of timber and/or non-timber forest products. Increasingly lucrative beef and timber markets and the resultant deforestation pressures in the 20th and 21st centuries have threatened the viability of the *milpa* cultural landscape and tropical ecosystem, which would be more resilient to fires, storms, and soil degradation than the current land use system (Schneider et al., 2017).

More recently, alongside *milpa*, home gardens are still prevalent in the region. Home gardens are small-scale agricultural systems that incorporate diverse plant species, including fruit trees, vegetables, medicinal plants, and herbs. In this context, home gardens are socio-ecological agricultural production systems that involve diversified management of plants and animals for subsistence farming. Home gardens supply farmers with essential goods such as food, medicinal herbs, and timber, as well as occasional income from selling home garden products. The home gardens' contribution to the farmers' livelihoods is critical for marginalized communities. Communities in the YP lowlands maintain a high diversity of plant species in their home gardens within a complex vertical and horizontal structure that mimics the natural ecosystem and often contains 300 to 500 species of plants and animals, where farmers combine practices for soil management, nutrient conservation, and water and crop protection (Neulinger et al., 2013).

Agricultural and agro-forestry livelihood activities hinge on the prevailing land tenure. Five distinct land tenure arrangements are recognized in the YP: i) the home garden, or *solar*, is private land and produce can be sold without constraint; ii) the *milpa* is *ejido* land, primarily for maize cultivation (For which there is a government subsidy of about ~USD 650 per hectare per year), *milpa* is effectively private land; iii) *caña* (or *cañada*) is *milpa* but only after one year of cultivation and is, therefore, less productive (it attracts a slightly lower per hectare government subsidy of ~USD 550 per hectare per year); iv) *parcela*, where communities set aside private land for agroforestry; and v) communal forest land, where fuelwood, timber and non-timber forest products (NTFPs) can be collected for private use but the community assembly must agree to the commercial use of any forest products (Pool et al., 2007). In this regard, compliance with regulations for the commercial use of forest products poses a challenge as it requires an effective governance structure and mechanisms to ensure that community decisions are respected.

Regarding non-timber forest products, the Yucatán Peninsula (YP) has 20 native palm species belonging to 13 genera and three subfamilies. All of these are economically exploited in construction (85%) and honey production (70%), followed by food and medicinal use (35% each), handicrafts (30%), ornamental use (25%), and forage (10%). These data confirm that native palms are an important livelihood for the inhabitants of the Mayan communities in the region, as they represent an additional source of income (Noguera-Savelli & Cetzal-Ix, 2021).

In addition to palms, other non-timber resources such as plant fibers, waxes, and gums are also used in artisanal production. The use of these resources has deep cultural and economic roots, and it is common to see crafts made from plant fibers, especially in local markets and fairs, where these products represent both a livelihood and a cultural heritage (Suárez, 2023).

BEEKEEPING

Nationally, beekeeping is practiced by more than 40,000 producers in Mexico, who have around two million hives in apiaries distributed in the country's five beekeeping regions: the North, Centre and Altiplano, Pacific, Gulf, and the YP. The average annual demand per apiary is approximately US$125,000 of labor in its primary production phase, representing an important source of jobs and income from salary payments in rural areas (Pool et al., 2007).

Beekeeping, also known as apiculture, has been and remains an important activity in Mexico and especially the YP, dating back to the indigenous Mayan civilization. The use of honey in the Mayan culture extended to medicine, where remedies for ear-, eye-, and throat-related illnesses were treated using honey and honey by-products (Echazarreta et al., 1997).

The YP is the apicultural heartland of Mexico as the region's diverse ecosystems, including tropical forests, savannas, and agricultural areas, provide an ideal environment for beekeeping and support a variety of bee species. The YP's bees have access to a variety of flowering plants, including tropical fruit trees, wildflowers, and *Melipona beecheii's* —commonly known as stingless bees— preferred food source, the *nance* tree (*Byrsonima spp*.), contributing to the distinct flavors and characteristics of the region's honey. Beekeeping not only supports community livelihoods but also provides important ecosystem services. Bees are key pollinators that facilitate the reproduction of many plant species, including agricultural crops and wild plants. Their pollination services support biodiversity and enhance agricultural productivity.

There are over 130 species of native bees in the YP, however, only a few are social and can be kept in traditional log hives. Amongst the most important of these is *Melipona beecheii* which build blister-like sacks of honey, and comb inside hollow trunks, which can be cut from the tree and sealed at either end with a wooden disc and mud, to be kept domestically. These traditional log hives are placed in natural settings, allowing bees to forage in the surrounding areas and collect nectar from a wide range of floral sources. Managed hives, including Langstroth and top-bar hives, are also used for European honeybees. While relatively small quantities of honey are harvested in this way (around 0.25-1 litre per colony per year) (Echazarreta et al., 1997).

The YP region is nationally significant since it contributes ~95% of Mexico's honey exports, while accounting for only 30 to 35% of the total number of Mexican bee colonies. Beekeepers in the YP are socioeconomically stratified with two main groups emergent: i) one that represents 95% of the producers and is made up of low-income peasants (mostly indigenous) who own 80% of the apiaries; and ii) the second group comprised of medium-sized beekeepers and fully integrated businessmen, who have modern technology and market honey products as their main economic activity (Martínez-Puc et al., 2018).

During the period 2003-2020, the entities with the highest honey production were Yucatan and Campeche (SAGARPA, 2018). In Campeche, 6,810 beekeepers are registered, 3,520 in Quintana Roo and 10,500 in Yucatan.

This order of magnitude is reflected in the organizational and marketing sense. In Yucatan there are 80 associations (first place nationally), in Campeche 56 associations (third place nationally) and in Quintana Roo 20 (SADER,2023). In the YP there are eight cooperative societies with the largest number of members: Miel y Cera de Campeche and Mielera de Champotón (Campeche), with 3,000 producers; the Cooperative Sociedad de Solidaridad Social Apícola Maya (Yucatan) with more than 4,000 members, and 5 cooperatives with a total of 2,000 members in Quintana Roo. There are also Social Solidarity groups, Women Beekeepers Group, Solidarity Groups with the National Institute of Indigenous Peoples (INPI) and independent beekeepers (SADER, 2023).

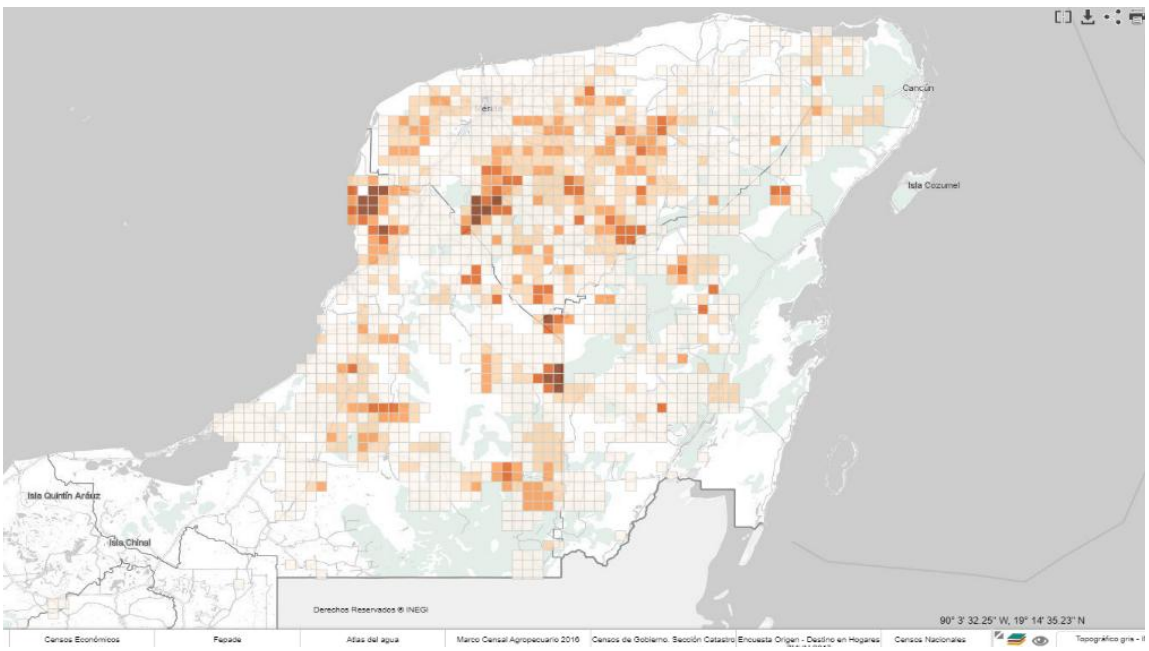


Figure 26 Hive distribution map. Source: INEGI, 2016.

In the municipalities within the project intervention zone, apicultural production is notable in the capital of Campeche, Calkiní, and Champotón, all in this state. Tizimin in Yucatán and Felipe Carrillo Puerto and José María Morelos in Quintana Roo also stand out, benefiting from favorable conditions for this activity such as the warm climate and abundant flora suitable for bee feeding (Figure 26). Honey production in these municipalities not only contributes to the local economy but also supports the conservation of the region's natural ecosystems (INEGI, DENUE, 2023).

Despite their critical role, bees face numerous challenges in the YP. Habitat loss due to urbanization, agricultural practices, and deforestation threatens their natural habitats.

Pesticides and insecticides used in farming can harm bees and disrupt their behavior. Climate change, with its unpredictable weather patterns, can impact the availability of nectar and disrupt the synchronization between plants and their pollinators (see section III.6. Adaptation options and expected impacts for climate-relate challenges of beekeeping).

FISHING

The waters of the YP, are characterized by the presence of a high biological diversity of fish species, including commercially important species such as snapper, grouper, tarpon, snook, and many others. Mangroves, lagoons, and estuaries are particularly important habitats for subsistence fishing in the region, especially in the northern coastal parts of the region which are characterized by the presence of marshland and flood lands, especially during the rainy season from June to October. These areas provide nursery grounds for many fish species and support the overall health of the marine ecosystem. Like beekeeping, agriculture and agroforestry, subsistence fishing in the YP is deeply rooted in the cultural heritage of the region. Fish were undoubtedly important for the region's ancient coastal societies, with fish remains consistently found in excavations of several pre-Hispanic Maya settlements, where fishing was a local subsistence activity that helped to meet the dietary needs of the ancient villagers (Jiménez Cano and Sosa, 2015).

Campeche has an old fisheries tradition with 3,904 boats, of these 96.89% constitute the artisanal fleet with about 12,100 formal and informal fishers. In the coastal zone, there are eight primary fishery sites: Isla Arenas, Campeche, Lerma, Seybaplaya, Champoton, Sabancuy, Isla Aguada, and Ciudad del Carmen, reporting 7,428 formal fishers in 2015, with a total catch of 55,664 tons that year. At the national level, Campeche's fisheries are eighth by volume and value and represent 2.73% of the national production. Yucatan's fisheries tradition is more recent, dating from the mid-1940s. The state has a semi-industrial fleet with 549 ships or boats and an artisanal fleet with 4,654 boats, 14,955 formal fishers and about 50% more informal fishers. Yucatan's fisheries are in 13th place by volume and sixth by economic value on the national level, with 48,213 tons per year representing 2.24% of national production (Pedroza-Gutiérrez et al., 2021).

Regarding economically important species, Mexico has the third-largest octopus fishery in the world. The octopus fishery yields between 9 000 and 21 700 metric tons per year in the YP alone, making it arguably the most economically important marine livelihood activity in the region, particularly from a commercial perspective. The fishery consists of two primary species, the Maya octopus *(Octopus maya)* and the common octopus (*Octopus vulgaris*). The non-migratory Maya octopus (**Error! Reference source not found.**) lives exclusively on the seafloor off the coastal states of Yucatan, Quintana Roo, and Campeche, so all Maya octopus sold in the world comes from this fishery (Porterfield et al., 2022). In 2018, Mexico exported more than 11,700 metric tons of octopus, worth US$94 million.

Around 90% of the fishers in the states of Yucatan and Campeche —about 15,000 in total— fish for Maya octopus (Porterfield et al., 2022). Fishers in Quintana Roo also target the Maya octopus, though to a lesser extent than in Yucatan and Campeche. A total of 3,225 small-scale vessels and 344 large vessels are permitted to fish for octopus in these three states.

Underpinning the fishery are infrastructural investments in warehouses, ice factories, and dedicated octopus processing facilities that provide employment beyond fishing. In addition to bringing in revenue, the Maya octopus is also a highly valued food for locals.

To a lesser extent, inland fishing is also practiced in the YP. Inland fishing is artisanal and subsistence in nature with handlines being the main gear utilized, primarily through barefoot fishing along the shores of limestone-based water bodies, or with the aid of rafts and canoes. In addition to the subsistence benefits of inland fishing, this activity also plays an important cultural and recreational role as part of social reciprocity networks in communally owned land (*ejidos*), beliefs that reflect the close relationship between these communities and the natural environment. Much like many coastal regions around the world, subsistence fishing in the YP faces challenges and pressures. The rapid growth of tourism and commercial fishing, as well as environmental issues such as overfishing and habitat degradation, have had an impact on marine resources and ecosystems. These factors can affect the availability of fish and disrupt the delicate balance of the local ecosystem, potentially threatening the livelihoods of subsistence fishermen (Arce-Ibarra, and Charles, 2008).

In 2020, fishery and aquaculture production in Campeche reached 44,655 tons, with octopus, shrimp and snook being the main products, representing 2.6% of the national volume. The municipality of Carmen is the main producer. Despite the importance of the sector, only 9% of the people employed in the primary sector work in fishing and aquaculture, which is equivalent to approximately 7,910 people.

Most fishing is artisanal, except for species like shrimp, lobster, and demersal fish, which are caught by both fleets. In the three states, several fisheries are at the level of maximum sustainable use (Salas, S., Núñez, et al, 2022). The table 22 below summarizes the status of the resources supporting the main fisheries in the Yucatán Peninsula. In this table, red color means that means that most of the resources exploited by fishermen in the area are in deterioration. Yellow means that the resources are at their maximum sustainable level and green means that the exploitation of the resources is healthy:

Table 22 Status of the resources that support the main fisheries in the states of the Yucatan Peninsula

Resource	Target Species	State of the fishery	%Capture by State
Octopus Gulf of Mexico and Caribbean Sea	*Octopus maya* *O. vulgaris*[3]	Deteriorating Development power	Campeche 29.6%. Quintana Roo 1.1%. Yucatan 68.9%.
Snails Gulf of Mexico and Caribbean Sea	*Lobatus gigas Turbinella angulata*[4]	Deteriorating Maximum sustainable use.	Campeche 94.28%. Quintana Roo 2.30%.

[3] Recently identified as O. americanus (Avendaño et al., 2021).

[4] National Fishing Charter 2018 (DOF,2028)

	Sinistrofulgur perversum *Triplofusus giganteus* *Lobatus costatus* *Strombus pugilis* *Melongena melongena* *Melongena corona bispinosa* *Fasciolaria tulipa*	Deteriorating Deteriorating	Yucatan 1.06%.
Robalo and Chucumite Gulf of Mexico	*Centropomus undecimalis C. poeyi* *C. parallelus*	Making the most of sustainable. Overexploited in Campeche	Campeche 29.9%. Quintana Roo 1.4% Yucatan 1.6%.
Crab Gulf of Mexico	*Callinectes sapidus* *C. rathbunae* *C. bocourti* *C. similis* *C. ornatus*	Maximized to sustainable use	Campeche 27.1%. Yucatan 0.8%
Horse mackerel[4] and cojinuda[5] Gulf of Mexico and Caribbean Sea	*Caranx latus* *C. hippos* *C. crysos*	Healthy- Levels close to maximum sustainable yield	Campeche 29.2%.[4], 6.9%**Error! Bookmark not defined.**[5] Yucatán 3.5%4, 1%**Error! Bookmark not defined.**
Stripes Gulf of Mexico	*Hypanus americanus* *Actobatus narinari* *Rhinoptera bonasus* *Cymnura micrura* *Pseudobatos lentiginosus* *Styracura schmardae*	Maximized to sustainable use	Campeche 32.6%.[4]; 6.9%[5] Quintana Roo 0.2% 0.2% 2[4]; 1.9%[5] Yucatán 1%.[4]; 6%[5]

[5] National Fishing Charter 2012 (DOF,2021) and National Fishing Charter 2022 (DOF, 2022)

	Bathytoshia centroura		
Sierra and Peto Gulf of Mexico	*Scomberomorus regalis* *S. maculatus* *S. cavalla*	Maximized to sustainable use	Campeche 35.8%. Quintana Roo 0.1%. Yucatan 1.0%
Red snapper and snappers Gulf of Mexico and Caribbean Sea	*Epinephelus morio Mycteroperca bonaci*	Fully exploited sustainable with signs of overexploitation in some federal zones (west, central and northern Yucatan).	Campeche 7.7%. Quintana Roo 6.6%. Yucatan 75.8%.
Red snapper and snappers Gulf of Mexico and Caribbean Sea	*Epinephelus morio Mycteroperca bonaci*	Deteriorating	Campeche 18%. Quintana Roo 5.3% Yucatan 15.4%.
Sharks Gulf of Mexico and Caribbean Sea	*Rhizopronodon terranovae* *Sphyrna tiburo* *Carcharhinus limbatus* *C. acronotus* *S. lewini* *C. leucas* *C. falsiformis* *C. porosus* *C. brevipinna*	Maximized to sustainable use	Campeche 15.4% Quintana Roo 5.3% Yucatan 11.8%
Lobster Gulf of Mexico and Caribbean Sea	*Panulirus argus* *Panulirus guttatus*	Fully exploited sustainable with signs of overexploitation in some focal zones (west, central and northern Yucatan).	Quintana Roo 46.1%. Yucatan 53.9%.
Sea cucumber from the Yucatan Peninsula	*Isostichopus badionotus* *Astichopus multifidus* *Holoturia floridana* *H. mexicana*	Overexploited	Campeche 6% Quintana Roo 0.1% Yucatan 93.6%

Red shrimp and rock shrimp Gulf of Mexico and Caribbean Sea	*Farfantepenaeus* *Brasiliensis* *Sicyonia brevirostris*	Deteriorating	Quintana Roo Red shrimp 81% Rock shrimp 19%.
Pink shrimp Gulf of Mexico	*Farfantepenaeus*	Deteriorating	Campeche 64.9%.
Marine catfish Gulf of Mexico	*Catfish marinus* *Ariopsis felis*	Overexploited and at risk of deterioration	Campeche 49.6%. Yucatan 16.5%.

Currently 85% of the Aquaculture Production Units in Campeche are at the rural aquaculture level, and most of them are located in the most marginalized areas of the state. This reflects the importance of fishing and aquaculture for coastal communities in Campeche, since it is a source of employment and economic development for marginalized areas (see section III.6. Adaptation options and expected impacts for climate-relate challenges of fishing).

TOURISM

The YP is renowned for its cultural and historical attractions — a tourist field survey undertaken in Quintana Roo by the World Bank in 2020 found that more than 80 percent of tourists were interested in visiting archaeological sites and carrying out activities related to them. The ancient Mayan ruins of Chichen Itza, Tulum, Uxmal, and many others attract visitors interested in exploring the region's rich archaeological heritage. The colonial cities of Merida and Campeche offer well-preserved architecture, vibrant markets, and traditional festivals that provide insights into the region's colonial history and indigenous cultures.

In quantitative terms, tourism represents 8.7% of the national gross domestic product (GDP) mainly through the use of coastal areas where almost half of Mexico's population lives. The tourist sector is critically important for livelihoods in the YP, representing 10.1% of the state's GDP, while 13.4% of the economically active population of the state and 10.5% of its companies are engaged in tourism. Campeche's reliance on tourism mirrors the national ratio and provides 8.7% of the state's GDP (Neulinger et al., 2013).

There is a growing emphasis on sustainable and community-based tourism in the YP. Initiatives focus on promoting responsible tourism practices, supporting local communities, and preserving the region's natural and cultural heritage. A priority challenge for the YP's coastal areas is the lack of sustainability of the tourism model that has driven economic growth, particularly in Quintana Roo. This represents an important case of an economy whose development has been led by the expansion of the tourist industry organized around the traditional model of the tourist enclave and beach resort concentration. Deteriorating environmental conditions and changing international trends combined with climate change threats have made this tradition obsolete as a model of industrial organization, and increasingly unreliable as an engine of sustainable development. Moreover, the model has excluded local populations, particularly indigenous households, from its economic benefits. Encouraging the indigenous community's involvement in the various segments of the tourism value chain, including agriculture, transportation, lodging, and tourism operations is seen as a critical measure to improve the sustainability of the tourism sector (The World Bank Group, 2020).

Tourism can be a valuable source of economic growth and cultural exchange, but it can also negatively impact local communities and the environment. In response to this, many communities in the YP have turned to community-based tourism as a way to promote sustainable development and preserve their cultural and natural resources. Community-based tourism faces several challenges in the YP including a lack of resources and training for community members to effectively manage and promote their tourism products. In addition, community-based tourism often competes with larger, more established tourism businesses that have greater resources and can offer lower prices (Jouault et al, 2022).

Community-based tourism in the YP has provided new opportunities for women's participation and leadership in local communities. Through community-based tourism projects, women can actively participate in the planning, management, and promotion of tourism in their area, which in turn can generate economic and social benefits for them and their families (Sánchez et al, 2018; Casais et al. 2015). (see section III.6. Adaptation options and expected impacts for climate-relate challenges of tourism).

II.2. Gender assessment

The Sustainable Communities for Climate Action in the Yucatan Peninsula (ACCIÓN) project aims to increase the climate resilience of vulnerable communities, ecosystems, and productive systems in coastal areas through ecosystem-based adaptation (EbA) and sustainable livelihoods in marine-coastal regions of the Yucatán Peninsula. To ensure appropriate participation of both women and men in the activities and benefits of the Project, a Gender Assessment and a Gender Action Plan were conducted.

The Gender Assessment identifies and describes relevant gender gaps in the project intervention area. It addresses issues such as the sexual division of labor and differentiated access to natural resources and identifies gender risks associated with project implementation. The Gender Action Plan details gender-sensitive measures to address these risks and enhance equal benefits.

The content of this document is organized as follows: We begin with an analysis of Public Policies for the Promotion of Gender Equality in the Yucatán Peninsula and Federal Policies and Frameworks, followed by Regional Policies by State, with specific details for Campeche, Quintana Roo and Yucatán. Subsequently, the "Demographic and Economic Characteristics of the Population" is examined, which includes segments on indigenous population, Afro-Mexican population, education and economy.

The section on "Gender relations in the main local productive sectors" describes the economic activities carried out by men and women and the constraints women face in carrying them out or benefiting from them on an equal footing. The analysis of "Identified Gender Risks" precedes the "Gender Action Plan". Finally, the "Process of socializing the gender assessment and action plan " is described and a "Photographic Memory" is included as a conclusion.

Part I: Gender Assessment

Public Policies for the Promotion of Gender Equality in the Yucatán Peninsula

Federal Policies and Frameworks:

- 2011 Human Rights Reform: Integrates all human rights into the Constitution and international treaties, establishing the pro-persona principle to maximize protection for individuals.
- General Law for Equality between Women and Men: Its purpose is to regulate and ensure equal opportunities and treatment between women and men, proposing guidelines and institutional mechanisms that guide the Nation towards the achievement of substantive equality in both public and private spheres.
- General Law on Women's Access to a Life Free of Violence: Reviewed frequently since 2007, this law aims to establish coordination among the Federation, federal entities, and municipalities to prevent, punish, and eradicate violence against women, adolescents, and girls.
- National Program for Equality (PROIGUALDAD 2020-2024): Aims to empower women's economic autonomy, recognize and redistribute care work, improve health and well-being, combat violence, ensure participation in decision-making, and create safe environments.

Regional Policies by State:

Each state in the Yucatán Peninsula has developed policies and agencies aligned with federal laws to promote gender equality and combat violence against women. Regional strategies include the establishment of municipal agencies, development centers, and specialized support services.

Campeche

- Women's Institute of the State of Campeche: Focuses on ensuring equal rights, promoting gender equity, and implementing public policies for women. Key programs include:
    - PROABIM (Program for the Advancement, Well-being, and Equality of Women): Supports equal opportunities and reduces gender inequality gaps.
    - FOBAM (Fund for the Well-Being and Advancement of Women): Funds projects to address child and teenage pregnancy.
- Development of Women Centers: Implement activities to promote women's development, autonomy, and empowerment across the state's municipalities.

- Gender Violence Alert: is a mechanism for the protection of women's human rights, derived from the General Law on Access of Women to a Life Free of Violence. Eight municipalities in the state have been declared on alert: Calakmul, Calkiní, Campeche, Candelaria, Champotón, Escárcega, Hecelchakán and Hopelchén.

Quintana Roo

- Quintana Roo Women's Institute (IQM): Strengthens women's organizations through:
  - Municipal Women's Agencies: Established in municipalities such as Benito Juárez and Solidaridad.
  - Centers for the Development of Women: Located in Bacalar, José María Morelos, Felipe Carrillo Puerto, Tulum, Puerto Morelos, Lázaro Cárdenas, and Isla Mujeres.
  - IQM Offices: Situated in several municipalities including José María Morelos, Felipe Carrillo Puerto, Tulum, Benito Juárez, Solidaridad, Lázaro Cárdenas, and Cozumel.Principio del formulario

Yucatán

- Centers for the Development of Women: Provide workshops for personal improvement, empowerment, and women's rights promotion.
- Gender Violence Alert: The state has not had any gender alert, although in 2017 there was a request to declare one, which was not granted.
- Observatory of Women's Political Participation: Promotes women's political involvement and decision-making, aiming to close gender gaps.
- Municipal Women's Agencies: Required in all municipalities by state law to provide counseling, support, and referral services.
- Municipal Centers for Attention to Violence Against Women: Offer legal advice and support for women facing gender violence. There are about 20 centers statewide, with three in coastal municipalities: Tizimín, Progreso, and Hunucmá.

Demographic and economic characteristics of the population

Population.

The ACCIÓN Project will be implemented in the marine and coastal landscape of the Yucatán Peninsula, which includes the states of Campeche, Yucatán, and Quintana Roo. This 20 km strip of land and 20 km offshore area is home to a range of communities from small rural settlements to large cities. The total population in the area is 2.3 million, with a nearly equal distribution between men (49.9%) and women (50.1%). The majority of the population is young, with specific age ranges prominent in each state: Campeche (30-34 years), Quintana Roo (25-29 years), and Yucatán (5-9 years).

Indigenous People and Afro-Mexicans

Although the Yucatán Peninsula has a significant indigenous demographic presence, this is much smaller in the project area, since traditionally indigenous regions are located in the central part of the peninsula and sparsely along the coastline. In the coastal areas, only 17% live in indigenous households, and less than 10% speak an indigenous language. The most numerous group is the Maya, but there is also a diversity of ethnic groups from other regions of the country (Tseltal, Ch'ol, and Tsotsil) and even from Central America (Mam and Q'anjob'al).

While more men than women speak an indigenous language in the three states, there is an additional peculiarity in the case of monolingualism. In Campeche, there is parity between male and female monolinguals; in Yucatán, there are 2% more male monolinguals than females, whereas in Quintana Roo, there are 18% more female monolinguals than males. This greater difference may be because Quintana Roo hosts the most traditionally Maya communities on the entire peninsula, and women continue to play a role based on strong cultural organization.

The presence of the indigenous population in the coverage area is crucial to the project. Although not numerically predominant, they play an important role in certain productive activities traditionally associated with coastal and marine production systems, particularly in Quintana Roo with fishing, tourism, and beekeeping. The project's opportunities for including indigenous populations and women lie in the contributions these sectors can make to sustainable management and conservation of natural resources due to their ancestral relationship with the ecosystems present in the coverage area.

The Afro-Mexican population in the area is 61,099 people, primarily concentrated in Quintana Roo (72%), followed by Campeche (21%) and Yucatán (7%). Overall, they represent less than 2.9% of the total population in these states, with no significant historical settlements. Afro-Mexican communities are found in large cities such as Cancún, Playa del Carmen, and Chetumal. In terms of gender differences, the disparity in any case does not exceed one-tenth of a percentage point.

Health

Most of the localities within the ACCIÓN area have basic health centers, but specialized care may require long-distance travel. Although there is generally a low fertility rate throughout the project's coverage area, there is an observed increase in the number of live births among women living in coastal localities, particularly in Campeche. This trend could be related to limitations in access to reproductive health services and other cultural factors that reflect a disparity in living conditions between small communities and urban centers. The main causes of death for both men and women are heart disease, diabetes, and malignant tumors. Life expectancy is higher for women due to their caregiving roles and lower exposure to risks.

Education

Illiteracy varies among the three states, with Yucatán having the highest percentage (4.55%) and Quintana Roo the lowest (2.27%). The illiteracy gap between men and women is more pronounced in the coastal localities of Yucatán. The higher number of women who cannot read and write may limit their development opportunities through access to credit, technology, or technical advice.

The average years of schooling across the three states is 9.8 years; for women, the average is 9.7 years, and for men, it is 9.9 years. In the localities within the project intervention area, the average years of schooling are reduced. The trend of higher educational attainment among men compared to women is especially notable in Campeche and Quintana Roo, with almost a year of difference. Similarly, educational gaps are also more pronounced among the indigenous population, not only due to language barriers but also due to the lack of nearby educational infrastructure in the communities, which are often located far from urban centers.

Occupation and Employment

The Economically Active Population (EAP) is highest in Quintana Roo (68%), followed by Campeche (63%) and Yucatán (58%). State-level data broken down by gender reveal that the male EAP is between 20% and 25% higher than the female EAP, and this gap increases at the municipal and local levels, reaching up to 30% in Yucatán. Most of the population works in the tertiary sector, followed by the secondary and primary sectors. Income is higher in Quintana Roo and lower in Campeche, with a difference in earnings between women and men across all states, favoring men.

It is important to consider that the lower economic activity of women can be interpreted in various ways. On one hand, it may mean that the activities they perform and their contributions to the family economy are not visible, as they may be considered “non-productive” or “informal,” even though they do generate monetary or in-kind income.

Land ownership

There are 753 ejidos in the Yucatán Peninsula: 274 in Campeche, 254 in Quintana Roo, and 225 in Yucatán. It is noticeable that the percentage of female representatives is quite similar across the three states, not exceeding 15% of the positions, which is the maximum in Quintana Roo. In the case of ejidal representatives by governing body, women's participation is more limited in higher-ranking positions, with only 7% of presidencies held in Campeche's ejidos and 5% in Quintana Roo.

The most common risks for women in the ejidos stem from their limited participation in the ownership of communal land, in representative positions, and consequently, in access to means of production and development.

Gender Inequality Index

Since 2020, the UNDP has developed the Gender Inequality Index (GII) at the municipal level, "which measures the inequality between men and women in a specific territory based on three components: empowerment, labor market participation, and reproductive health" (UNDP, 2023a). For the municipalities within the project’s coverage area, those with the highest inequality indices are located in the eastern part of Yucatán, while those with the lowest inequality are found in Campeche. There is no clear trend explaining why some municipalities are more unequal; for instance, in Quintana Roo, they tend to be more urban, whereas in Yucatán, they are smaller communities. Conversely, in Campeche, large cities like Carmen have the lowest gender inequality index, which may be attributed to women's economic participation.

Violence against women

Violence against women is a public health issue and a violation of human rights. According to the ecological model (Olivares et al., 2011), understanding the causes of gender-based violence requires examining individual, familial, community, and social levels. There is no single explanatory factor for violence; it can be exacerbated by poverty, lack of opportunities, unemployment, and environmental degradation, impacting the well-being of women and the most vulnerable populations.

Yucatán has the highest percentage of women over 15 who have experienced violence compared to the national average, with psychological violence being the most frequent, followed by sexual, physical, and economic violence. Quintana Roo ranks second in the region with percentages slightly above the national average regarding experienced violence, while Campeche has the lowest percentage, falling below the national average. At the municipal level, the trend is different. In Campeche, eight municipalities have declared a Gender Violence Alert against Women, three of which are located in the coastal area: Calkiní, Campeche and Champotón.

The ACCIÓN project must establish mechanisms to ensure equal opportunities and avoid perpetuating gender violence, promoting equitable participation of men and women and creating spaces for women to make decisions.

Gender relations in the main local production sectors

Understanding the sexual division of labor and the challenges faced by the local population in their primary productive activities is essential for implementing actions that promote equal participation and benefit for both men and women within the project.

Table 23 Gender participation and limiting factor in main productive systems

Productive system	Men's participation	Women´s participation	Limiting factors for women
Beekeeping	1. The *Apis mellifera* is managed by men because it is part of activities related to the milpa (cornfield); the hives are located in areas far from the home, and the bee is considered dangerous.	1. The Melipona bee is managed by women as an extension of their domestic activities. The bee does not have a stinger and is kept in the backyard. 2. The products made with Melipona honey are associated with characteristics culturally attributed to women.	1. Lack of access to own land. 2. Lack of access to technical training and the strengthening of financial capacity for honey production and management of its by-products.
Fishing	1. They have access to resources of higher economic value.	1. They have access to resources of lower economic value.	1. Fishing regulations thatfavor men's access to permits and,

Productive system	Men's participation	Women´s participation	Limiting factors for women
	2. They hold most of the fishing permits. 3. They obtain resources throughdirect capture. 4. They have greater decision-making power over the resources.	2. They carry out complementary activities, such as fish filleting and bait catching. 3. They obtain resources from estuaries or areas adjacent to the coast.	consequently, to resources. 2. Gender norms and representations that limit women's participation.
Natural-based tourism	1. It is the secondary activity carried out bymen as an alternativeto fishing. 2. They have access to infrastructure and equipment (boats) to perform the activity.	1. Most women engage in activities that reinforce their traditional gender roles, such as food preparation and cleaning. 2. Although it is an activity with greater potential for participation compared to fishing.	1. Lack of access to credit. 2. Lack of access to capacity building. 3. Lack of promotion of service offerings. 4. Traditional gender roles.
Handcrafts	1. Lower participation of men. 2. Participation in collecting raw materials, such as seashells, sand, scrap wood, tools, and equipment.	1. Greater participation of women in both production and sales.	1. Lack of promotion ofthe activity to make it more profitable. 2. Limitations to incorporating a greater number of women.

Gender Risks

Based on the general conclusions of the gender evaluation, the following summarizes the main risks identified for the equal participation of men and women in the ACCIÓN project.

Table 24 Identified gender risks

Gender risks	Risk category	Impact	Topic
Risk of null or low participation of the indigenous women in project activities due to limited access to project information, dissemination through inappropriate channels for their communication channels or linguistic characteristics, with a greater impact on women who tend to have a higher level of monolingualismand are linked to traditional roles where they have less participation in public and collective life spaces.	Low or no participation	High	Culturally appropriate communication
Risk of non-inclusion or limited access of women to project benefits due to the digital divide in families, low availability of communication servicesin homes, and lack of infrastructure in communities, if project communication focuses onthese channels.	Low or no participation	Moderate	Culturally appropriate communication
Risk of non-compliance with indigenous women due to the lack of consultation processes and failure to obtain prior, free, and informed consent in traditional areas or habitats.	Social dissatisfaction	High	Project consultation and dissemination
Risk of excluding women from financing opportunities if the project establishes requirements that are impossible for them to meet, such as property ownership, fishing permits, or belonging to legally constituted groups.	Exclusion	High	Eligibility criteria for women
Risk of excluding women from the project if traditional gender schemes and roles are reproduced, limiting them due to their marital status, ethnicity, educational level, illiteracy, and/or place of origin.	Exclusion	High	Eligibility criteria for women
Risk of perpetuating gender inequality gaps in economic activities by excluding women from theproject who do not have fishing permits, land titles, or access to means of production.	Reproduction of Inequalities	Very High	Eligibility criteria for women
Risk of perpetuating gender inequalities if the project does not consider actions for the conservation of lower economic value resources inmarine coastal production systems, which are captured and commercialized by women.	Reproduction of Inequalities	High	Eligibility criteria for women
Risk of non-inclusion of indigenous women due tothe lack of identification of indigenous communities in the territory, whether due to livingin remote or inaccessible areas, being located far from the coast (which concentrates the most important economic activities in the coverage area), being demographically minority groups, or being dispersed in large urban areas.	Low or no participation	High	Eligibility criteria for women
Risk of non-inclusion of Afro-Mexican women dueto their minority status and dispersion in the project's coverage area, which could make them invisible. Although this social sector has a low proportion at the local level, they could live in concentrations as a cultural unit that would give them the same collective rights as indigenous peoples.	Low or no participation	Moderate	Eligibility criteria for women
Risk of non-inclusion of youth, children, or students due to their non-economically active status and lack of	Low or no participation	Moderate	Eligibility criteria for

Gender risks	Risk category	Impact	Topic
visibility as stakeholders.			women
Risk of duplication in support for organizations and additional efforts in gender equality, due to a lack of coordination with local specialized institutions and those with responsibilities in women's care.	Poor management	Bajo	Project management
Risk of low or null effectiveness of the project toprovide development opportunities for women because their needs and interests were not considered, in addition to not providing the necessary flexibility for the fulfillment of theirdifferent activities.	Reproduction of Inequalities	High	Project impacts
Risk of deepening the subordination of women inproject activities due to the persistence of traditional gender roles that could limit their access to economic activities, as well as the transfer of domestic roles to productive activitiesthat assign less significant tasks to women.	Reproduction of Inequalities	High	Project impacts
Risk of maintaining or increasing the deficit in the inclusion of women in project activities due to the perpetuation of gender social norms related to the sexual division of labor.	Reproduction of Inequalities	High	Project impacts
Risk of expanding women's inequality gaps if aspects of women's empowerment and access tothe labor market, which are two key elements ofthe gender inequality index, are not considered.	Reproduction of Inequalities	High	Project impacts
Risk of increasing the gender gap in women's participation in the project due to the inability to overcome barriers that could arise from their marital status, reproductive health, or traditional roles of responsibility in the domestic sphere.	Reproduction of Inequalities	Moderate	Project impacts
Risk of maintaining or widening the wage, income, and asset gaps between men and women.	Reproduction of Inequalities	High	Project impacts
Risk of reproducing barriers to women's participation in the project due to the creation of agreements within working groups that could limitthe greater inclusion of women in productive andconservation activities due to a perception of competition.	Reproduction of Inequalities	High	Project impacts
Risk of reproducing inequalities in women's access to means of production and development in ejidos and agrarian communities due to their limited participation in holding social property titles and representation positions, as well as the undervaluation of their involvement in agrarian organizations.	Reproduction of Inequalities	High	Project impacts
Risk of widening gender inequalities due to the lack of social recognition of women's economic contribution to households and their involvementin marine and coastal production systems.	Reproduction of Inequalities	High	Project impacts
Risk of an increase in double or triple work shifts for women due to their participation in the project, given the marginalized conditions of the communities in the project's coverage area and the shortcomings of the households, where women are primarily responsible for efforts to alleviate them.	Reproduction of Inequalities	Very High	Project impacts
Risk of maintaining the deficit of women's knowledge or skills regarding the use of information technologies, which could affecteconomic activities that heavily rely on these resources, such as ecotourism services and the	Reproduction of Inequalities	High	Project impacts

Gender risks	Risk category	Impact	Topic
marketing of fishery products, among others.			
Risk of maintaining existing social and gender norms in the beekeeping system, which have limited women's access to technical training, strengthening financial capacities for production, and adding value to honey and its byproducts.	Reproduction of Inequalities	Very High	Project impacts
Risk of reproducing exclusion patterns for women in higher-value productive activities within the project's coverage area due to stereotypes that limit their activities to the domestic sphere or because they lack the necessary skills as women,among other reasons. This is especially prevalentin fishing.	Reproduction of Inequalities	Very High	Project impacts
Risk of perpetuating or widening the gender gap inclimate change knowledge, particularly among vulnerable populations, hindering their participation in mitigation actions.	Reproduction of Inequalities	High	Project impacts
Risk of exacerbating and perpetuating gender inequalities by failing to consider the gender- differentiated impacts of climate change across urban and rural settings, particularly on vulnerable social groups with specific needs and interests.	Reproduction of Inequalities	High	Project impacts
Risk of perpetuating organizational inequalities by neglecting the development of female leadership.	Reproduction of Inequalities	High	Project impacts
Risk of manifestation of acts of violence against women (mainly community, family, and intimate partner violence) in the context of the project, as aproblem inherent to the social context of the region.	Violence against women	Very High	Prevention of violence
Risk of occurrence of crimes against women, children, and girls in certain project activities andareas (such as human trafficking, rape, child corruption, and femicide) due to the high prevalence of these in the region.	Violence against women	Very High	Prevention of violence

Part II: Gender Action Plan

ACCIÓN aims to increase climate resilience for vulnerable communities and populations, including women and girls, as well as ecosystems and productive systems along the coast of the Yucatán Peninsula (YP) through ecosystem-based adaptation (EbA) and sustainable livelihoods.
By the end of the project, the expected impacts on women are as follows:
1. Increased resilience to climate change for women living in vulnerable communities within the intervention area.
2. Enhanced capacities of women for the sustainable management of coastal and marine ecosystems through their participation in conservation, restoration, and productive activities.
3. Access for women to sustainable financing mechanisms to expand EbA projects and improve their productive activities, microenterprises, cooperatives, and others.
4. Increased knowledge among women about climate change and strengthened multilevel coordination mechanisms in the region to reduce their vulnerability to this situation.

To achieve these impacts, the project's gender assessment identified a series of risks associated with four general issues:
a) Exclusion of women due to their gender, cultural identity, marginalization within their communities, migratory status, and other factors that block their access to programs, projects, and development opportunities.
b) Limited or unequal inclusion of women in projects that overlook or undervalue their contributions and tend to perpetuate stereotypes and gender roles.
c) Limited experience of women in high-value economic activities within marine-coastal systems due to historical and social gender assignment to men.
d) The prevalence of certain types of gender-based violence in the project's coverage area that could arise during project implementation.

To address these identified issues and promote equal participation of women and men in project actions, the following Gender Action Plan has been developed.

Output 1: Ensure gender mainstreaming throughout the life of the project								
Activities	**Indicators**	**Base line**	**Targets**	**Means of verification**	**Budget**	**Timeline**	**Responsible**	**Relevant Component**
1.1 Promote equal employment opportunities for men and women within the Accredited Entity and ensure that there are no wage differences based on gender.	Percentage of wage difference between men and women for performing the same activities.	0%	0%	Contracts	To be defined	Throughout the project lifecycle	FMCN	All
1.2 The project's communication and knowledge management tools will: -Ensure that women and menare equally represented (parity). -Reflect the diversity and heterogeneity of people (age, ethnicity, culture, type of physique, complexion, gender identity,etc.) -Avoid reproducing gender stereotypes in audiovisual messages, especially regarding gender assignment in productive and reproductive activities. -Use inclusive and non-sexist language. -Promote gender equality through message titles and content. -Emphasize in all dissemination campaigns that women can participate in the project and that there are no political, religious, ethnic or other types	Percentage of communication materials developed with a gender perspective.	0	100%	Communication materials	$50,000.00	Throughout the project lifecycle	FMCN-Sureste Sostenible	All

of discrimination. -Systematize lessons learned, good practices and success stories, mainly from the women participating in the project, so they can talk about the work carried out and the benefits obtained to encourage other women to participate.								
1.3 Socialize and promote appropriation of the project's Grievance and Consultation Mechanism among the beneficiary population, to receive and investigate complaints of gender-based violence, as well as harassment, sexual harassment and abuse or other problems related to project activities. The agency in charge of project implementation shall: • Use the media to disseminate information on receiving complaints, the rights of complainants, the processing of complaints and the expected results. • One of the means of greater penetration in the communities is WhatsApp, so a number for this mechanism could be enabled. Conduct an evaluation of the complaints received at the MAQ to prevent new issues.	Percentage of events (workshops, courses, informative talks) in which the MAQ and its WhatsApp number are socialized by the project implementation team.	0%	100%	Case registra tion and annual MAQ reports	$0.00	Annual report throughou t the project lifecycle	FMCN-Sustainabl e Southeast	All
	Percentage of complaints and denunciations of gender-based violence attended	0%	100%					
1.4 Include criteria and questions in the external mid-term and final project evaluations to demonstrate the impacts the project has had on women. For example, benefits (tangible and intangible), such as capacity building, increasing their assets (e.g. fishing permits, equipment for productive activities,), and other aspects that enhance their access to higher-value resources.	Chapter or Section on Gender in External Evaluation Reports	0	1 section in each external evaluati on (2 in total)	Mid-term and final external evaluation reports	To be defined	At the mid-point and at the end of the project	FMCN	All
Output 2: Ensure that women benefit from the activities financed by the project in ecosystem conservation, ecological restoration, and sustainable production.								
2.1 The request for proposals (Component 1 and 3) for the different activities financed must be designed with a gender perspective: • Ensure that request for are simple, brief, and easy to understand. • Use inclusive and non-sexist language. • Highlight the possibility and importance of women's participation. Include eligibility criteria that promote the inclusion of women in project activities, such as: • Prioritizing the funding of productive and	Percentage of request for proposals designed with gender perspective.	0%	100%	Request for proposals	$0.00	Initial stage	FMCN-Sureste Sostenible	Component 1 and 3

conservation initiatives led by women, where their participation is significant either quantitatively or qualitatively, or in sectors where they have traditionally been excluded or subordinated in terms of economic benefits. • Avoid eligibility criteria related to land ownership, fishing permits or concessions, technical knowledge, minimum education levels, age limits for participation, Spanish as the dominant language, or non-native status in the project areas (internal migrants).								
2.2 Disseminate the request for proposal through accessible means for women, for example: • Conduct workshops for socializing the request for proposal directed to the OLLC and local population in the intervention areas. • Disseminate through audiovisual media and not only in written formats (local radio stations and social networks). • Interpret key information into the major indigenous languages spoken in the region (Maya, Tzeltal, and Ch'ol) when local contexts require it. • Distribute the request for proposals in accessible locations for women, such as schools, plazas, community centers, municipal women's agencies, among others.	Number of gender-sensitive request for proposals socialization events conducted	0	3 events (one per State)	Portfolio of evidence of events (session plan, attendance list, memory, photographs)	$150,000	Initial stage	Sureste Sostenible -FMCN	Component 1 and 3
	Number of media and channels used to disseminate request for proposal and promote women's access to them	0	To be defined	Media and communications	$10,000	Initial stage	Sureste Sostenible -FMCN	Component 1 and 3
2.3 Promote, during the request for proposal socialization process, the connection between potential female beneficiaries and established OLLCs with experience or interest in the project topics, as well as in working with women's groups.	Percentage of request for Proposals socialization events where OLLCs are linked with potential female beneficiaries.	0%	100%	Portfolio of evidence of events (session plan, attendance list, memory, photographs)	$0.00	Initial stage	Sureste Sostenible -FMCN	Component 1 and 3
2.4 Incorporate at least one gender-specific activity and indicator in each subproject, and PLAT to	Percentage of subprojects, and PLAT that incorporate at least	0%	100%	Results framewor	$0.00	Initial stage	OLLCs and FMCN	Component 1 and 3

promote gender equality and address the interests and needs of women.	one gender-specific activity and indicator.			k for subproject , and PLAT				
2.5 Develop capacities in the selected OLLCs a of Component 1 and PLATs of Component 3 on how to incorporate a gender perspective into the performance of their function.	Percentage of OLLCs and PLATs trained on gender perspective	0%	100%	Portfolio of evidence of events (session plan, attendance list, memory, photographs)	$150,000	Initial stage	FMCN - Sureste Sostenible	Component 1 and 3
2.6 Ensure that women directly benefit from the activities financed by Subprojects and PLATS of the project, including receiving technical assistance, working directly in the implementation.	Percentage of women directly benefiting from the project trough financed Subprojects and PLATs.	0%	At least 30%.	Beneficiary population databases disaggregated by gender	To be defined	Annual reports throughou t the project implement ation cycle	Sureste Sostenible -FMCN	Component 1 and 3
Output 3: Increase the capacities and knowledge of women regarding climate change and reduce their vulnerability								
3.1 Strengthen multilevel and multi-stakeholder coordination mechanisms in the region to contribute to reducing climate change vulnerability from a gender perspective.	Number of workshops for multilevel and multi-stakeholder coordination mechanisms to build capacity in climate change vulnerability with a gender perspective.	0	2 at regional level	Portfolio of evidence of events (session plan, attendanc e list, memory, photograp hs)	$210,000	Years one, two and three of project implement ation	Sureste Sostenible -FMCN	Component 4
3.2 Within the framework of the coastal and marine EbA learning community, conduct experience exchanges to gather both lessons learned and best gender practices, highlighting women's initiatives and fostering relationships for innovation and co-creation. In these exchanges, women will evaluate their work, visualize the impacts achieved on their substantive role in the execution of activities, and collectively build their success stories in the project to strengthen their participation and leadership.	Number of experience exchange workshops to address women's needs and promote gender-transformative approaches.	0	1 at national level. 3 at regional level (5 in total)	Portfolio of evidence of events (session plan, attendanc e list, memory, photograp hs)	$500,000.00	Annual events throughou t the implement ation of the project	Sureste Sostenible -FMCN	Component 4

Process of socializing the gender assessment and action plan

The Gender Action Plan included a socialization process through which it received feedback from local stakeholders, especially women. The socialization was carried out through three community workshops held in Isla Arena, Campeche; San Felipe, Yucatán; and Buenavista, Quintana Roo.

Each workshop lasted an average of three hours. In Isla Arena, 21 people participated: 2 men and 19 women. The main sectors represented were fishing, tourism, and conservation. In Buenavista, 15 people attended: 10 women and 5 men working in tourism, beekeeping, and handicrafts. In San Felipe, 8 fisherwomen participated.

For more information on Gender Action Plan, see Annex 4 Gender assessment and action plan.

II.3. Financing options, reasoning for the concessionallity requested, capex and opex (O&M) description

GCF funding is crucial for ACCIÓN, which aims to increase climate resilience for vulnerable communities, ecosystems, and productive systems along the YP's coastlines. ACCIÓN aligns with GCF priorities, focusing on community livelihoods, ecosystem services, and EbA approach. The project targets protecting mangroves, establishing fishery recovery areas, and enhancing coastal protection. ACCIÓN is aligned to GCF Sectorial priorities addressing GCF possible action outlined in the guidelines: (i) Forest and Land use (for example, strengthening systems of protected areas (Outcome 2), catalysing climate innovation and mobilisation of finance at scale (Outcome 3); and supporting coalitions and knowledge to scale up success (Outcome 4); and (ii) Ecosystem and ecosystem services: for example, the focus on enabling environment for EbA in coastal and marine areas (all Outcomes), novel value chains in niche markets, incubation and acceleration programmes with ecosystems-based management approach, and multi-stakeholder partnerships for innovative finance (Outcome 2). This alignment makes GCF an appropriate donor, particularly given Mexico's financial constraints in addressing climate change. GCF is the adequate donor due to its specific focus on climate resilience, its experience in funding similar climate-related projects. This funding presents a significant opportunity to tackle to bridge Mexico's adaptation finance gap and is pivotal in addressing climate challenges, particularly in the YP.

The GCF concessionallity is strategically passed down to the beneficiaries by providing them with access to financial resources that would otherwise be inaccessible due to high costs. These concessional funds serve as critical entry points, enabling beneficiaries to transition to more sustainable and often more expensive activities that they would not be able to undertake without this support. By reducing the financial barriers, the concessional funding allows for the implementation of transformative projects, fostering long-term resilience and sustainability. This approach not only facilitates the adoption of innovative practices and technologies but also ensures that the benefits of these projects are equitably distributed among those most vulnerable to climate change impacts.

ACCIÓN aligns with the objectives of the Mexican government such as Mexico's National Development Plan and its NDCs, focusing on biodiversity conservation and in marine and coastal ecosystems restoration. It aims to enhance resilience in vulnerable municipalities and develop financing mechanisms to address climate impacts in the primary sector. Despite being an uppermiddle-income country, Mexico faces high income inequality and poverty levels, emphasizing the need for external funding to combat climate change effectively, mainly in regions highly vulnerable to climate change and with significant levels of poverty, such as ACCIÓN targeted areas.

The economic analysis of ACCIÓN demonstrates its concessionallywhich encompasses all activities supported by the project, including conservation, restoration, and livelihood enhancement practices. Some of the of the financial analysis assumptions were: discount rate of ten percent; inflation rate of four percent; 20 years of project implementation. The calculations included Net Present Value (NPV), Cost Benefit Index (CBI), Internal Rate of Return (IRR), and recovery period. The results of the financial analysis showed that in all activities except blue carbon credits, the NPV and CBI index was positive. The CBI range from 1.79-1.20: 1.79 sustainable fisheries, 1.61 sustainable mangrove charcoal, 1.50 ecotourism, 1.46 in agroforestry, 1.24 silvopastoral systems, and 1.20 apiculture with value added. For blue carbon credits, it was 0.20, and the cost of ton of carbon would be required to be more than US$40 to have a positive CBI. The IRR was also positive in all cases compared to BAU without GCF financing, except blue carbon credits.

ACCIÓN will mobilize private investment and align limited coastal and marine areas investments in to respond to climate adaptation needs. GCF investment will allow the coordination of multiple stakeholders to increase climate adaptation. ACCIÓN leverages and catalyzes finance in a tailored way. Activities with positive returns, such as small-scale fisheries, will be financed with impact investment and risks will be reduced with parametric insurance. Activities that positively impact ecosystem services, such as mangrove and coral reef conservation and restoration, will be funded by grants and linked to other schemes that catalyze private investment, such as ecotourism. Lessons learned from FMCN's GEF project CONECTA regarding access to financial institutions will be considered in this Project. ACCIÓN will employ a risk-sharing structure between public and private sectors, mitigating financial risks and encourages investment. This is essential in Mexico, where public funds are limited, and private sector engagement is crucial for environmental initiatives. GCF funding will fill critical financial gaps, mobilize private investment, and support a risk-sharing structure that encourages sustainable development and long-term resilience in the YP. The challenges in accessing climate finance at national and subnational levels include limited private and public finance to implement EbA measures in marine and coastal ecosystems, which the project aims to overcome through its innovative financing mechanisms.

Moreover, ACCIÓN will support the recently approved GBFF-financed MEx30x30 Project, a long-term financing mechanism following the PFP approach. MEx30x30 will strengthen the capacity of CONANP to pursue diverse financing options and will secure funding from other sources while public financing flows are developed. A central feature of the MEx30x30 project is the use of long-term financing to structure a transition fund that will bridge CONANP's funding gap until federal funds can be secured to support the costs of the PAs over the long term. ACCIÓN will contribute to these efforts, financing the closing of financial gap of 20 PAs in coastal and marine ecosystems in the YP.

II.4. Economic and/or financial viability

The analysis carried out in Annex 10. Economic and financial analysis reflects an evaluation of the economic and socio-environmental feasibility of the ACTION project. To evaluate the relevance of the proposed activities, the estimated profitability levels were contrasted with those of traditional economic activities in the area (Business as Usual, BAU), which were taken as a baseline. The results suggest that the activities are profitable at the private level (in financial terms) and the social level. In this sense, they offer sustainable alternatives to extensive traditional practices that tend to degrade ecosystems and make unsustainable use of natural assets.

It is worth mentioning that the study conducted and, therefore, the conclusions presented assume that certain social conditions are met, including the existence of governance structures that allow organized groups to access sources of financing for the implementation of the projects, and that they can carry out prior diagnoses to demonstrate the viability of their participation in the project. Therefore, the acceptance and active participation of local communities in implementing and managing projects is assumed.

Each of the activities suggests different financial and social advantages, and the choice of one or the other will depend on the context in which it is to be applied and on the priorities of the project investor. The analysis provides for each activity, in addition to an estimate of the net present value of the projects in the defined time frame and an estimate of the NPV integrating externalities whose monetary value is approximated using literature findings. The purpose of the above is to exemplify the magnitude of the social and environmental benefits generated by the projects, which in current markets cannot be accounted for in monetary terms.

Mangrove charcoal is an innovative and highly profitable activity. It is essential to mention that the interested parties must have forest harvesting permits. The activity offers a way to use resources often wasted, such as the remains of dead mangroves and fallen branches. Harvesting also contributes to cleaning up the ecosystem, thus representing an effective and highly profitable alternative for carbon generation.

In the case of beekeeping, its wide presence in the PY and its profound cultural importance are highlighted, being considered an ancestral practice maintained by many indigenous communities. Therefore, a broad niche of potential stakeholders is identified to improve their practices to produce higher-quality products while implementing systems that ensure the long-term sustainability of resources. Finally, in environmental terms, this activity stands out for integrating regional agricultural production with biodiversity conservation, improving soil health, and providing ecosystem services.

Agroforestry, on the other hand, is a viable activity on smaller plots of land, which makes it suitable for stakeholders who are not part of large groups. It offers the advantage of generating products for self-consumption so that economic benefits do not depend exclusively on sales. Also, compared to other activities, it requires a smaller initial budget.

Ecotourism requires significant initial investments but is very profitable. This activity requires excellent internal coordination on the part of the groups that implement it. It is considered a favorable alternative for those with a long-term commitment, especially because of the investment required in infrastructure.

In addition to their profitability, all activities are more likely to offer long-term financial security for community members. This is because environmental degradation and overexploitation of resources, such as forest, fishing, and water resources, compromise the availability on which livelihoods depend.

It is also observed that, for certain activities, the Net Present Value (NPV), net of taxes, reaches profitable figures. Mangrove charcoal, blue carbon credits, ecotourism, sustainable fishing, and silvopastoral systems stand out in descending order. However, the application of these values covers large areas of land. The project with the largest extension corresponds to blue carbon credits (3000 ha), followed by mangrove carbon (105 ha), and in third place, sharing position, sustainable fisheries, and silvopastoral systems (both with 10 ha). It is also important to note that the above activities generate an equivalent annual flow exceeding 160,000 pesos/year.

On the other hand, when analyzing the unit financial results for each activity, the equivalent annual flow of agroforestry activities ranks third in profitability, only surpassed by sustainable fishing and ecotourism. Regarding the cost-benefit index, sustainable fishing has the highest benefits, followed by ecotourism and mangrove charcoal.

In this context, the above results suggest that the different activities adapt to various needs and conditions. It is essential to mention that diversification of productive activities reduces the risks associated with dependence on a single product or market. On the other hand, economies of scale maximize investments in enabling conditions and resource management efficiency by integrating diverse activities. This not only improves the profitability and sustainability of productive practices but also contributes to local communities' economic and environmental resilience. This recommendation seeks financing for a possible mix of activities, not just one specific activity.

Diversification of productive activities and transition to sustainability schemes are necessary not only for environmental preservation and climate change mitigation but also to offer viable and sustainable economic opportunities for local communities in the region. The adoption of these systems and practices reveals an alternative toward a more resilient and sustainable future, where production and environmental conservation go hand in hand. For broader information on this, see Annex 10. Economic and financial analysis of the full proposal.

II.5. Exit strategy and sustainability

Several key sustainability strategies will ensure ACCIÓN's benefits continue post-project and facilitate a successful exit:

i. Community ownership. ACCIÓN emphasizes community-level ownership over project activities, proposed and carried out by the communities, ensuring their knowledge is incorporated and sustainability practices reinforced. It will provide technical assistance to strengthen community organizations' capacities in management, conservation, and sustainable use of resources in YP coastal landscapes and seascapes and transfer the knowledge of the use of EbA practices. FMCN's experience shows that community engagement in project design and implementation leads to sustained and replicable outcomes.

ii. Long-term institutional ownership. ACCIÓN's institutional arrangements and activities leverages the successful implementation of the GEF- financed C6 Project. This approach capitalizes on FMCN's extensive experience in managing projects financed by multilateral entities and fosters solid inter-institutional collaboration with key organizations like CONANP and SSAC, ensuring effective environmental conservation efforts.

iii. Supporting institutional capacity. ACCIÓN focuses on knowledge management and lessons learned at national and subnational levels, this includes developing a regional strategy for scaling up EbA and generating policy recommendations to support sustained replication. EbA integration into regional development planning aligns with NDCs, National Adaptation Plan, municipal adaptation programs, and ecological zoning plans. In addition, ACCIÓN will support the development and/or strengthening of coordination mechanisms to serve as platforms that convene diverse stakeholders in planning processes, including government agencies at state and local levels, the private sector, smallholder farmers' producer groups and cooperatives, academia and local community representation. ACCIÓN will support that these coordination mechanisms are effective, participatory, and inclusive and may support specific actions agreed upon under these mechanisms, such as sectorial, regional, or local adaptation strategies and plans.

iv. Sustainable financial mechanisms. ACCIÓN incorporates innovative financial mechanisms including a pioneering insurance solution for small-scale fishers and tools connecting small producers with blended financing mechanisms, that addresses immediate financial needs, ensuring long-term financial sustainability for EbA activities. ACCIÓN will contribute to MEx30x30 GBFF project that promotes a long-term financing mechanism following the PFP approach. Additionally, ACCIÓN leverages the knowledge of the Global Fund for Coral Reefs (GFCR) initiative MAR+Invest, that links private investment to coral conservation.

v. Ensuring results and benefits continue beyond the project implementation phase. ACCIÓN will enhance communities, livelihoods, and ecosystems resilience by scaling up best practices, coordinating stakeholders, disseminating lessons, and involving communities and government entities. It improves financial sustainability and scales EbA measures, adopts climate-resilient practices, and focuses on knowledge management and interinstitutional collaboration, integrating experiences and insights are into future policies and practices.

vi. Support letters have been presented by the National Commission of Natural Protected Areas (CONANP); Ministry of Environment, Biodiversity, Climate Change and Energy of the State of Campeche; and the Ministry of Sustainable Development of Yucatan confirming O&M in the future. In Annex 16.

III. Specific information on the project

III.1. Climate rationale[6]

The YP has experienced several significant climatic changes in recent decades. These changes, as well as projected future climate changes for the region, are summarized in Table 25. A brief description of each of these climatic changes is presented in the sections below the table, and a detailed analysis is available in the Projected future climate section below.

Table 25 Observed and projected future climate changes in the Yucatan Peninsula

Climatic change	Observed trend and period of the trend	Projected future (years for projection)
Precipitation	• Declining average precipitation trend (1971-2020) • Increasing extreme rainfall/peak rainfall trend (2010-2014) • Increasing drought conditions (1980-2020)	• Annual precipitation will decline across much of the YP (2015-2100) • Most severe declines: south-eastern parts of Quintana Roo (15.0–19.8 mm per decade) (2015-2100) • An increasing trend in average precipitation is projected for central and south-western areas (parts of south-western Campeche up to 10 mm per decade) (2015-2100) • Extreme rainfall will become more common on the east coast (2015-2100) • The number of consecutive dry days is also projected to increase (2015-2100) • Periods between rainfall will become longer, drought conditions will intensify, and rainfall periods will become more intense.(2015-2100)
Temperature	• Rising mean annual temperatures (1980-2020) • Increasing maximum temperatures (1950-1980) • Increasing minimum temperatures (1950-1980)	• **Mean temperature:** northern and eastern coastal areas are predicted to experience increases of between 0.24–0.26°C per decade (2015-2095) • Southern Yucatán State and the western part of Quintana Roo, temperature increases of up to 0.29°C per decade are predicted • **Peak temperature:** North-eastern coastal region of the peninsula, maximum temperatures are expected to rise by 0.26–0.27°C per decade. (2015-2099) • South-western Campeche will experience increases in **average maximum temperatures** by up to 0.32°C per decade. (2015-2099) • **Average decadal minimum temperature**: 0.23–0.24°C per decade in north-eastern Quintana Roo; up to 0.31°C per decade in the southwest of Campeche. (2015-2099)
Tropical cyclones	• Unclear trend in tropical cyclone activity (1970 and 2014). • Tropical cyclones and storm/ depressions:	• Highly variable into the future with a likely (67% confidence) ~50% to -50% range on either side of current occurrence. • Expected decrease change overall in the number of events. • Category 4 and 5: likely expected to increase by 50%

6 This section is based on the Climate pre-feasibility study to assess the vulnerability of selected ecosystems, productive systems, and communities prepared by Ogier (2023)

	increase from 1950 to present of ~0.2 events over 5 years (1950-2020)	• Slight increase in the maximum intensity per tropical cyclone event • Increase in the precipitation rate associated with tropical cyclone events Storm surges will become increasingly common and severe
Ocean characteristics	• Sea level rise of ~2 mm/year since 1990 • Rising sea surface temperatures • Clear trend in ocean acidification (1950 to 2014)	• **SLR:** north-eastern areas of the YP of up to +0.17m between 2020 and 2050. • Areas to the west are projected to see a lower increase of up to +0.15m • **SST:** Areas to the west and east of the peninsula will show a rise in SST of up to 0.94 and 0.86, respectively (2050-2100) • Ocean acidification: Continued projected trend (2036-2065)

Source: Ogier, 2023, p. 132.

Observed climate trends

PRECIPITATION

Precipitation rates vary across the YP, with the eastern coastal areas of Quintana Roo and southern areas of Campeche receiving relatively more rainfall than the northern and central parts of the YP. Overall, the YP gets a relatively low annual rainfall of approximately 600-1600 mm, with its southern parts receiving more rainfall overall than the northern parts (Metcalfe et al., 2020).

The YP is experiencing decreasing average precipitation, and an increase in extreme rainfall and drought conditions. Between 1971 and 2020, the YP saw a decrease in average precipitation. Except for some parts of Quintana Roo, all subregions experienced a 1-2.9 mm decline in annual rainfall. Some areas, especially in the western regions, witnessed reductions of 8-16.2 mm per decade. Climate change has contributed to this trend, causing rainfall patterns to become more variable, with heavy precipitation becoming more common and periods between rainfall becoming longer. Extreme rainfall and drought occurrences have increased across the region, with the north-western areas experiencing abnormally dry conditions since the 1980s, intensifying since 2010.

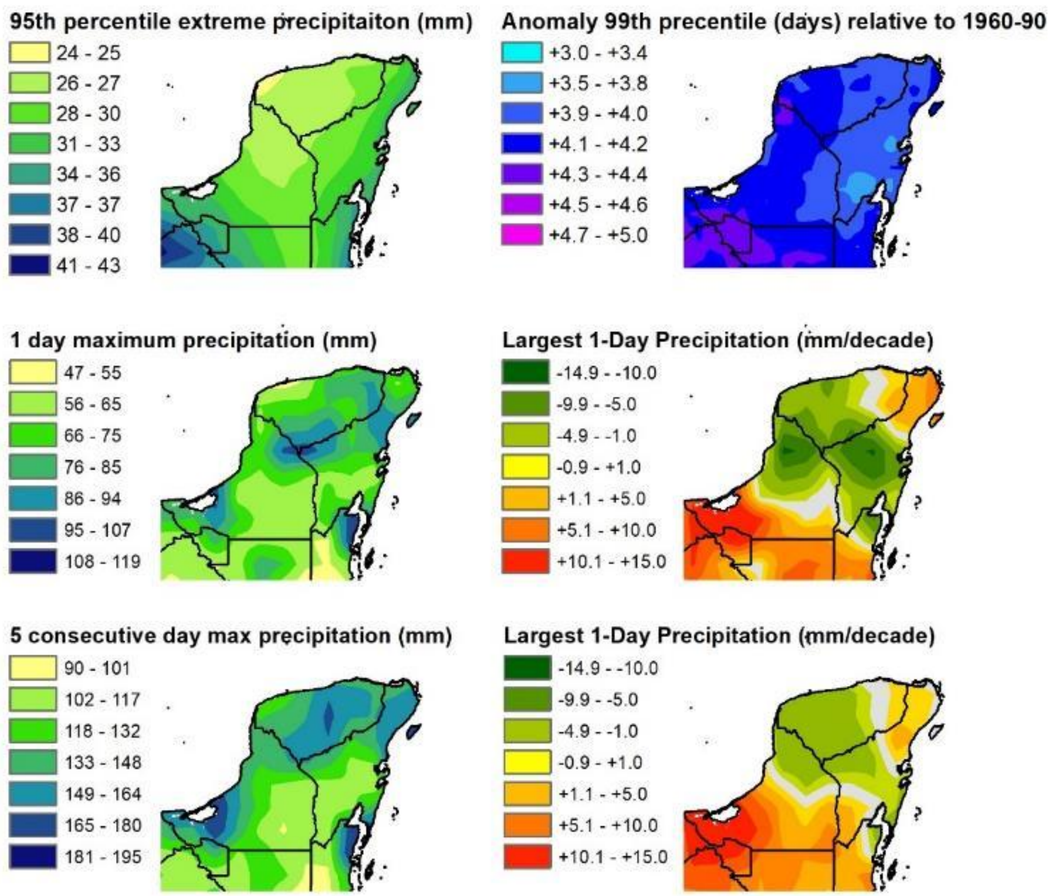


Figure 27 Current change in peak rainfall distribution and trends of extreme rainfall parameters. Source: Ogier, 2023, p. 134.

The change over time in these three coastal locations —southwest, northern, and eastern— shows local changes in the precipitation profile. The southwest has a varied but ultimately unchanged annual rainfall volume. Changes are, however, occurring with an increase in the early part of the season in May/June and decreases during the peak period. In the northern area, there is a slight increase over time in annual precipitation, though this is not significant. There are noted decreases in the early season (May) and peak season (Sep) and slight increases in other months. The eastern coast sees an increase over time, with the most consistent increases noted in Oct/Nov in more recent years.

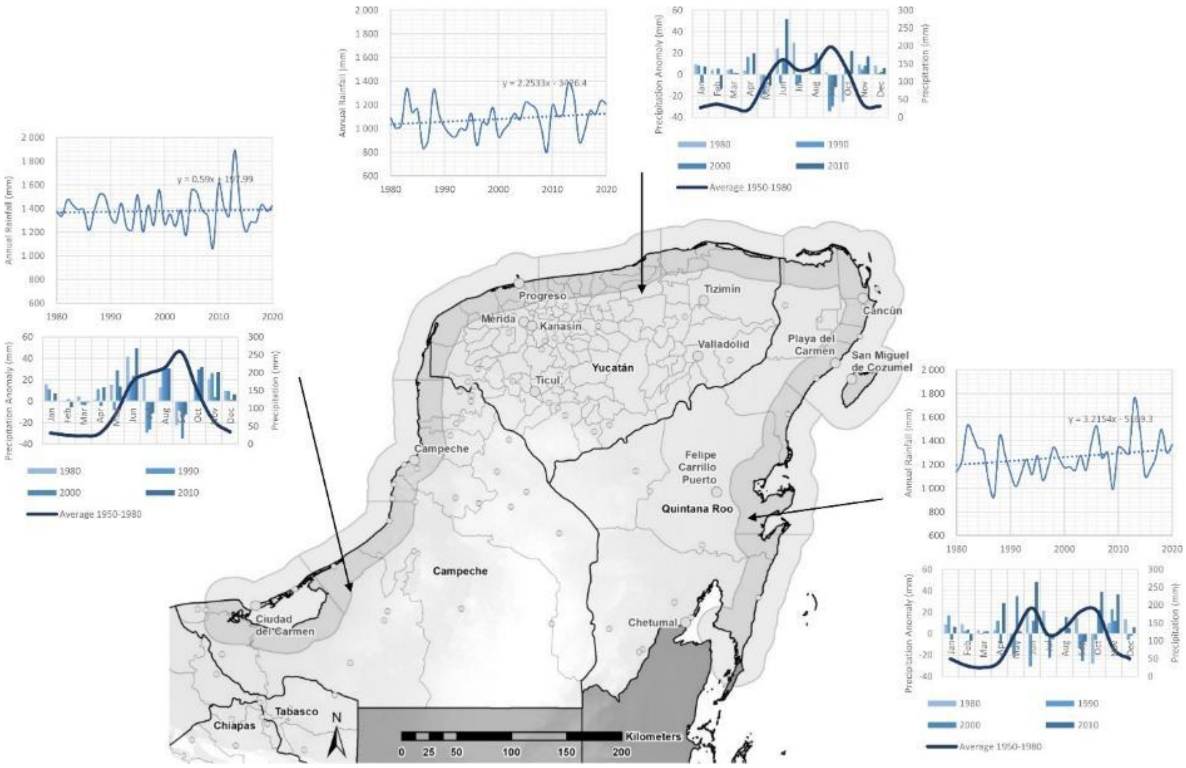


Figure 28 Observational precipitation trends around the Yucatan Peninsula

Extreme rainfall

Figure 27 shows the current change in peak rainfall distribution and trends of extreme rainfall parameters. Extreme rainfall in the region corresponds to overall precipitation rates for the. On average, extreme rainfall is most common in the southwest, specifically in western Campeche. Comparatively, high levels of peak rainfall also occur in south-central Yucatan and the coastal areas of Quintana Roo.

Since the 1960s, there has been an increase in both 1 and 5-day maximum precipitation rates in the central and northern areas of the YP, indicating a possible correlation with the increasing occurrence of tropical cyclones in the region. In the central areas of the YP, the trend in 1 and 5-day events shows a decrease. Overall, precipitation across the YP is becoming increasingly variable, with extreme rainfall becoming increasingly frequent in many parts of the region.

Drought and variability

Droughts are an essential feature of the climate in southern regions of Mexico and occur alongside changes in precipitation, although they are less common than in northern regions. The YP was historically considered a homogenous region in terms of rainfall. Recent studies, however, have highlighted four distinct precipitation sub-regions, showing the YP's high degree of climatic variability (De la Barreda et al., 2020). Droughts have historically been a recurring problem in the YP. Observed trends indicate that average drought occurred across most of the region from 1980 to the present (Figure 29). However, although the overall trend for the YP is for average drought during this period, there was high spatial variability in the severity of drought within the sub-regions. There was also temporal variability in terms of drought severity per decade. For example, droughts in 1980 and the 2000s were considered mild, while those in the 1990s and 2010 were severe and extreme, respectively. Severe droughts also occurred in later years. For example, in 2015, drought was experienced in 87.5% of the YP, and from mid-2016 to mid-2017, droughts again occurred over most of the region (Metcalfe et al., 2020). Regarding seasonality, the western parts of the YP show the most significant changes between years, while changes were low on the east coast despite having similar annual precipitation levels.

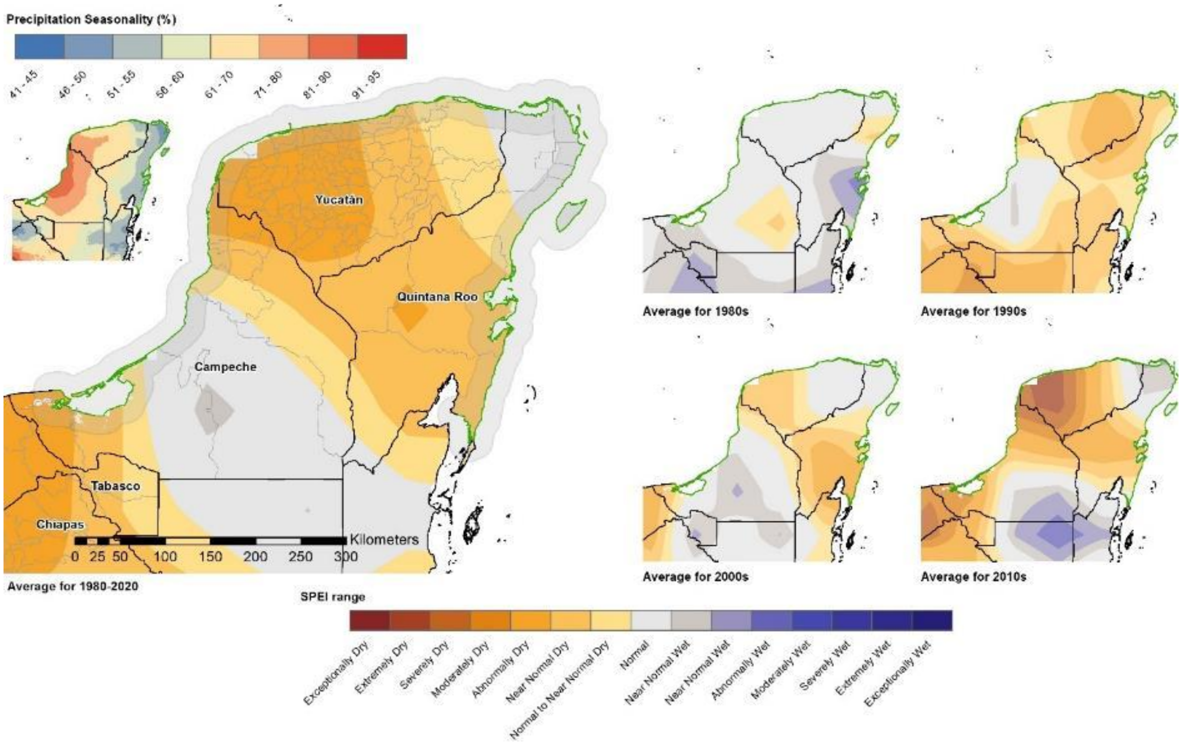


Figure 29 Current SPEI drought classification (A); and Decadal SPEI drought conditions over time (B); current rainfall trend and precipitation seasonality. Source: Ogier, 2023, p. 16.

TEMPERATURE

The YP is one of Mexico's warmest regions, with average daily temperatures of approximately 33°C (WorldData.info, n.d.). The hottest months in the region are from April to September, corresponding to the northern hemisphere summer. Long-term temperature trends for the YP indicated that increases in average temperatures are most significant on the south and east coasts of the region (Figure 30 A). This trend contrasts with some central areas of the YP's west coast, such as in the coastal areas between Yucatan and Campeche states, where temperatures show a decreasing trend. Concurrent with the increasing average temperature trend, a rise in the occurrence and duration of heat waves has also been observed. Between 1960 and 1990, there was a significant increase in warm spell duration, particularly in the coastal areas on the east and northeast coast of the YP.

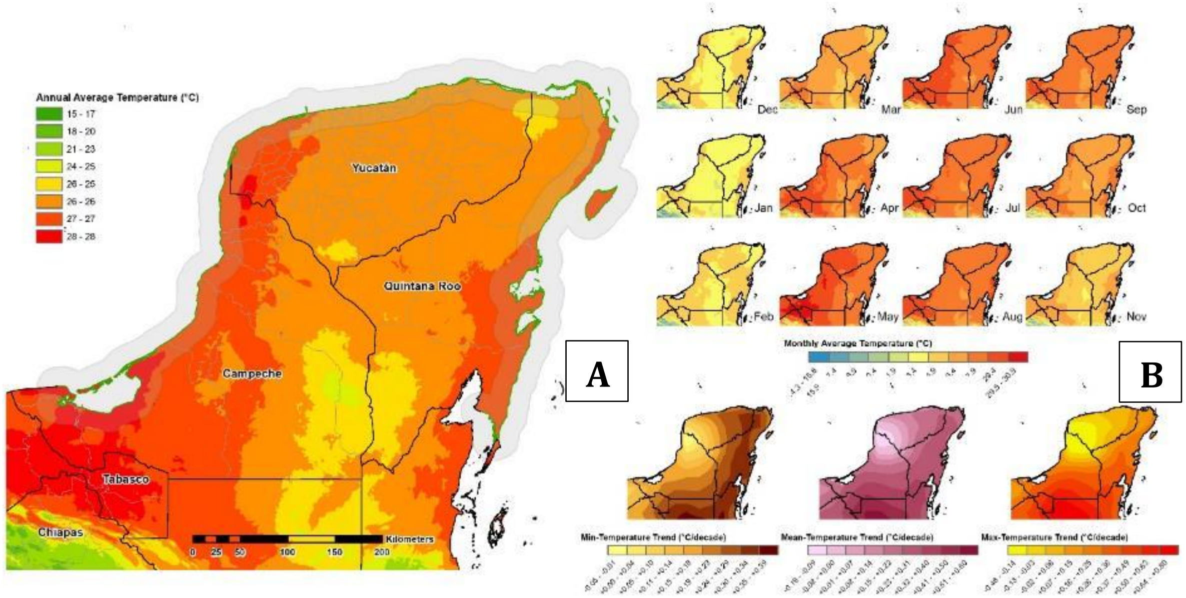


Figure 30 Current annual and monthly average temperature distribution (A) and temperature trends (B). Source: Ogier, 2023, p. 17.

Temperature changes in the coastal areas have seen general average increases in the observational record (Figure 31) . There is a slightly higher rate of increase in the minimum temperatures than in the mean and maximum temperatures. The location to the southwest is currently the warmest and has seen average temperatures increase more rapidly than the other locations. This is the only area where the maximum temperature increase outstrips the minimum temperature. The northern areas see the second-highest temperatures, and the east coast area sees the lowest temperatures. All the areas have generally warm night-time temperatures and hot average temperatures.

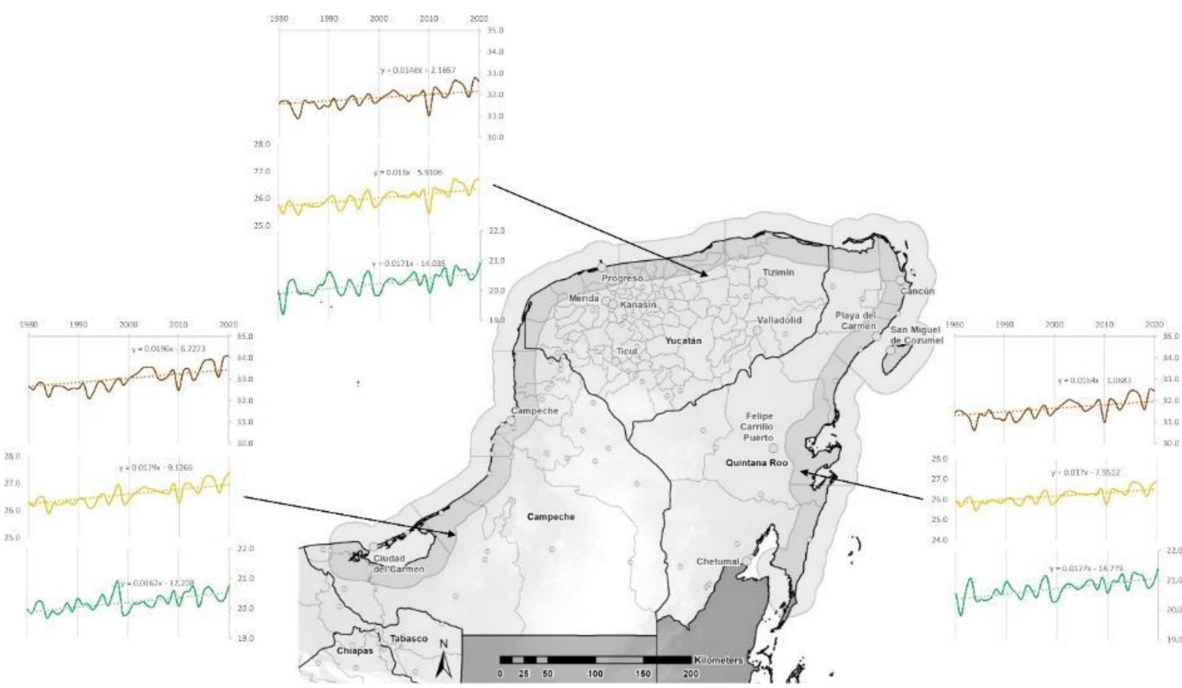


Figure 31 Observational temperature trends around the Yucatan Peninsula. Source: Ogier, 2023, p. 18.

Heatwaves

Monthly maximum temperature peaks are highest in the upland areas towards the western parts of the YP, as shown in Figure 32 (A) below. Coastal areas on the eastern side of the YP have relatively lower monthly maximum temperature peaks. However, these coastal areas have comparatively high average temperatures (Figure 31 above), which indicates that inland areas have more extreme temperature fluctuations than coastal areas. The figure also shows the current change in peak temperature distribution and in cooling degree days (B). Between 1960 and 1990, there has been a significant increase in 90th percentile warm spell duration in coastal areas along the east coast. Relative to the baseline period, 99th percentile event days have also increased significantly compared with western parts of the region. However, there has been no significant increase in the number of days with temperatures of more than 35°C, while this has been the case in the central uplands of Campeche in particular.

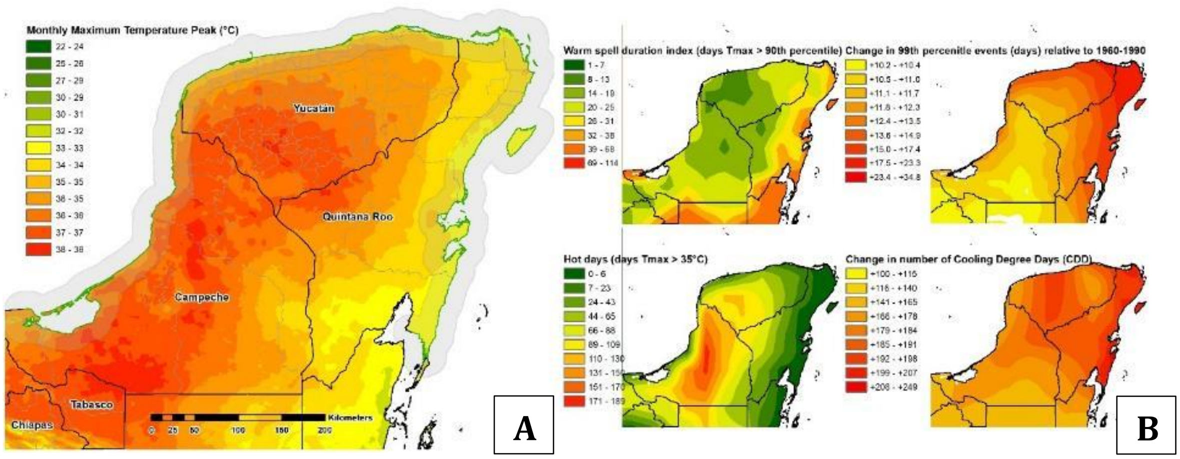


Figure 32 Current peak temperature distribution and distribution of extreme temperature parameters (A) and Current change in peak temperature distribution and change in cooling degree days (B). Source: Ogier, 2023, p. 18.

With the increase in average maximum, mean, and minimum temperatures, there has been a shift in the temperature profile, and there is a shift in the temperature magnitude of the more extreme events. All locations see an increase of up to 2-3°C in the 75th percentile maximum and minimum temperature extreme average month (Figure 33) .

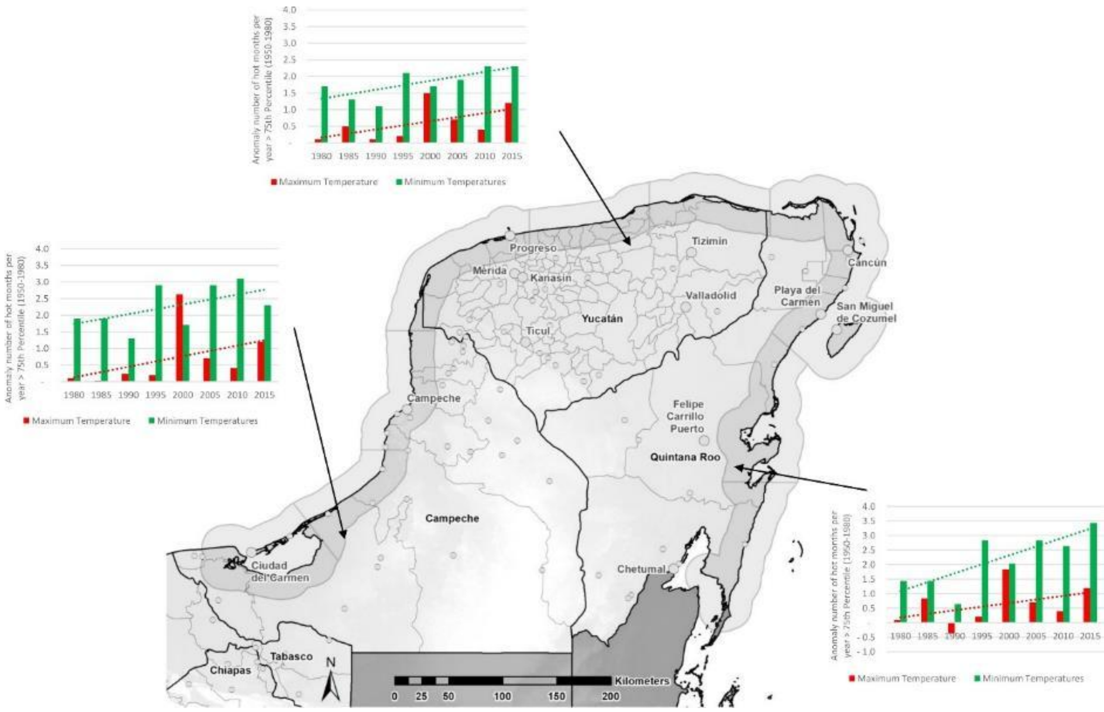


Figure 33 Observational extreme temperature trends around the Yucatan Peninsula. Source: Ogier, 2023, p. 18.

Tropical cyclones

The YP is particularly prone to tropical cyclones, owing to its location between two oceans and the Gulf of Mexico. It is generally an area of high tropical cyclone density and has experienced numerous events in recent decades. These cyclones are associated with high wind speeds, extreme rainfall, and the corresponding flooding, directly impacting the YP's most vulnerable communities.

The YP has experienced numerous extreme climate events in recent decades. The figure 34 shows the tracks of tropical cyclones, storms, and tropical depressions that made landfall in the YP between 1970 and 2014. During this period, some of the most destructive tropical cyclones that have occurred include Gilbert (1988) and Wilma (2005), both of which developed into Category 5 cyclones (NASA, 2005; Sánchez-Triana et al., 2019). The YP is, therefore, exposed to regular floods, and given that the economic activity of the region is concentrated along the coast, it is also highly vulnerable to the impacts of sea level rise (Breña-Naranjo et al., 2015).

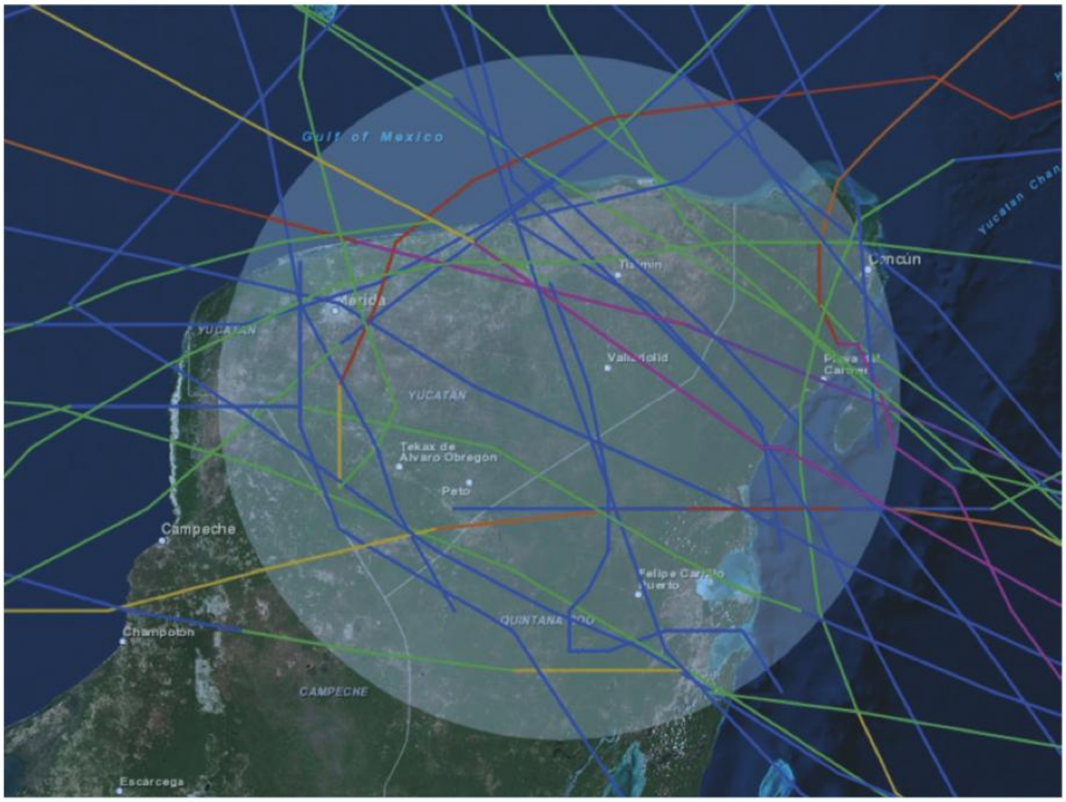
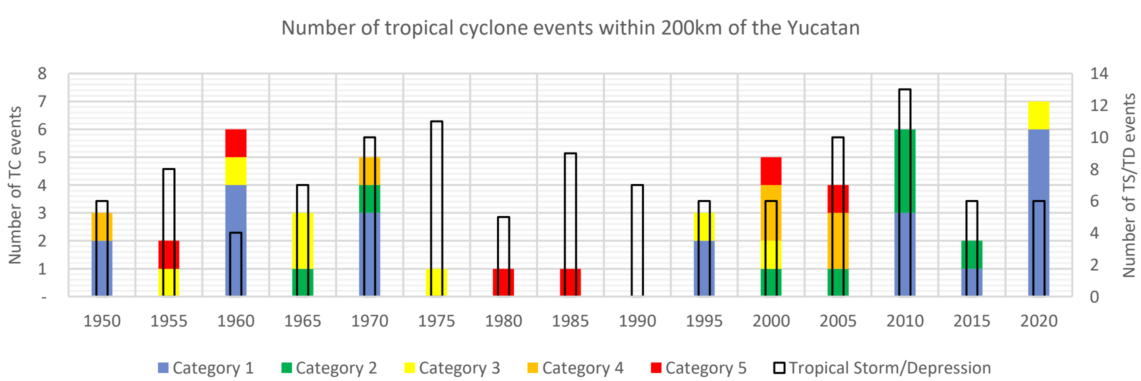
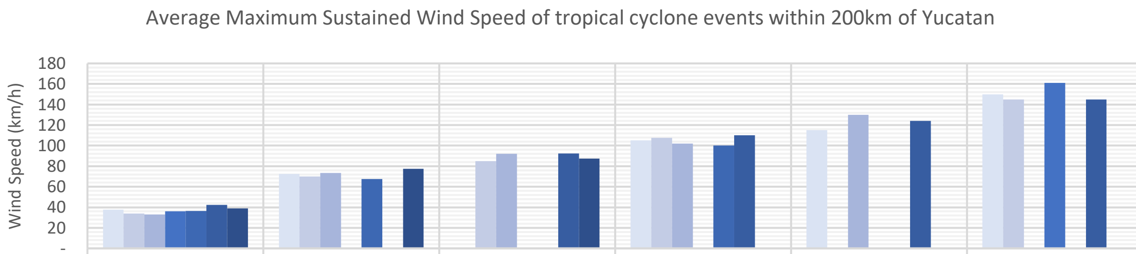


Figure 34 Tropical cyclones, tropical storms and tropical depressions that made landfall in Yucatan between 1970 and 2014. Green = tropical storms; blue=tropical depression; Yellow=category 1 TC (winds of 119-1753 km/h); Orange = category 2 (154-177 km/h); Red = category 3 (178-208 km/h); Pink = category 4 209-251 km/h). Source: Sánchez-Triana, et al., 2019

The change over time in tropical cyclones and storms/depressions shows an increase from 1950 to the present of ~0.2 events over a 5-year period. From 2000, there has been an increase in severe events with the 2000 and 2005 periods having several events above category 3, and multiple storm events. Since then, there have been more events classed as category 1 or 2 and a high number of tropical storm events (particularly in 2010-2014). The trend is, however, not statistically significant due to the generally varied nature of these events (Figure 35).





	Tropical Storm/Depression	Category 1	Category 2	Category 3	Category 4	Category 5
1950	38	73	-	105	115	150
1960	34	70	85	108	-	145
1970	33	74	92	102	130	-
1980	36	-	-	-	-	161
1990	36	68	-	100	-	-
2000	42	-	93	110	124	145
2010	39	77	88	-	-	-

Figure 35 Number of tropical cyclone events from 1950 to present (top), change in maximum sustained wind speed over time per category (bottom). Source: Ogier, 2023, pp. 20-21.

While a discernible trend is not evident, there appears to be a more significant occurrence of tropical cyclone events in recent times. The Yucatan's vulnerability to tropical cyclones means it is also exposed to storm surges and high wind speeds.

Storm Surge

Storm surges —an abnormal rise in sea level generated by a tropical cyclone, hurricane, or tropical storm as it moves over the ocean— are a significant concern in coastal regions. The YP is vulnerable to storm surge events due to its exposure to the Caribbean Sea and the Gulf of Mexico.

The severity of storm surges can vary depending on various factors, including the intensity and size of the storm, the angle at which it approaches the coast, and the shape of the coastline. The YP has a diverse coastline, with both open coast areas and areas protected by offshore islands and reefs. The more exposed areas have a loss of natural vegetation. In these low-lying areas, communities near the coast will be more susceptible to damage from storm surges, which can result in coastal flooding, erosion, and significant damage to coastal infrastructure.

The areas to the northeast, which experience a greater density of tropical cyclone activity, are also subject to a larger-than-average wave height for all the significant extreme return events. The areas to the north and those to the east with straight coastlines are also exposed to high wave height but less so than the areas directly to the northeast. Areas to the west and along the east coast with natural coastal protection experience lower storm surge heights (Figure 36).

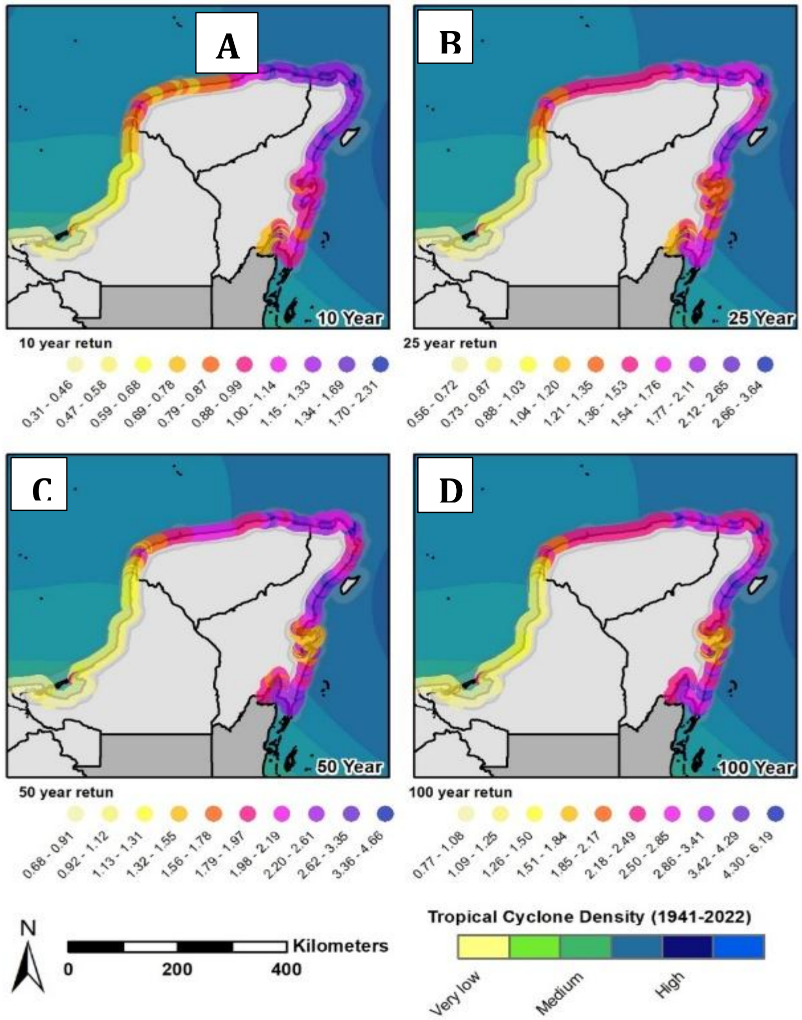


Figure 36 Storm surge 10-year return (A); 25-year return (B); 50-year return (C) and 100-year return (D). Source: Ogier, 2023, p. 22.

OCEAN CHARACTERISTICS

Mexico's territorial waters are characterized predominantly as subtropical, with mean sea surface temperature reflecting the subtropical climate and warmer waters along the southern coast, particularly in the Gulf of Mexico (CMCC, 2021). The Yucatan Channel, the passage between the Gulf of Mexico and the Caribbean Sea, provides most of the inflow into the Gulf. This northward flow on the western side of the Channel is known as the Yucatan Current, while there is a counter-current flowing southwards on the eastern side of the Channel named the Cuban Counter Current (Gyory et al., 2013). The flow of the Yucatan Current is strongest during the summer months (Britannica, 2015). The sections below provide further information on sea surface temperature (SST) in the waters around the YP, as well as on acidification and sea level rise (SLR).

Sea Surface Temperature (SST)

Figure 37 below shows the average annual SSTs and monthly average SST for the target region. Annual average SST is highest in the area east of the YP. SSTs along the western coast of the YP are comparatively lower. The average annual SST is between 28-28.2°C in this region, compared with an average annual temperature range of 25.8-26.1 in the areas to the north of Yucatan state.

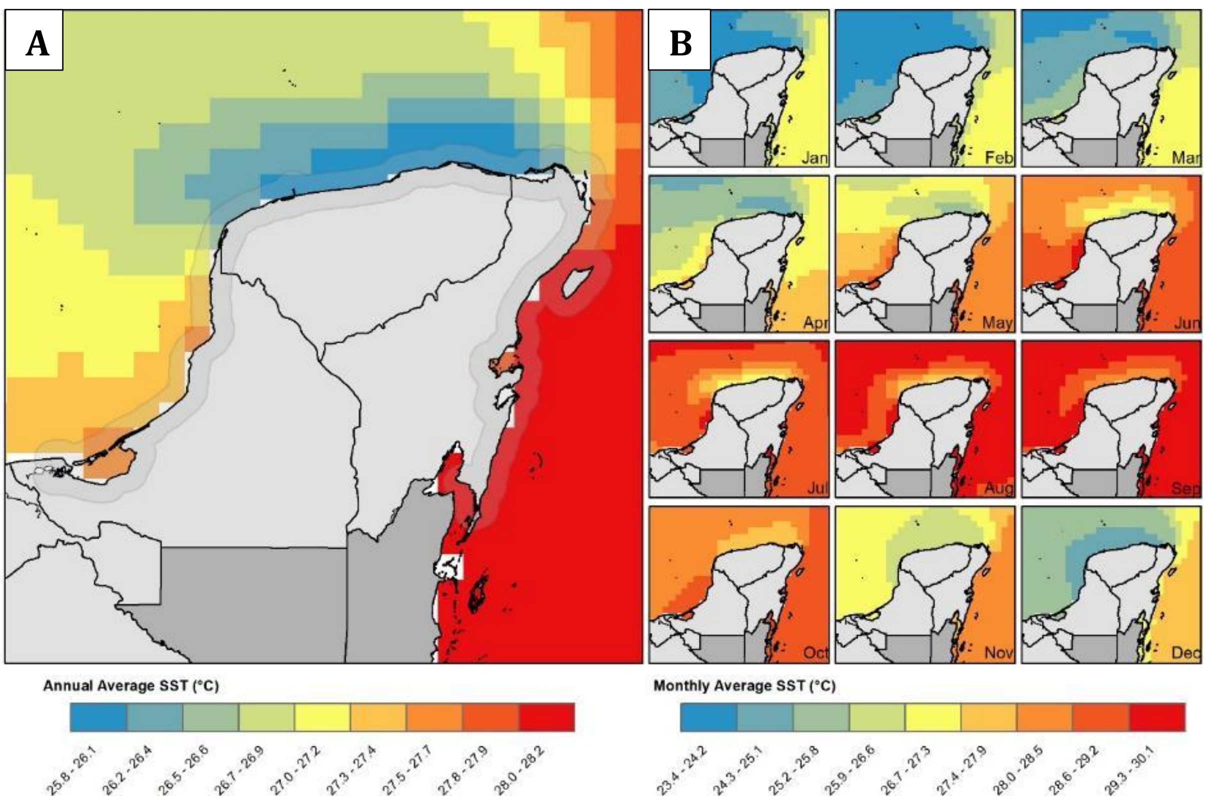


Figure 37 Average annual SST (A); Monthly average SST (B). Source: Ogier, 2023, p. 23.

Sea Level Rise (SLR)

During the past 100 years, Mexico has experienced sea level rise (SLR) above the global average, reaching more than 2 mm/year since 1990 (CMCC, 2021). Sea level rise has also been observed in the waters surrounding the YP (Figure 38). Sea levels along the YP's eastern coast have risen comparatively more than areas west of the YP, corresponding to the higher sea surface temperatures observed in this area (A); (B) indicates that sea levels in the east have increased at a faster rate than areas to the west.

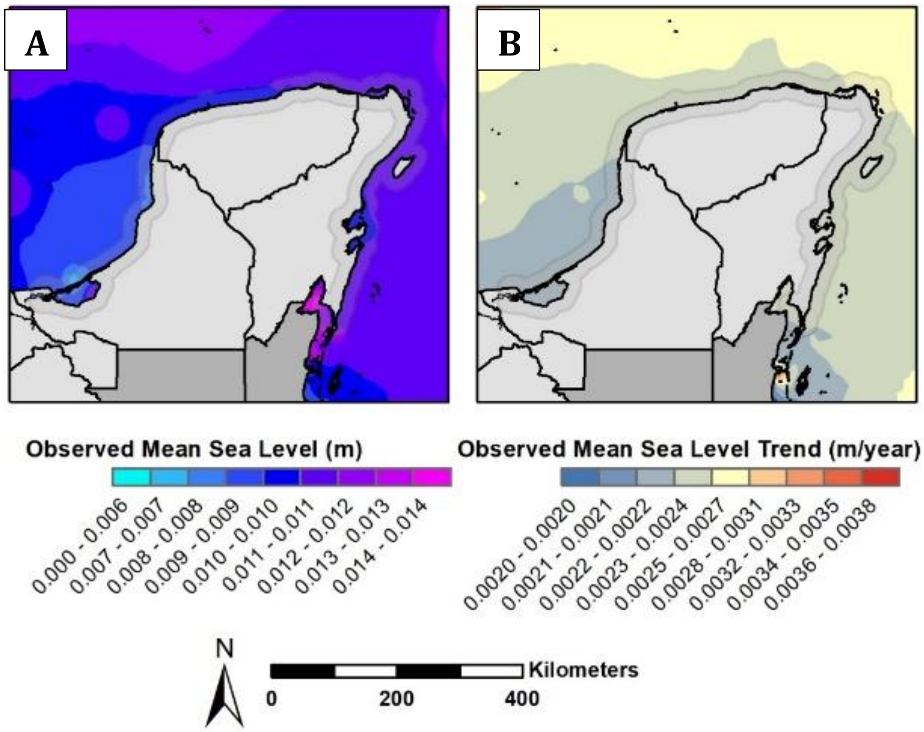


Figure 38 Observed mean sea level (A); Observed mean sea level trend(B). Source: Ogier, 2023, p. 24.

Acidification

Globally, an increase in atmospheric CO_2 concentrations has already caused an increasing trend in ocean acidification (EEA, 2023). Over the industrial era, oceans have become approximately 30% more acidic due to CO_2 emissions, with this reduction in surface water pH observed worldwide. Mexico is not an exception, and Figure 39 shows the decreasing pH of the oceans surrounding this country from 1950 to 2014. A clear trend towards acidification due to climate change is observable.

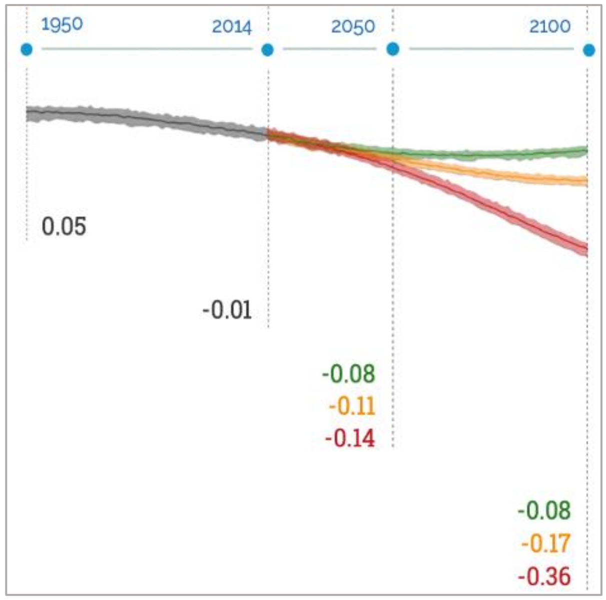


Figure 39 Observed and projected ocean acidification around Mexico for the baseline period of 1950-2014, 2050 and 2100. Source: CMCC. 2021. G20 Climate Risk Atlas: Mexico. Available at https://files.cmcc.it/g20climaterisks/Mexico.pdf

While other parameters can also have important impacts on ocean biodiversity and tourism, ***pH, aragonite saturation state, calcite saturation state***, and ***water salinity*** are generally considered the most critical factors. These four factors play a crucial role in determining the biodiversity of marine ecosystems. They can negatively impact many marine species, especially those with calcium carbonate shells and skeletons, such as coral reefs, shellfish, and some types of plankton. As the ocean becomes more acidic, or the aragonite saturation state of seawater decreases, it becomes harder for these organisms to build and maintain their shells, leading to reduced growth rates and increased mortality, with a ripple effect throughout the food chain, affecting the abundance and diversity of other species that depend on these organisms for food or habitat. Furthermore, changes in these four factors can also affect the behavior and physiology of many marine organisms, such as fish and squid, and understanding their impacts on marine life is essential for developing effective biodiversity conservation and management strategies. For example, studies have shown that ***increased acidity*** can alter the ability of fish to detect predators and affect their ability to swim and find food, which can have cascading effects on the entire ecosystem.

Moreover, coral reefs, home to a vast array of marine life, are particularly vulnerable to changes in ***aragonite saturation state***. When seawater becomes undersaturated with aragonite, coral growth rates decrease, and coral reefs become more vulnerable to erosion and collapse. Furthermore, the ***calcite saturation state*** of the ocean affects some plankton species, such as coccolithophores, which are important primary producers in the ocean food web and rely on calcite to build their protective shells. Coccolithophore growth rates decrease when seawater becomes undersaturated with calcite, which can impact the entire marine food chain.

Additionally, some marine organisms, such as mangroves and fish species, are adapted to live in estuaries and coastal areas with varying ***salinity levels***. Moreover, changes in water salinity can also impact the availability of nutrients and dissolved gases, such as oxygen and carbon dioxide, which are critical for the survival and growth of marine organisms. High salinity can make it more challenging for some marine organisms to regulate their internal water balance. In contrast, low salinity can impact their ability to absorb oxygen and remove waste products. Furthermore, changes in water salinity can affect the productivity of marine ecosystems, as high salinity levels can limit the growth of phytoplankton, which are the base of the marine food web.

Projected future climate

A map showing an overview of the future climate of the YP is shown in Figure 40 below. A shift in climate is projected for much of the western part of Yucatan state and norther-eastern Campeche State. The degree of climate shift in these areas is predicted to be moderate. The sections below provide additional detail on the climatic changes and climate change impacts projected for Mexico and the YP specifically.

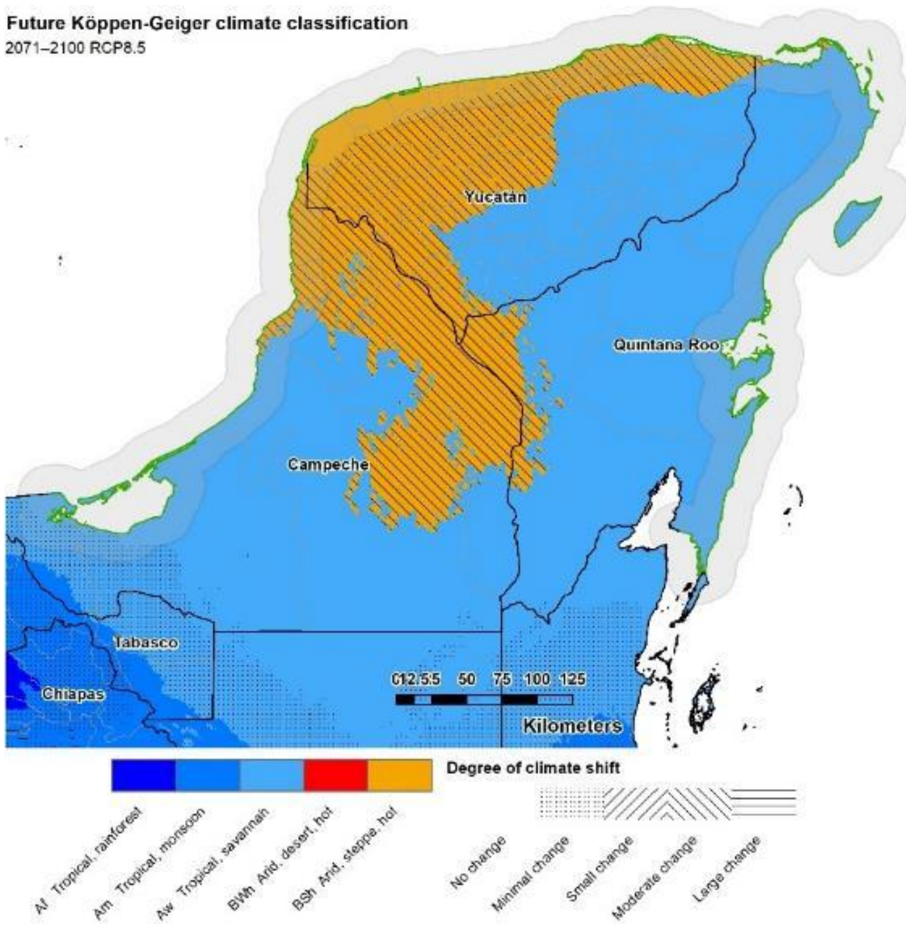


Figure 40 Future Köppen Climate Classification and change in the Yucatan Peninsula. Source: Based on World Bank. 2023. Climate Projections. Mexico. Available at https://climateknowledgeportal.worldbank.org/country/mexico/climate-data-projections

Projected statistical climate analysis was calculated over 9 sections of coastline each of ~100km in order to provide as high a possible resolution of detailed climate impacts at a practical scale (Figure 41) .

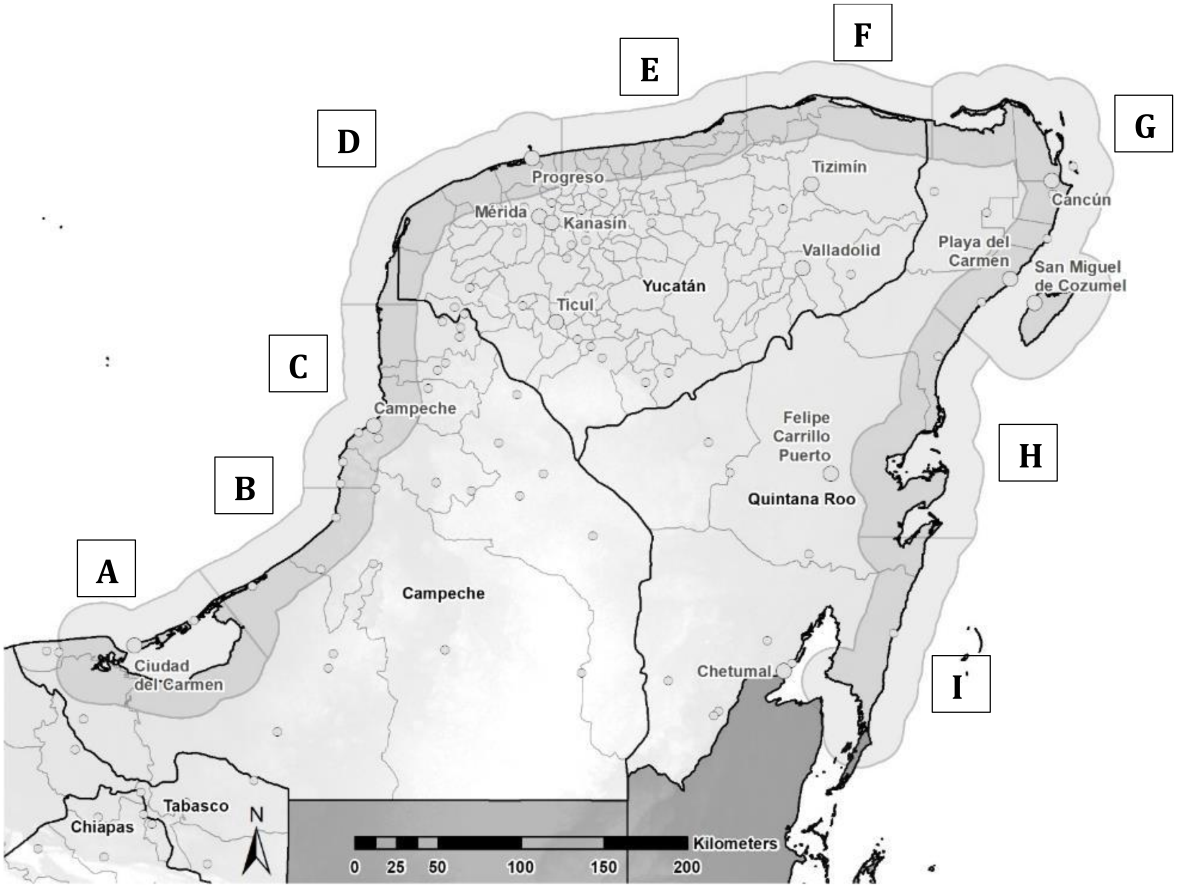


Figure 41 Climate analysis subdivisions of the coastal study area. Source: Ogier, 2023, p. 27.

PRECIPITATION

Under future climate conditions, projections for the YP indicate that extreme rainfall will become more common while drier conditions will become more prevalent. Projections, however, indicate variation as a result of the geography of the region. Precipitation is expected to decrease by 15.0-19.8 mm/decade in southeastern Quintana Roo. Concurrently, areas to the west of the central uplands will experience less severe declines, and the trend diminishes towards the central and south-western areas of the peninsula. An increasing trend in average precipitation is projected for the central and south-western areas, with some parts of southwestern Campeche expected to see precipitation increase by up to 10 mm/decade (Figure 42)

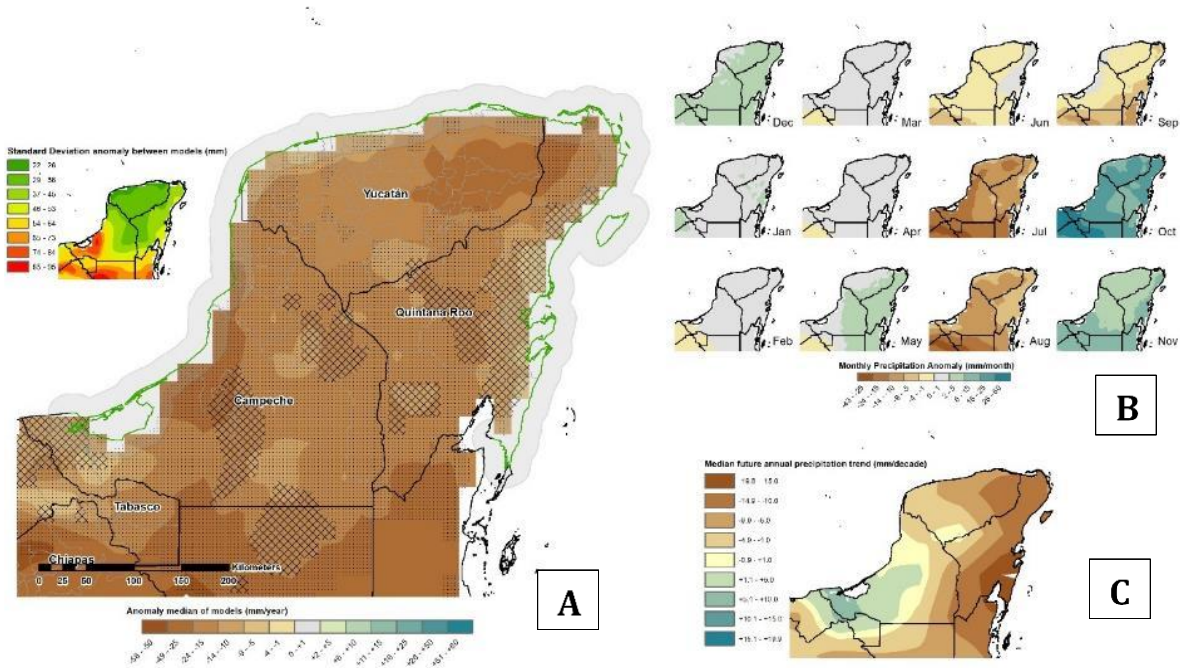


Figure 42 Precipitation changes. (A) shows the median future rainfall and standard deviation between ensemble models for the Yucatan Peninsula. (B) shows model agreement and monthly rainfall changes. Projected rainfall trends and the 10th to 90th percentile range are shown in (C). Median future rainfall and standard deviation between ensemble models (A) model agreement and monthly rainfall changes (B) and Projected rainfall trend and 10th to 90th percentile range (C). Source: Ogier, 2023, pp. 28-29.

Extreme rainfall

Peak precipitation changes are also projected. In eastern coastal areas, increases in monthly precipitation peaks are predicted to be as much as 20.1 mm (Figure 42 A), with this trend diminishing further inland and becoming positive in the interior areas. In south-central parts of the Yucatan state, central and eastern Campeche, and western Quintana Roo, monthly mean precipitation peaks are predicted to decline by between 1.0-4.9 mm, along with several hotspot areas where projections show an increase in peak precipitation. Most parts of the YP —particularly southern parts of Quintana Roo and most of Campeche— will experience an increase in the average largest 1-day precipitation anomaly and 1-day precipitation per decade. An increase in the average largest 5-day cumulative precipitation anomaly and precipitation trend is predicted, with the YP's west coast most severely affected (Figure 43 B).

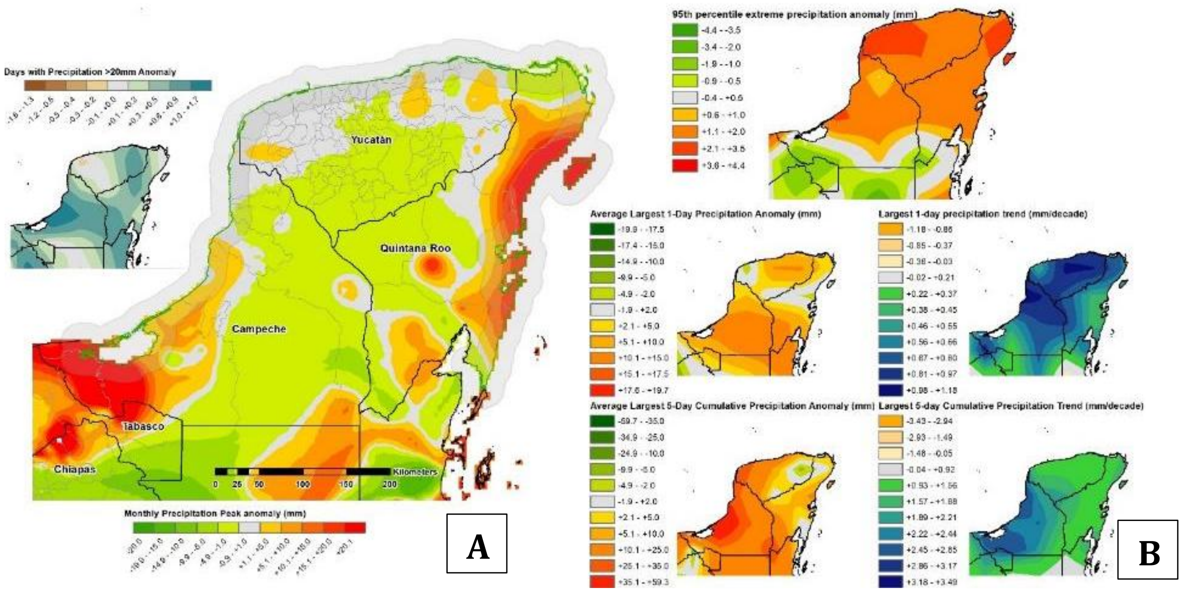


Figure 43 Projected peak rainfall distribution and distribution of extreme rainfall parameters (A); and Projected trend of extreme rainfall parameters (B). Source: Ogier, 2023, p. 33.

Drought and variability

In the YP, projections align with those for Mexico and indicate that drier conditions will become increasingly common, with average precipitation decreasing in central areas and increasing in coastal areas. From 2040, drying will occur across the YP —a trend that will intensify in the decades leading up to 2100 (Figure 44A). In most areas, the duration of dry spells (Figure 44 B, top) is projected to increase by 1.1-2.0 days per year and up to 3 days in large parts of Quintana Roo state. The number of consecutive dry days is also projected to increase, particularly in the uplands of the YP and towards the southeastern coast of Quintana Roo. Concurrently, there will be an increase in the number of consecutive wet days in most areas north and east of the uplands, which This indicates that periods between rainfall will become longer, with intensifying drought conditions, while rainfall periods will be more prolonged and intense.

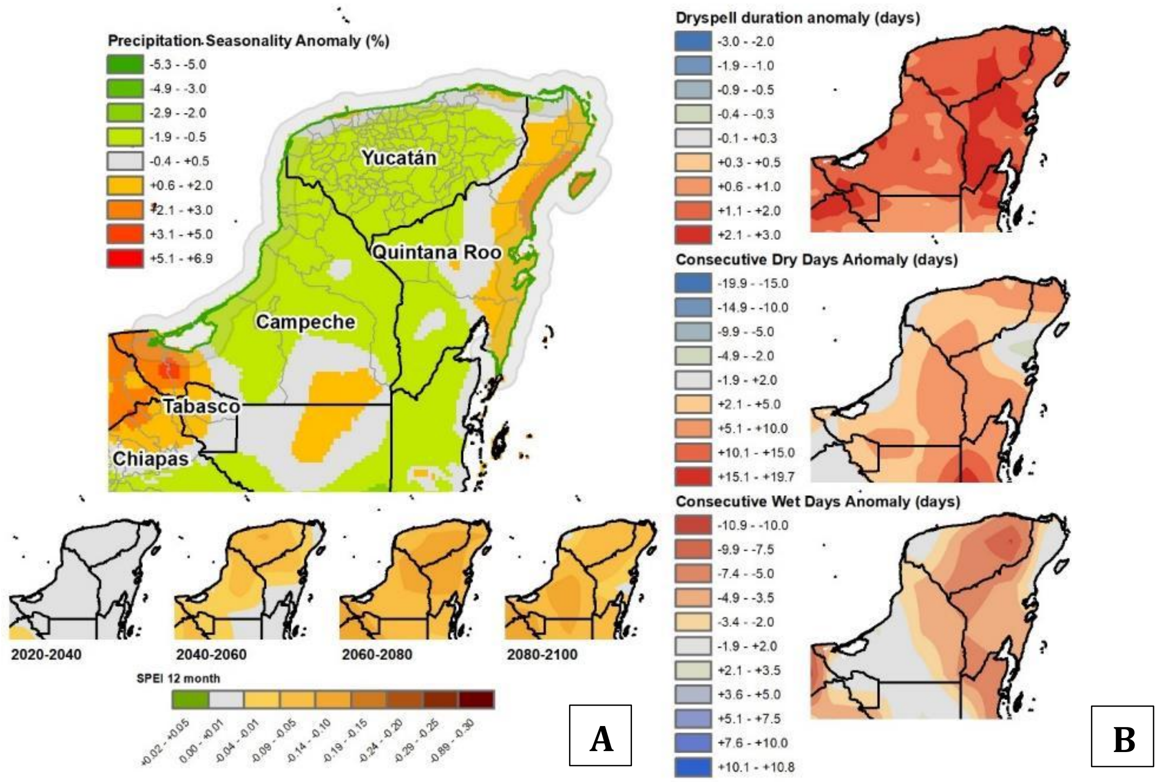


Figure 44 Projected changes in SPEI, dry spell duration, and consecutive dry and wet days (A); and Projected SPEI drought conditions and anomaly dry days over time (B). Source: Ogier, 2023, p. 37.

TEMPERATURE

Under future climate conditions, mean temperature increases are projected for the entire YP, with the northern and eastern coastal areas predicted to experience increases of between 0.24-0.26°C per decade (Figure 45). In the south of the Yucatan state and the western part of Quintana Roo, temperature increases of up to 0.29°C per decade are predicted. The southwestern parts of Campeche will see the most severe warming, with increases of between 0.30-0.31°C per decade expected. Overall, projections also indicate a rise in average minimum and maximum temperatures (Figure 45 C), in line with the geographic differences in mean temperature rise. In the northeastern coastal region of the YP, maximum temperatures are expected to rise by 0.26-0.27°C per decade, with the trend increasing in intensity further southwest. Southwestern Campeche will experience increases in average maximum temperatures by up to 0.32°C per decade. Concurrently, the average decadal minimum temperatures in the YP will increase along the same axis as for maximum temperature —between 0.23-0.24°C per decade in northeastern Quintana Roo and up to 0.31°C per decade in the southwest of Campeche.

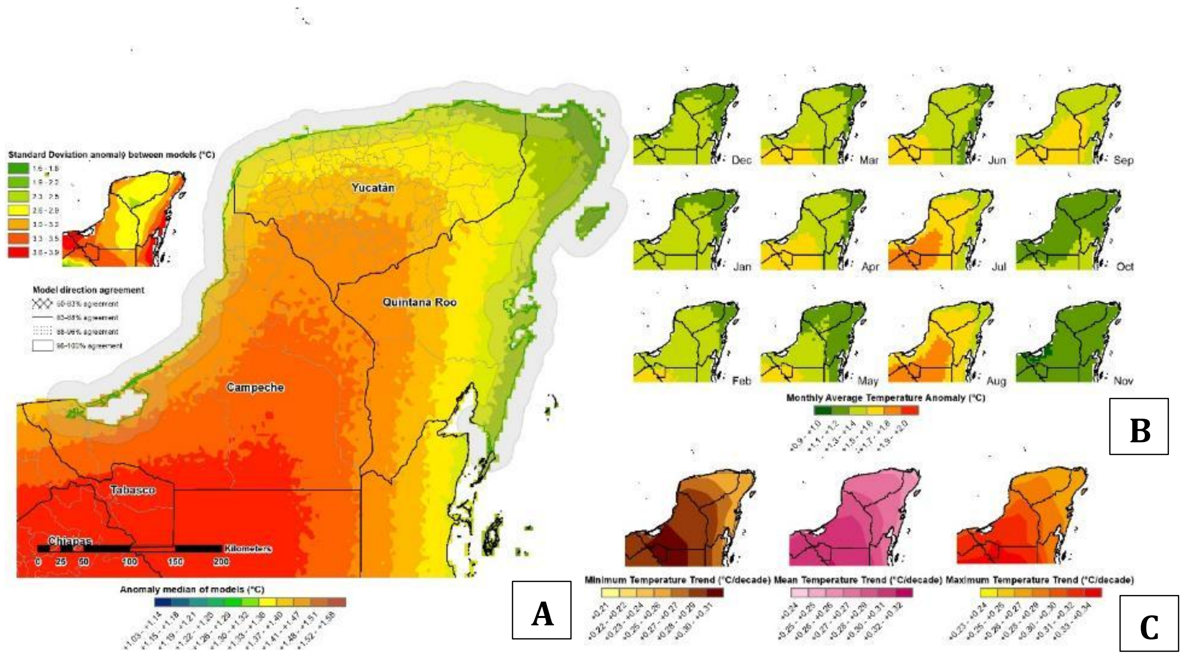


Figure 45 Median future average temperature, standard deviation between ensemble models, model agreement (A), and monthly temperature anomalies; and Projected temperature trends and 10th to 90th percentile ranges (b). Source: Ogier, 2023, p. 41.

Heatwaves

A rise in the occurrence of heatwaves is projected for the YP. The Figure 46 below shows the projected peak temperature distribution (A) and distribution of extreme temperature parameters, projected change in extreme temperature distribution, and change in cooling degree days (B). The analysis indicates an increase in monthly maximum temperature peaks across the entire YP and an increase in the duration of warm spells —particularly in coastal areas. The number of 99th percentile days relative to the 1960-1990 baseline period is also projected to increase most severely in coastal zones, but also across the western parts of the entire YP to a lesser extent.

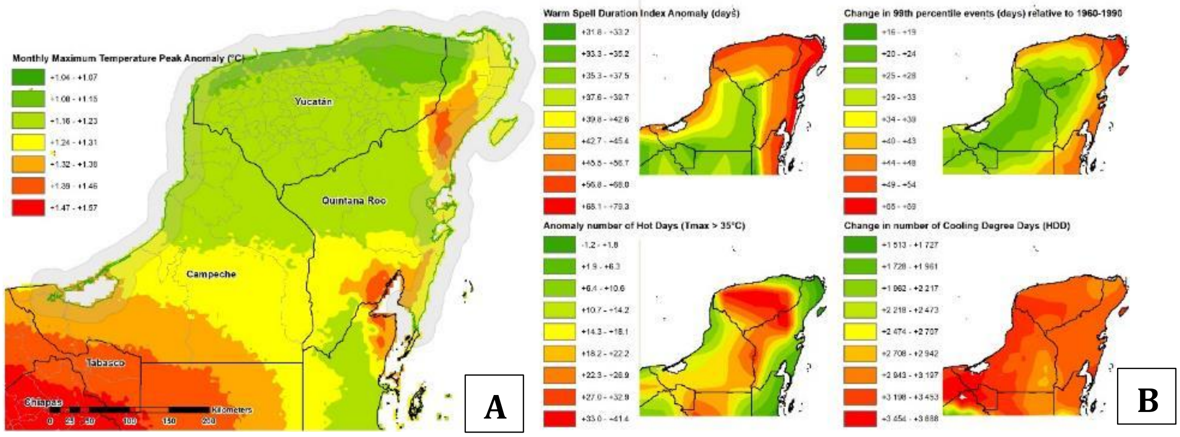


Figure 46 Projected peak temperature distribution and distribution of extreme temperature parameters (A); Projected change in extreme temperature distribution and change in cooling degree days (B). Source: Ogier, 2023, p. 44.

Fire weather

The Fire Weather Index (FWI), a global index that assesses fire risk, is based on meteorology. It consists of various factors that consider wind and fuel moisture impacts on fire behavior and spread. The likelihood of a wildfire starting increases as the FWI rises, indicating favorable weather conditions (Copernicus, n.d.).

Increased temperature, reduced annual rainfall, and increased dry spells result in an enhanced drying of vegetation and augmented susceptibility for more severe ignitions. There is, therefore, an increase in the duration of the fire weather season in all locations around the YP (Figure 47). The most significant increase is up to ~180 days in the southwestern and southeastern locations. The area to the northeast sees an increase, but only up to 75 days. The average and maximum fire weather indexes increase into the future by up to 6 FWI values in all locations other than the coastal area to the northeast, which sees increases of only up to 3 FWI values.

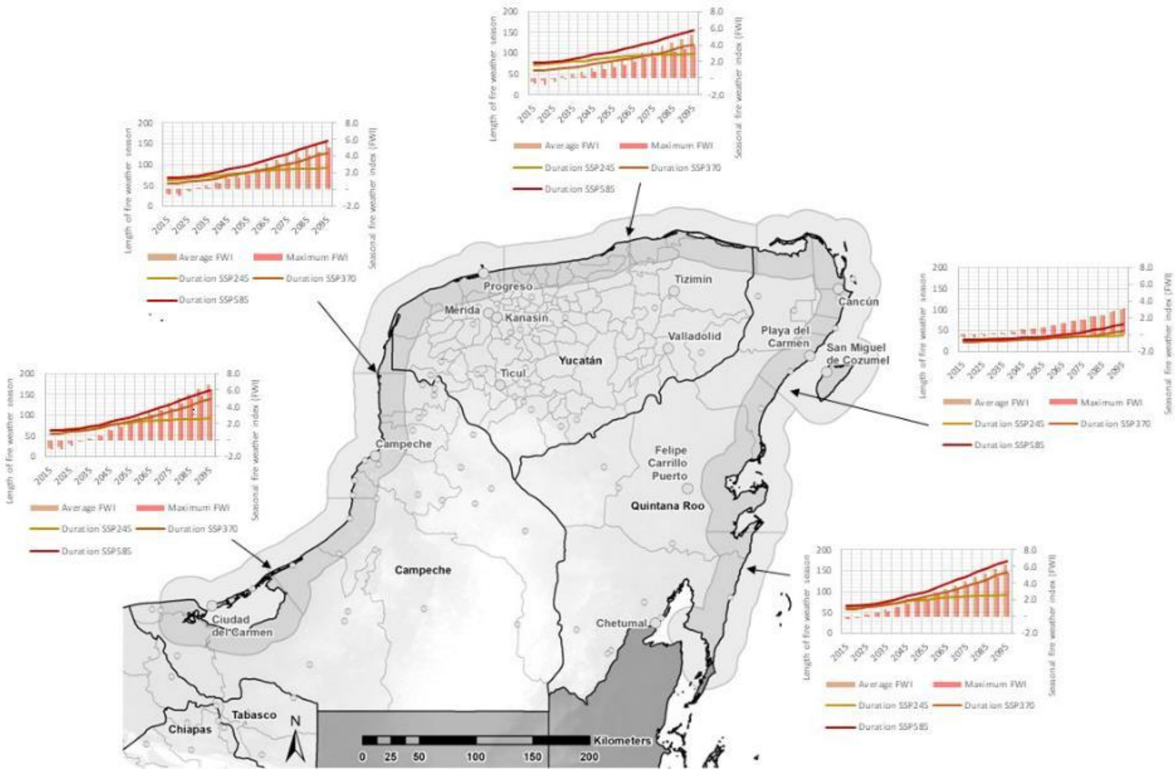


Figure 47 Change over time for the duration of fire season, average and peak changes in fire weather index. Source: Ogier, 2023, p. 47

TROPICAL CYCLONES

Projections for tropical cyclone activity under future climate conditions are highly variable, with a likely (67% confidence) ~50% to -50% range on either side of the current occurrence. There is, however, an expected decrease overall in the number of anticipated events and a likely increase in more severe Categories 4 and 5 (by 50%). Overall, a slight increase in the maximum intensity per tropical cyclone event and an increase in the precipitation rate associated with tropical cyclone events are expected. The frequency and intensity of tropical cyclones are strongly related to anomalous sea surface temperature (SST) in the main development region, the weakening of vertical wind shear (VWS) in the mid-troposphere during depression development, and the La Nina phase of the El Nino Southern Oscillation (ENSO). Each of these factors may change because of future climate change, influencing the characteristics of tropical cyclones. ENSO and wind-shear characteristics are highly dynamic and will vary on synoptic and annual time scales in response to current conditions. SST changes, on the other hand, will be more linear, and while they will exhibit a seasonal cycle, the baseline trend will not likely revert to oscillations around current SST means (Figure 48).

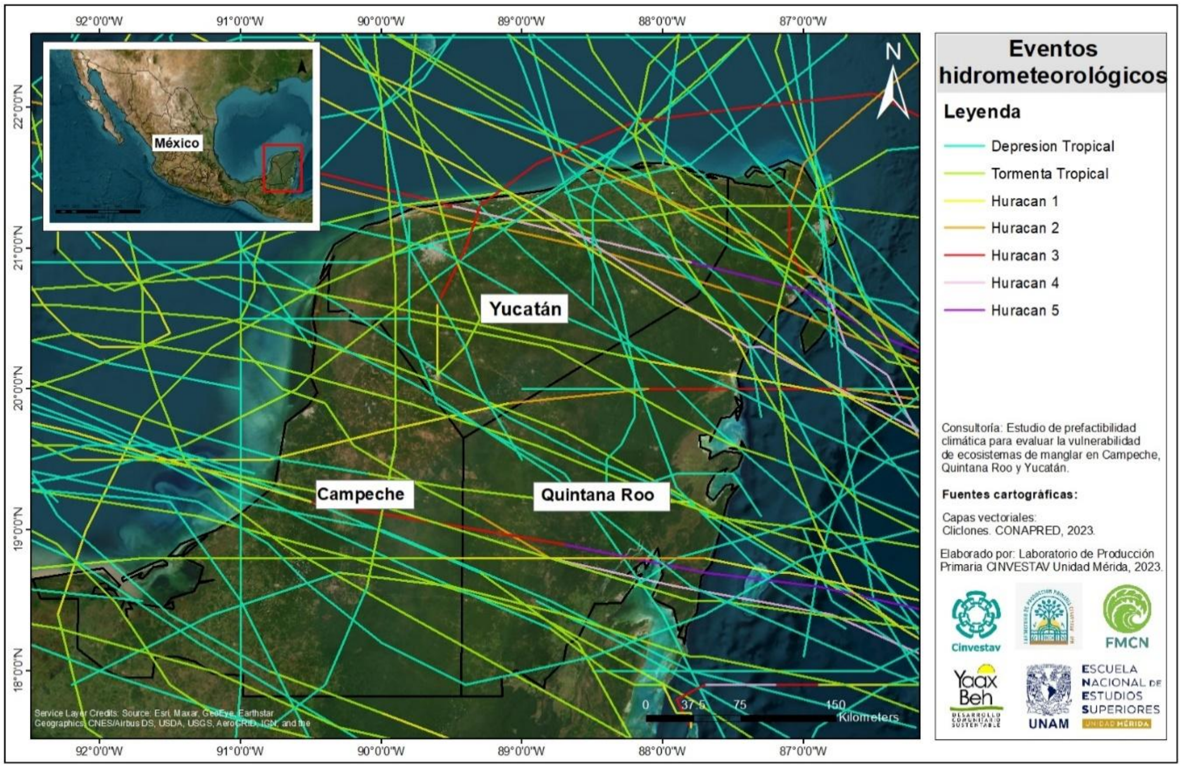


Figure 48 Extreme hydrometeorological events over the Yucatan Peninsula between 1960 and 2021. Source: Prepared by Frida Castillo, based on information from CENAPRED, 2023.

Sea Surface Temperature (SST)

While moving over the ocean, hurricanes use warmer ocean waters as an easily extracted moisture source for continued development. Hurricanes weaken and lose intensity as they move over land or sea with lower surface temperatures, which can result in their dissipation as they are overwhelmed by larger synoptic dynamics. The full atmospheric connection between SST and hurricane development and propagation remains unknown. However, according to the IPCC AR5 and several other studies, rising sea levels have resulted in increased hurricane activity (Christensen et al., 2013).

Using this premise, projected future SSTs are analyzed to show the potential anomalous state in which hurricanes may form and move later in the century. Assuming stationary hurricane forcing, an increase in SST would indicate increased hurricane activity. The SST rises by 2.0°C near the end of the century and 1.5°C by mid-century with a trend of 0.16°C/decade (Figure 49).

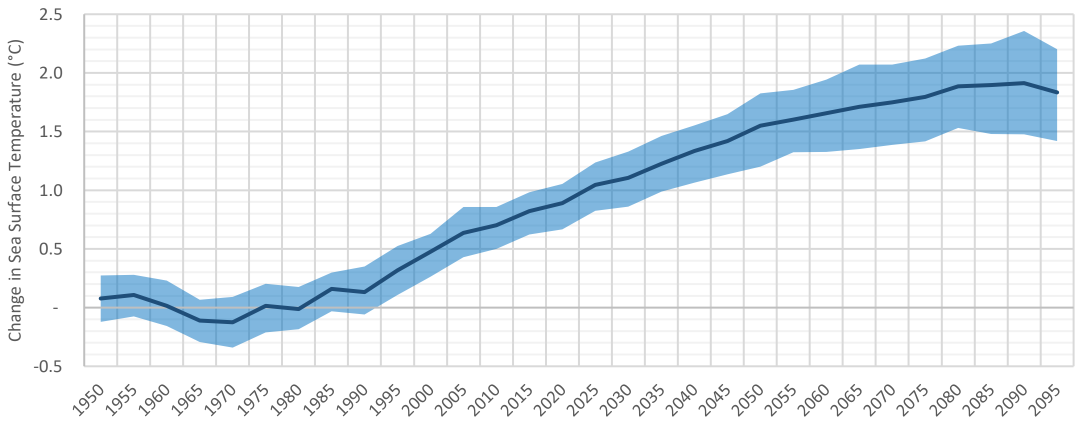


Figure 49 Sea Surface Temperature (SST) changes in the domain leading up to the Yucatan Peninsula. Source: Ogier, 2023, p. 51.

Accurate forecasting of future hurricane activity, both global and regional, will be critically dependent on reliable projections of the behavior of these modes of variability (including ENSO) under climate change, as well as a thorough understanding of their physical connections with hurricanes. Their projected behaviors are still uncertain, though additional research is being conducted to evaluate the physical influences of a changing climate on hurricane development and intensification (Emanuel, 2017).

Storm Surge

The analysis shows that under future climate conditions, storm surges will become increasingly common and severe in many areas along the YP's coastline (Figure 50). 10-year return period anomaly surge will increase by 0.006-0.019 m on Quintana Roo's southern coastline, with higher increases of up to 0.049 m projected for northern Yucatan state. In areas to the west of the YP, the 10-year return surge will decrease by 0.229-0.010 m. For the 25-year return surge, projections are similar to those for the 10-year return surge, although the increase will be more severe in southern Quintana Roo and the decreasing trend weaker on the west coast. For a 100-year return surge, a wider area of the eastern coastline will experience a surge of up to 0.034 m higher than the baseline. However, the trend of decreasing surges on the west coast will prevail.

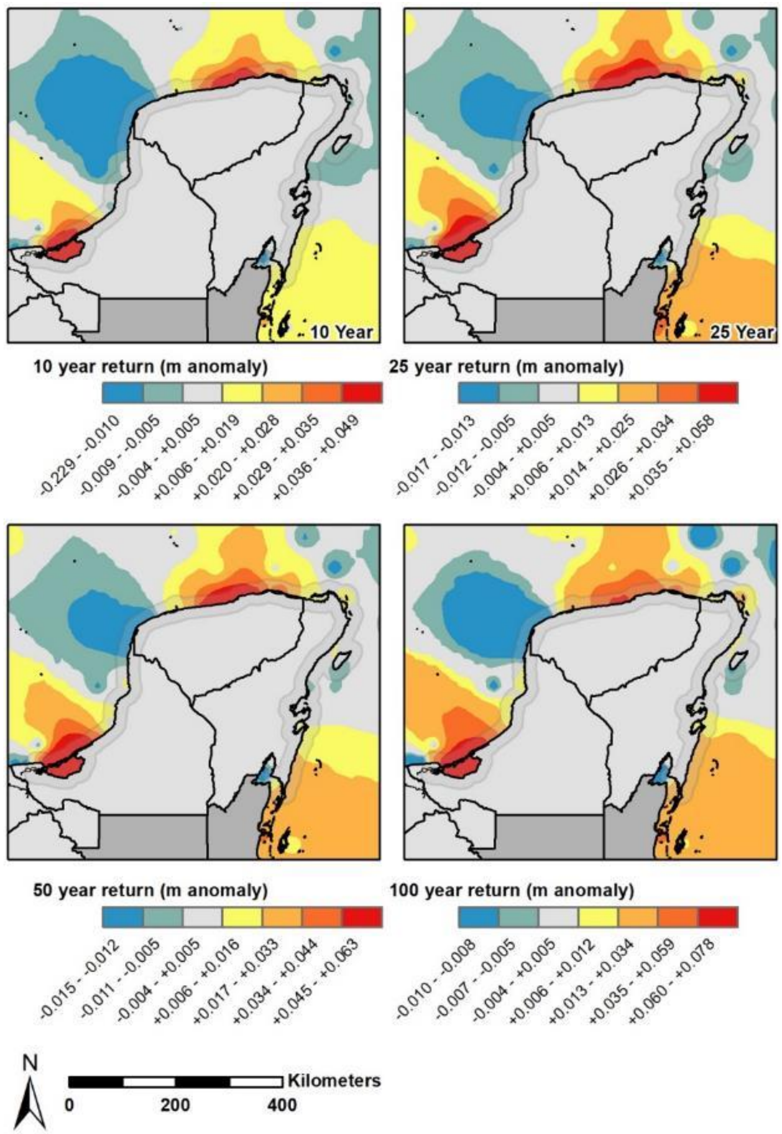


Figure 50 Storm surge at 10-, 25-, 50- and 100-year return periods (https://cds.climate.copernicus.eu/cdsapp#!/dataset/sis-water-level-change-indicators-cmip6?tab=overview). Source: Ogier, 2023, p. 52.

OCEAN CHARACTERISTICS

Projections show that SST will rise by 1.5°C by mid-century and 2.0°C towards the end of the century, with a trend of 0.16°C/decade.

Sea surface temperature (SST)

As with the rest of Mexico, the waters around the YP are also projected to increase under future climate conditions (Figures 51 and 52) which includes a projected increase in average sea surface temperatures (SST) to up to 28.1°C. Areas west and east of the YP will show SST anomalies of up to 0.94 and 0.86, respectively.

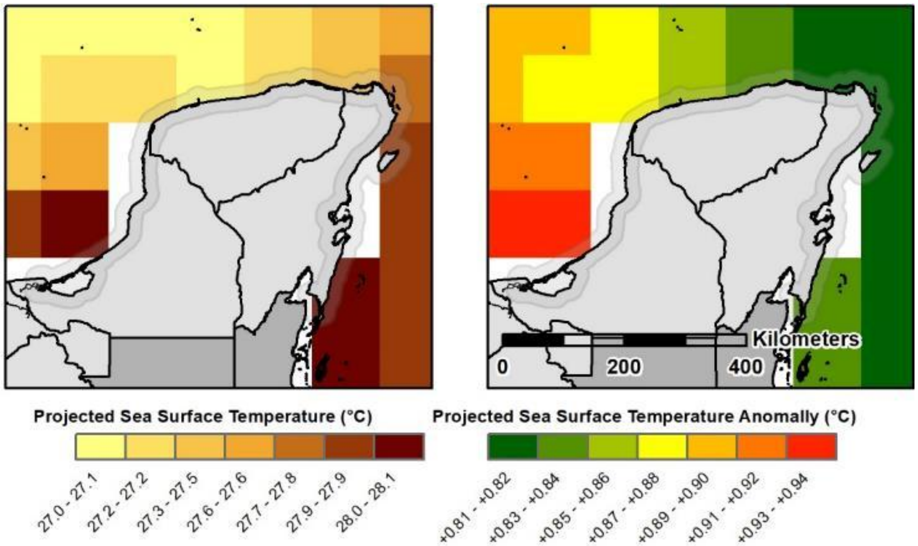


Figure 51 Projected sea surface temperatures and sea surface temperature anomaly. Source: Ogier, 2023, p. 57.

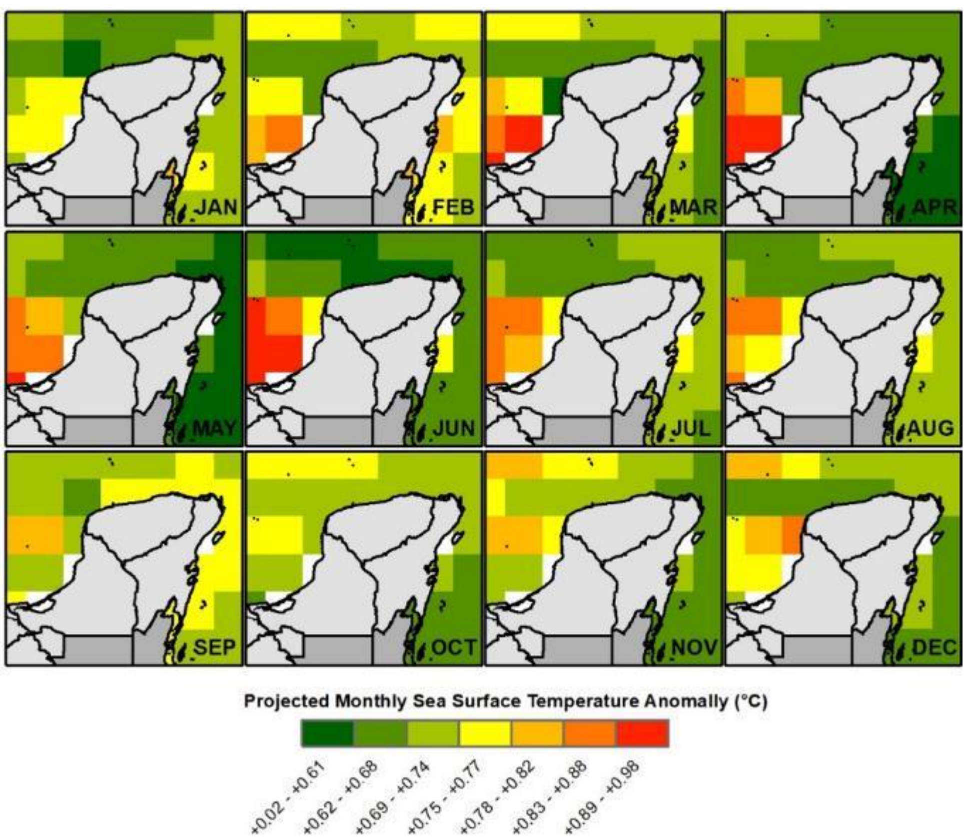


Figure 52 Projected sea surface temperatures and sea surface temperature anomaly. Source: Ogier, 2023, p. 58.

Sea level rise (SLR)

Along with increasing SST, the YP will also experience a significant rise in sea levels. Projected increases in sea level see the most significant change in the northeastern areas of the YP of up to

+0.17m between 2020 and 2050. Areas to the west are projected to see a lower increase of up to +0.15m. These increases will have a significant impact not only on the coastal mainland but even more so on the many small islands surrounding the YP (Figure 53) .

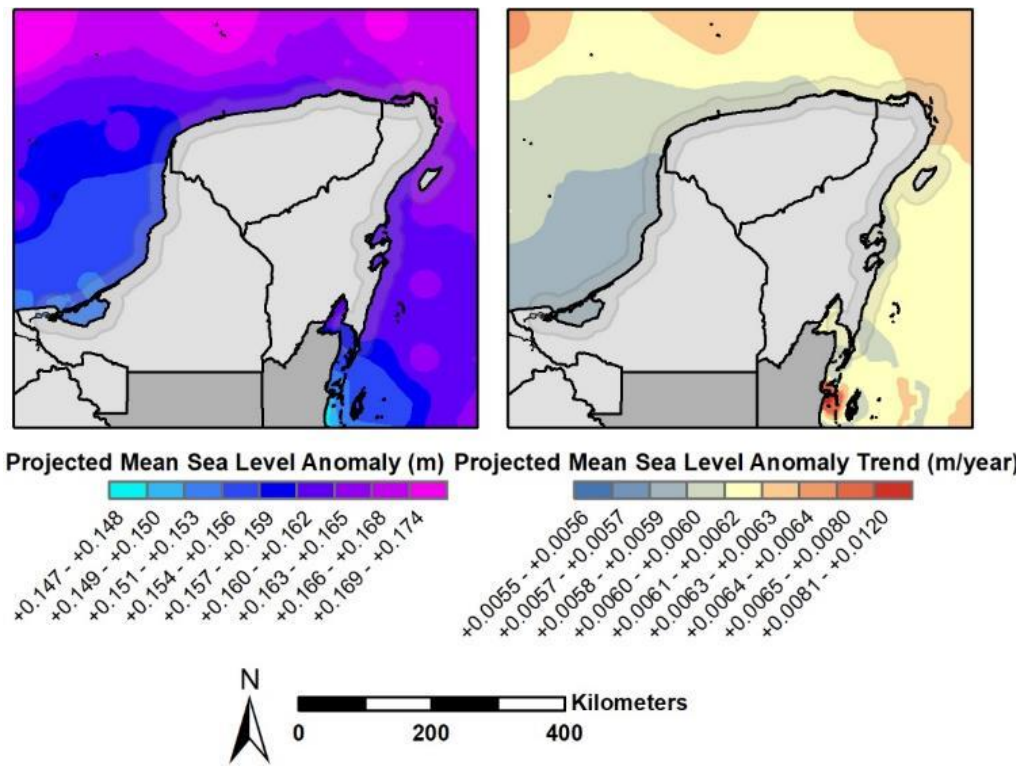


Figure 53 Projected mean sea level anomaly; and projected mean sea level anomaly trend (m/year). Source: Ogier, 2023, p. 58.

Acidification

Changes in ocean acidification can disrupt the balance of marine and coastal ecosystems, affect the survival of various species, and significantly impact marine biodiversity.

Salinity increase can affect marine organisms, particularly those adapted to lower salinity environments such as estuaries or coastal areas. Increased salinity can disrupt the balance of osmosis in aquatic animals, affecting their physiological processes and potentially leading to dehydration and death, which can alter the distribution patterns of marine species, disrupt the ecological balance, and impact the entire food chain. Additionally, corals are highly sensitive to changes in salinity. Elevated salinity can stress corals and contribute to coral bleaching events. The ocean surrounding the YP is projected to increase its salinity by up to +0.3, with the most significant increase noted to the west.

There is a projected decrease in calcite concentrations in the future, with the most considerable changes noted to the southwest. Decreased calcite concentrations can make it challenging for marine organisms like corals, shellfish, and some planktonic species to build and maintain their shells and skeletons. It can also lead to enhanced coral bleaching as coral growth is hindered.

Changes in aragonite are most noted to the southwest, with a decrease of up to -0.44. There is a lower decrease in the more northern areas. A reduction in aragonite will limit the development of coral and reef development as well as have negative implications for many marine organisms.

Decreases in pH (acidification) are most noted to the west of the YP. Decreased pH impacts coral reefs' ability to build calcium carbonate structures as well as having reduced growth rates. PH also negatively impacts shellfish and shell-forming organisms' ability to form and maintain shells (Figure 54)

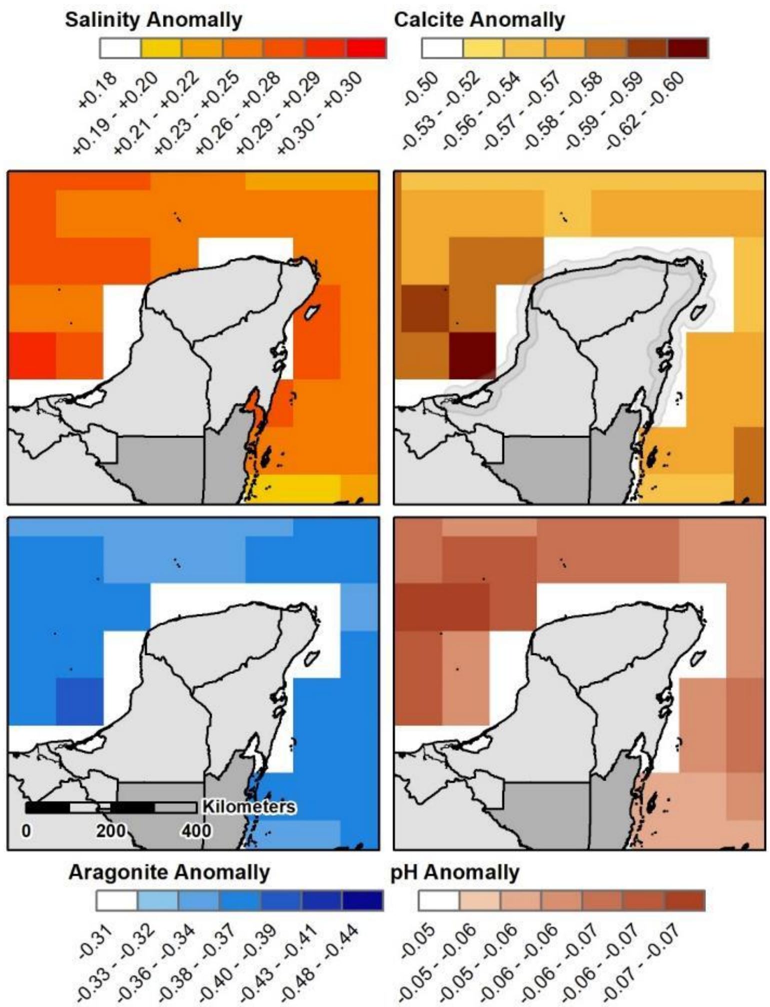


Figure 54 Projected ocean acidification, changes in Salinity (top left), Calcite (top right), Aragonite (bottom left), and pH (bottom right). Source: Ogier, 2023, p. 60.

Small island changes

The islands around the YP are very sensitive ecosystems and will be impacted significantly under the projected future climate scenarios. The four islands highlighted here are Alacranes Reef, Cayo Arcas, Cozumel, and Chinchorro, but all islands around the YP will be similarly vulnerable to climate change. These impacts include:

- An increase in sea level resulting in direct physical impacts to the low-lying coastal areas; this includes increased coastal erosion removing beaches and disrupting ecosystems and habitat loss, saline intrusion impacting coastal water tables, significant coastal flooding impacts from the passage of tropical storms and storm surge, displacement of coastal communities, infrastructure, and livelihoods, as well as damages to tourist infrastructure and assets. Indirect impacts will be disruption to the local economy, implications to water contamination and water stress for these isolated areas, and tourism perception of the area with reduced capacity.
- An increase in sea surface temperatures will lead to further coral bleaching and intensification of acidification. There will be impacts on the timing and distribution of phytoplankton blooms, altering marine food chains. If the local resources are compromised, there may also be a shift in species distribution or a reduction in marine species populations. The indirect impact of increased surface temperatures will provide more energy and moisture to severe storm events such as tropical cyclones. Changes to corals and marine species may significantly impact the islands' tourism draw.
- Ocean acidification will decrease corals' capacity to form and maintain structure, compromising species' ability to make shells and exoskeletons. It may alter species distribution, which will impact other marine species and have indirect negative perception implications for tourism and local livelihoods.

Figure 55 Critical islands surrounding the Yucatan Peninsula exposed to future climate changes. Projected future changes in ocean characteristics around the small, selected islands for 2020-2050. Source: Ogier, 2023, p. 61.

Table 26 Projected future changes in ocean characteristics around the small, selected islands for 2020-2050

Island	Average elevation	Sea level rise	Acidification	Sea surface temperatures
Alacranes Reef	2.05m	+0.1695m	Aragonite: -0.365 Calcite: -0.5675 Salinity: +0.231 pH: -0.066	+0.8511°C
Cayo Arcas	5.02m	+0.1567m	Aragonite: -0.3775 Calcite: -0.5825 Salinity: +0.244 pH: -0.065	+0.9114°C
Cozumel	9.58 (4.84m within 200m from the coast)	+0.1627m	Aragonite: -0.325 Calcite: -0.575 Salinity: +0.226 pH: -0.067	+0.8141°C
Chinchorro	4.57m	+0.1609m	Aragonite: -0.370 Calcite: -0.575 Salinity: +0.240 pH: -0.065	+0.8221°C

Source: Ogier, 2023, p. 61.

The risks for the islands are as follows:

1. **Alacranes Reef**: very high. This island has the lowest average elevation but the highest projected sea level rise. The island is mostly reef, and the future moderate acidification and temperature increases will likely severely impact the reef itself and the marine species in the area. There will also probably be a very negative indirect impact from tourism loss and compromise of livelihoods.

2. **Cayo Arcas**: high. This island has the lowest land area, only moderate average elevation, and the lowest projected sea level rise. This island, however, has the highest change in acidification and sea surface temperature changes.

3. **Cozumel**: medium high. This island's economy is driven by tourism, diving, and charter fishing, so changes in marine species and corals through acidification and sea surface temperatures, as well as damages to coastal infrastructure from sea level rise, will significantly impact the island. However, this island is the largest in the YP, with the highest average elevation and lowest acidification, sea level, and temperature anomalies. It is also better capacitated to cope with climate change disruptions than most other islands. The most significant risk driver here is the disruption of local livelihoods and the tourism industry that climate change may cause.

4. **Chinchorro**: medium. This island has a very small permanent population and is a complex mix of tidal estuary and marine environments. Changes in sea level are moderate and may result in some habitat losses, particularly in the southern end of the island. The northern parts, however, seem to have higher vegetation and would have greater resilience. The changes in acidification and temperatures are moderate.

Model data

The Coupled Model Intercomparison Project Phase 6 (CMIP6) is a large-scale climate modeling effort to provide the most up-to-date and reliable projections of future climate change. It is a collaborative project involving climate modeling groups from all over the world, and it is intended to help the Intergovernmental Panel on Climate Change (IPCC) in its assessments of the state of the climate system (Eyring et al., 2016; IPCC, 2021).

CMIP6 simulates the Earth's climate system's behavior using various modeling methodologies, including atmosphere-only models, ocean-only models, and fully coupled atmosphere-ocean-land models. These models represent the physical, chemical, and biological processes that govern the climate system, and they are used to simulate past and future climate conditions under various greenhouse gas concentrations and other climate drivers.

- Atmosphere-only models simulate atmospheric behavior to assess physical processes such as atmospheric circulation, radiation, and cloud formation, among others.
- Ocean-only models simulate the ocean's circulation, mixing, and heat transport.
- Fully coupled models, on the other hand, simulate the interactions between the atmosphere, ocean, land surface, and cryosphere, allowing for a more comprehensive understanding of the climate system and how it responds to external forcing.
- CMIP6 also includes Earth system models that incorporate the biogeochemical cycles of carbon, nitrogen, and other elements into the climate system, in addition to these modeling approaches. These models provide a more complete representation of the interactions between the Earth's physical and biological components, as well as their feedback to climate change (Eyring et al., 2016; IPCC, 2021).

The variety of modeling methodologies used in CMIP6 enables a comprehensive assessment of the uncertainties and range of future climate change projections, which is critical for informing climate policy and adaptation strategies.

The CMIP6 project expands on previous phases of the Coupled Model Intercomparison Project (CMIP), which have provided valuable information on the past and future evolution of the Earth's climate system. This analysis is based on CMIP6 data, which includes 134 models from 53 modeling centers. The publication of CMIP6 data began in 2019, with the majority of the data expected to be published by 2022, with CMIP6 scientific analyses used in the IPCC's 6th Assessment Report (AR6).[7] The CMIP6 models used for this analysis are as follows:

7 ECMWF, CMIP6 climate projections, information.

ACCESS-CM2 (Australia)
ACCESS-ESM1-5 (Australia)
AWI-CM-1-1-MR (Germany)
AWI-ESM-1-1-LR (Germany)
BCC-CSM2-MR (China)
BCC-ESM1 (China)
CAMS-CSM1-0 (China)
CanESM5 (Canada)
CanESM5-CanOE (Canada)
CESM2 (USA)
CESM2-FV2 (USA)
CESM2-WACCM (USA)
CESM2-WACCM-FV2 (USA)
CIESM (China)
CMCC-CM2-HR4 (Italy)
CMCC-CM2-SR5 (Italy)
CMCC-ESM2 (Italy)
CNRM-CM6-1 (France)
CNRM-CM6-1-HR (France)
CNRM-ESM2-1 (France)
E3SM-1-0 (USA)
E3SM-1-1 (USA)
E3SM-1-1-ECA (USA)
EC-Earth3 (Europe)
EC-Earth3-AerChem (Europe)
EC-Earth3-CC (Europe)
EC-Earth3-Veg (Europe)
EC-Earth3-Veg-LR (Europe)
FGOALS-f3-L (China)
FGOALS-g3 (China)
FIO-ESM-2-0 (China)
GFDL-ESM4 (USA)
GISS-E2-1-G (USA)
GISS-E2-1-H (USA)
HadGEM3-GC31-LL (UK)
HadGEM3-GC31-MM (UK)
IITM-ESM (India)
INM-CM4-8 (Russia)
INM-CM5-0 (Russia)
IPSL-CM5A2-INCA (France)
IPSL-CM6A-LR (France)
KACE-1-0-G (South Korea)
KIOST-ESM (South Korea)
MCM-UA-1-0 (USA)
MIROC6 (Japan)
MIROC-ES2H (Japan)
MIROC-ES2L (Japan)
MPI-ESM-1-2-HAM (Switzerland)
MPI-ESM1-2-HR (Germany)
MPI-ESM1-2-LR (Germany)
MRI-ESM2-0 (Japan)
NESM3 (China)
NorCPM1 (Norway)
NorESM2-LM (Norway)
NorESM2-MM (Norway)
SAM0-UNICON (South Korea)
UKESM1-0-LL (UK)

Because CMIP6 includes more advanced representations of the physical, chemical, and biological processes that govern the climate system than previous phases, it allows for a more comprehensive understanding of the complex interactions between the atmosphere, oceans, land surface, and cryosphere and how they are likely to change in response to increasing greenhouse gas concentrations and other climate change drivers.

Model validation

Model validation should be performed in locations of varying climate drivers and forcing mechanisms to ensure a robust simulation of the current and future climate scenario.

Servicio Meteorológico Nacional has 5,466 observational meteorological stations distributed throughout Mexico. Of these, only 2,926 stations are currently operational. In the provinces of Yucatan, Campeche, and Quintana Roo, these stations are 97 total stations with 67 operational, 82 total stations with 56 operational, and 61 total stations with 46 operational, respectively. The observational stations selected for validation should be operational within the study area or as near as possible to the study area and have at least 30 years of accurate daily observational data.

The study area of this project is 20km from the coast along the YP. Within the study area, there are 42 observational stations of which only 28 stations are currently operational. Of these stations, only 23 stations have more than 30 years of observational data.

Table 27 Observational stations in the study area with at least 30 years of data

ID number	Station	Province	Data start year	Data end year	Record length (years)
4003	CAMPECHE (OBS)	CAMPECHE	1878	2018	140
4007	EL CARMEN (SMN)	CAMPECHE	1926	2018	92
4014	ISLA ARENAS	CAMPECHE	1970	2018	48
4015	ISLA AGUADA	CAMPECHE	1959	2018	59
4029	SABANCUY	CAMPECHE	1953	2018	65
4038	CAMPECHE (DGE)	CAMPECHE	1952	2017	65
4041	CHAMPOTON (DGE)	CAMPECHE	1986	2018	32
4052	CANASAYAB	CAMPECHE	1975	2018	43
4053	SANTA CRISTINA	CAMPECHE	1976	2018	42
4068	CHINA	CAMPECHE	1983	2018	35
4072	SIHO CHAC	CAMPECHE	1982	2018	36
23023	SOLFERINO	QUINTANA ROO	1969	2017	48
23025	TULUM	QUINTANA ROO	1964	2017	53
23048	COZUMEL (DGE)	QUINTANA ROO	1994	2012	18
23155	CANCUN	QUINTANA ROO	1988	2012	24
23158	MAHAHUAL	QUINTANA ROO	1999	2011	12
23163	PLAYA DEL CARMEN	QUINTANA ROO	1998	2012	14
23166	CENTRAL VALLARTA	QUINTANA ROO	2000	2012	12
31007	CHICXULUB PUERTO	YUCATAN	1963	2016	53
31010	DZILAM DE BRAVO	YUCATAN	1961	2016	55
31012	EL CUYO	YUCATAN	1954	2016	62
31023	PROGRESO (OBS)	YUCATAN	1951	2017	66
31024	RIO LAGARTOS	YUCATAN	1962	2016	54
31029	SISAL	YUCATAN	1957	2016	59
31031	TELCHAC PUERTO	YUCATAN	1952	2016	64
31040	CELESTUN (DGE)	YUCATAN	1961	2016	55
31083	YALSIHON	YUCATAN	1982	2016	34
31094	DZIDZANTUM	YUCATAN	1986	2016	30

Source: Servicio Meteorológico Nacional

The stations selected for the validation were based on data quality, being in the study area, record length, and distribution around the YP covering the various climates. The stations selected were as follows:

Table 28 Stations selected for model validation

Geographic Location	Coastal southwest YP	Coastal northwest YP	Coastal north YP	Coastal east YP
Station ID	4007	4014	31010	23025
Name	**El Carmen**	**Isla Arenas**	**Dzilam de Bravo**	**Tulum**
Municipality	Carmen	Calkini	Dzilam de Bravo	Solidaridad
Latitude (°N)	18.653	20.69	21.393	20.226
Longitude (°W)	91.761	90.453	88.891	87.458
Altitude (meters asl)	5	1	2	10
Duration of record (years)	92	48	55	53

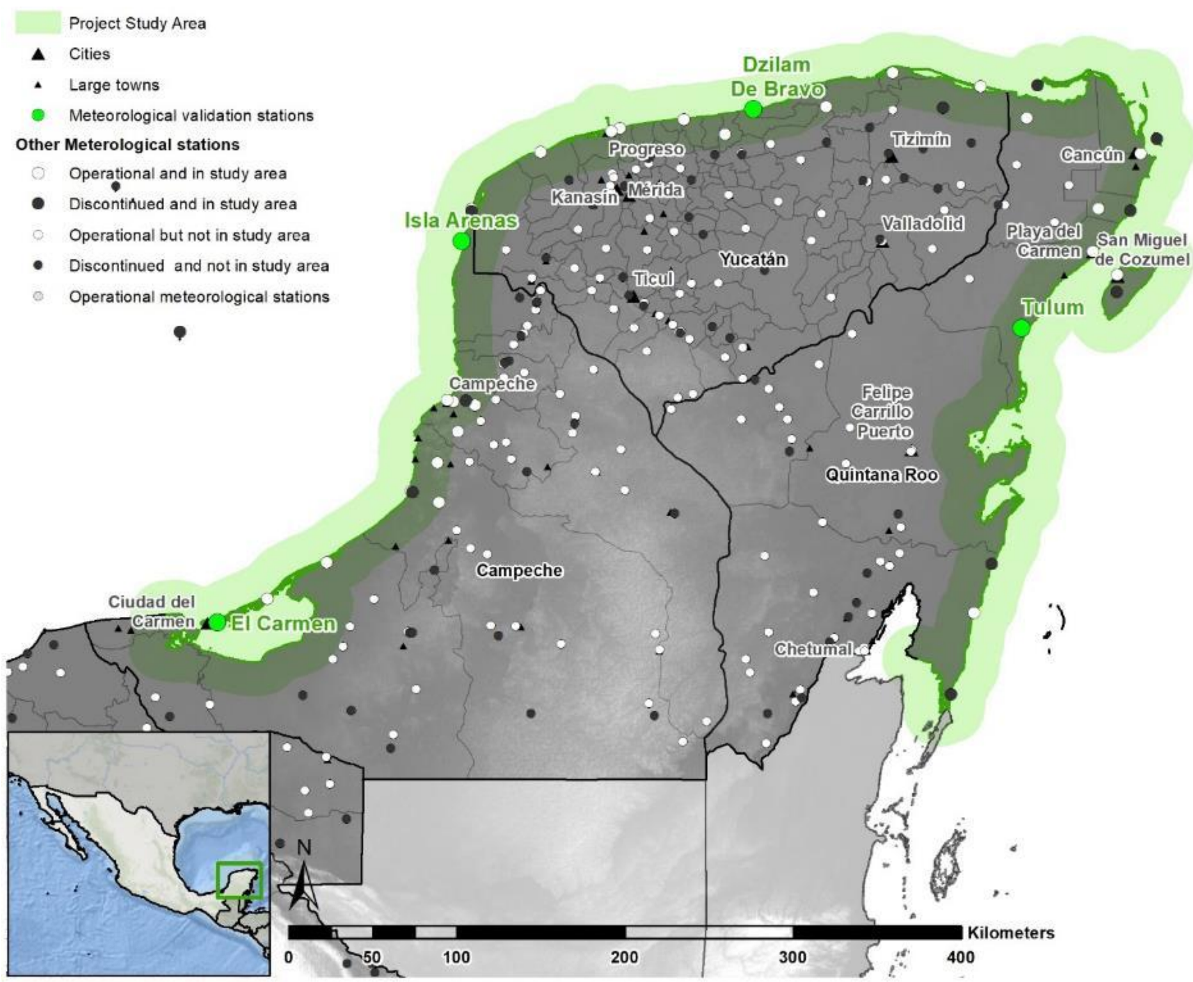


Figure 56 Location of observational meteorological stations and selected stations for validation. Source: Ogier, 2023, p. 71

VALIDATION OF PRECIPITATION DATA

Rainfall is challenging to model, particularly in a dynamic area such as the YP. However, given that future drought and water stress are paramount to the country, validation of rainfall is essential in more accurately representing future rainfall scenarios.

Seasonal signal

The agreement in the seasonality of models to observational data is essential as this reflects the sub-annual dynamics that will impact water security agriculture and disaster planning. Models that have the lowest seasonal anomalies are the best at representing these sub-annual dynamics and will likely be more realistic in the projected future.

The seasonal rainfall signal is well-matched between the modeled ensemble and the station data. Models can simulate the early season false peak, the slight decrease mid-season, and the late season peak. Some models show significant seasonal outliers of several times higher volumes in the early season. These were excluded. Slightly lower volumes are simulated by the models compared to the station data. The models are closest to the station data in El Carmen. In Tulum, the early season peak is only captured by some models and is not reflected in the ensemble.

The best-performing models with the simulation closest to the station data are mpi-esm1-2-hr, ipsl-cm6a-lr, miroc-es2l, kace-1-0-g, and noresm2-lm.

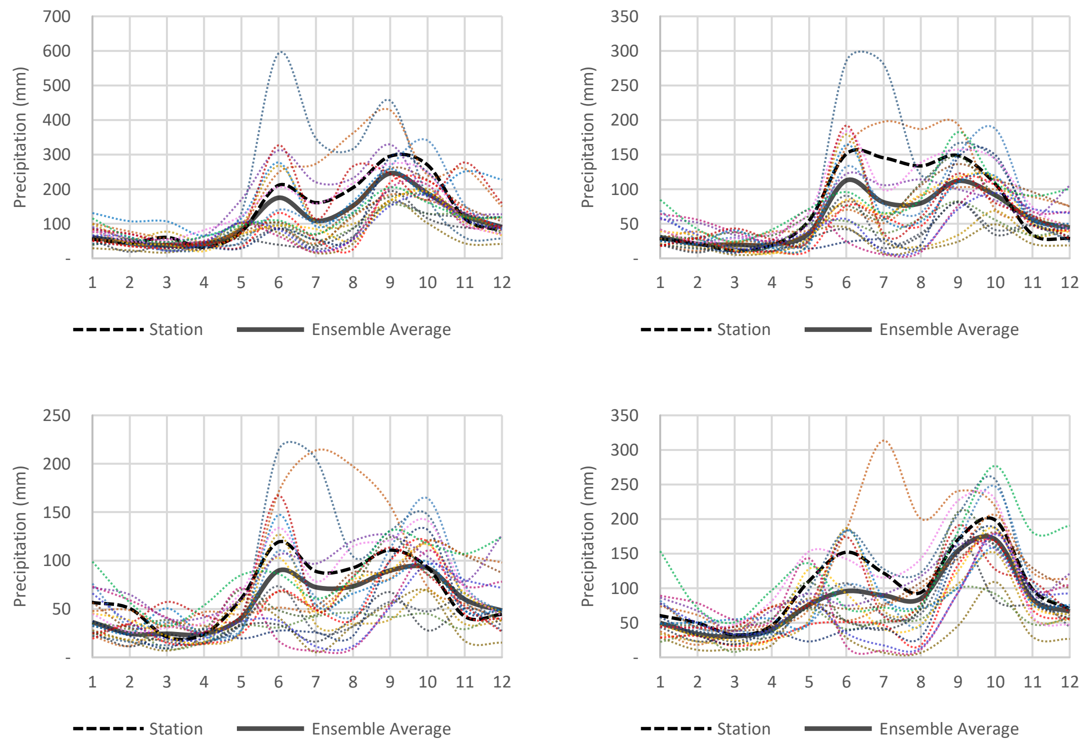


Figure 57 Seasonal rainfall for the observational reanalysis, model ensemble and individual models for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, p. 72.

Variability

Rainfall variability is likely to have a range that can be expected within a regular season. It will impact water supply and groundwater recharge. If models can better estimate the potential variability, this will indicate a more accurate modeled representation of the past climate.

There is a wide range in the models' annual and seasonal standard deviations. These models slightly overestimate the variability in most locations, and over each season, the variability is consistently higher than the station data, which is most evident in the annual data. The low rainfall season of DJF and MAM see little variability between the stations and the model data. There is slightly more disparity in the higher rainfall seasons of JJA and SON.

The models that performed the best in the coastal area were bcc-csm2-mr, cmcc-cm2-sr5, and cmcc-esm2, while inland the models that performed well were taiesm1, cmcc-esm2, and cmcc-cm2-sr5.

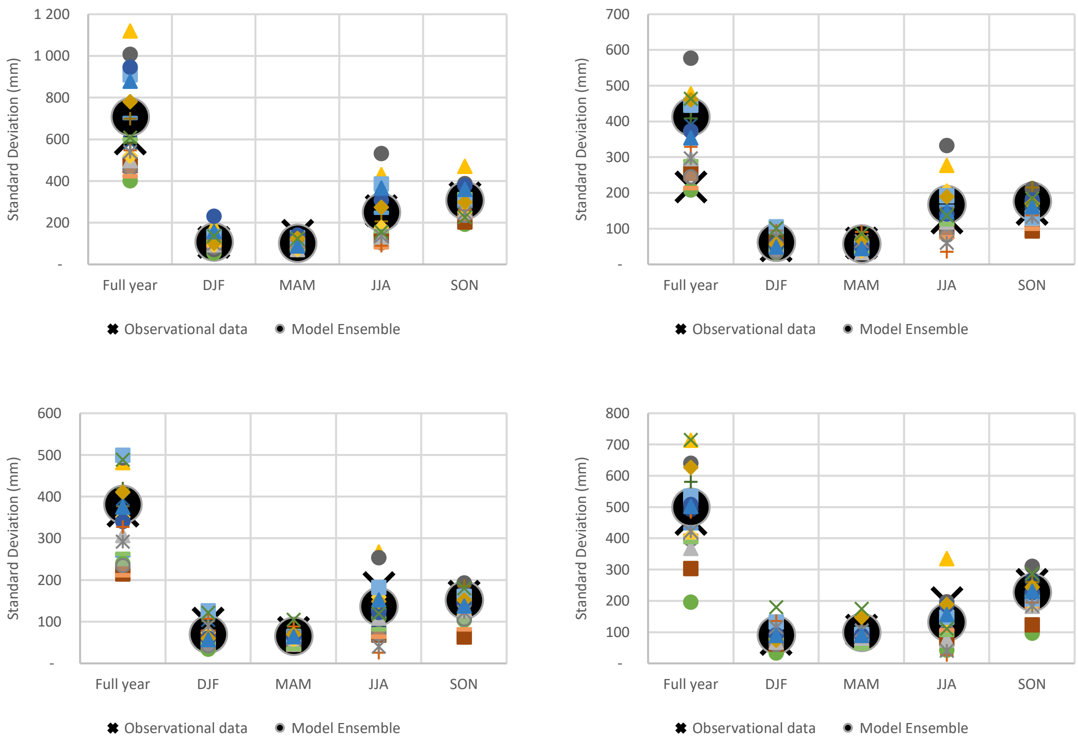


Figure 58 Annual and seasonal rainfall variability of the station and individual models for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, p. 73.

Trends

The long-term trends of the observational data may indicate the local response to current climate changes and pre-empt further future changes. The model's ability to replicate the trends of the observational data is indicative of the model's adherence to the local climate forcing principles.

There is a wide disparity between the trends of the models and the station data in the same location. The trend disparity is lower in the lower rainfall season of DJF and MAM and higher in the more dynamic rainfall seasons of JJA and SON. The overall trends in the station data sets, other than Dzilam de Bravo are generally small (<20mm per decade change). Dzilam de Bravo sees generally increased trends annually and from MAM, JJA, and SON, but a decrease in DJF. This particular system is not well simulated by the models.

The models that performed the best area were gfdl-esm4, access-esm1-5, ipsl-cm6a-lr, cmcc-cm2-sr5, inm-cm4-8, and mpi-esm1-2-hr.

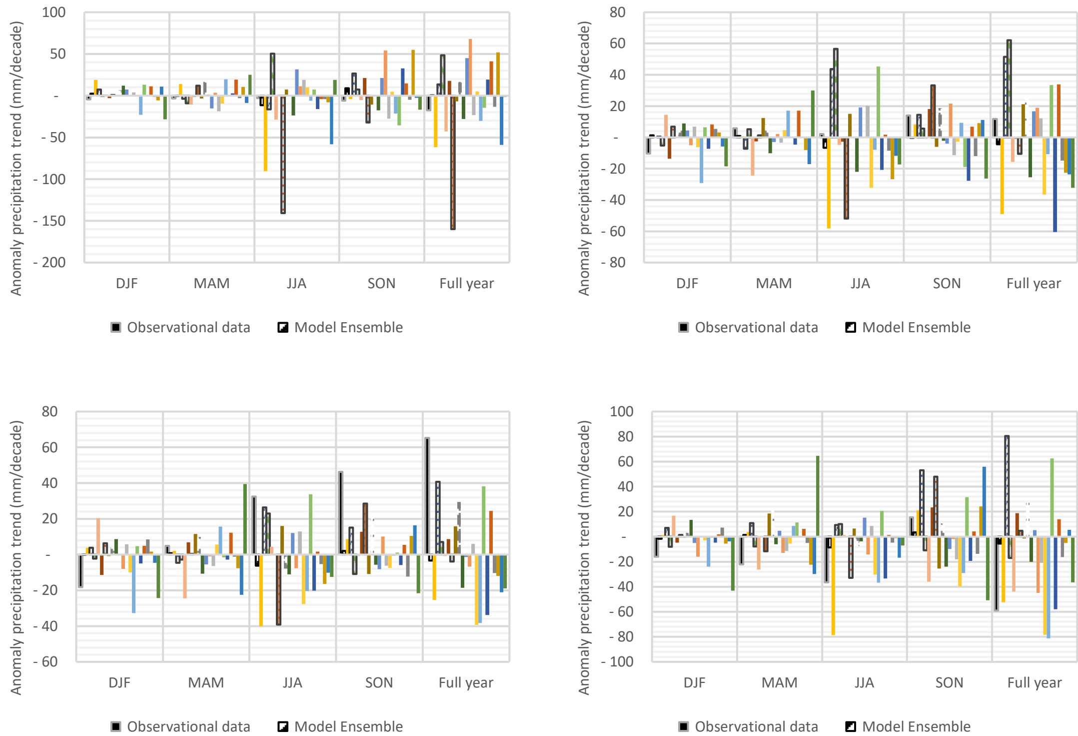


Figure 59 Long-term trends of station data, model ensemble, and individual models for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, pp. 73-74.

Validation of temperature data

Modeling temperature is less changing than modeling rainfall. As the noted impacts in the YP are water security and drought, the validation and scoring of models in their performance for temperature agreement are weighted lower than the agreement of rainfall models to observation.

Seasonal signal

The agreement in the temperature seasonality of models to observational data is essential as this reflects the sub-annual dynamics that will impact water security agriculture and disaster planning. Models that have the lowest seasonal anomalies are the best at representing these sub-annual dynamics and will likely be more realistic in the projected future.

The climate models seem to consistently overestimate the maximum temperatures from June to October and underestimate temperature in the first half of the year for Isla Arenas and Dzilam de Bravo. Generally, however, they tend to match the seasonal timing of the cooler and hotter periods noted in the station data.

The models performing best are cnrm-esm2-1, inm-cm5-0, inm-cm4-8, mri-esm2-0, and mpi-esm1-2-hr.

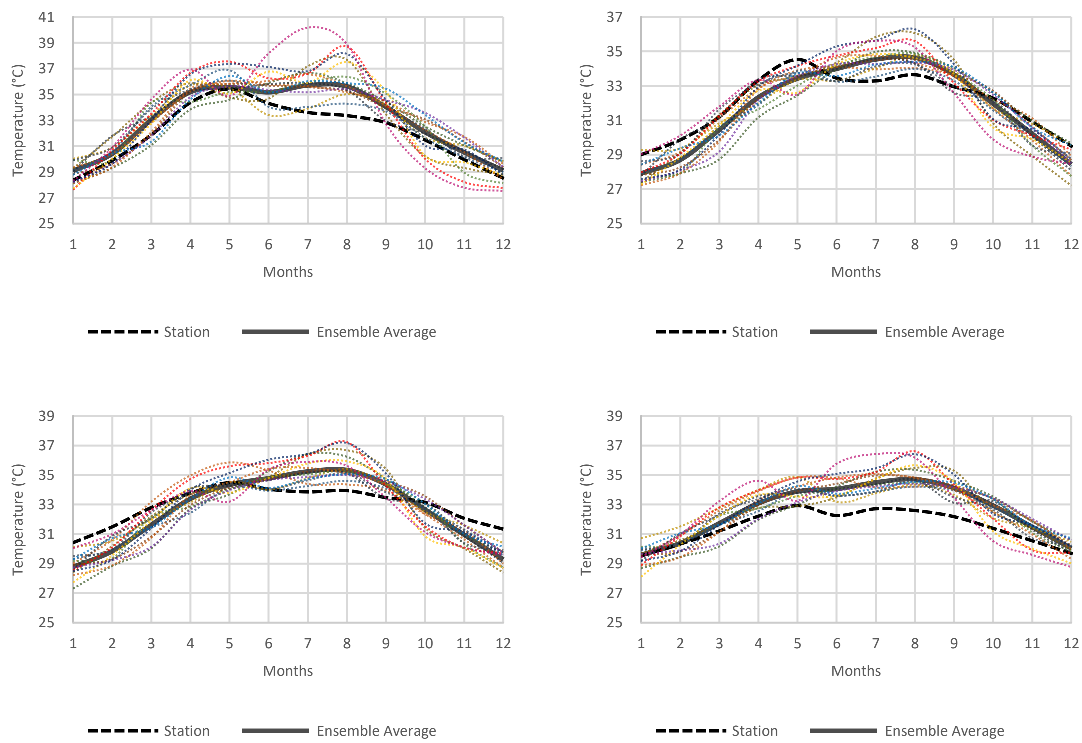
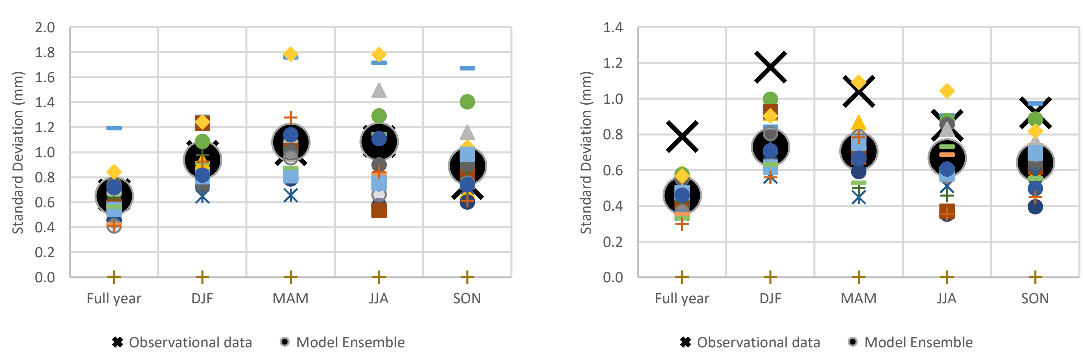


Figure 60 Seasonal rainfall for the observational reanalysis, model ensemble and individual models for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, pp. 73-74.

Variability

Temperature variability is likely ranges that can be expected day to day and within a normal season. This will impact evaporation and evapotranspiration and heat wave occurrence. If models are better able to estimate the potential variability, this will indicate a more accurate modelled representation of the past climate.

The models underestimate the variability of station temperatures in all locations other than El Carmen. This underestimation is quite severe as the station's variability is near the outlying models. No models perform particularly well here, but the best-performing models in the coastal area were ipsl-cm6a-lr and nesm3.



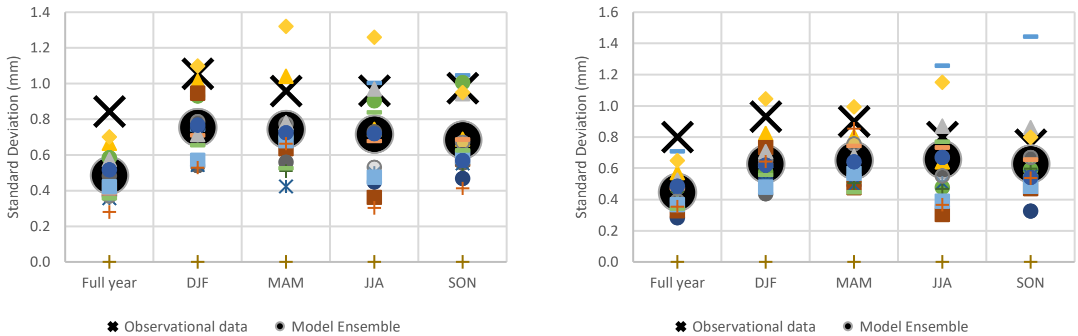


Figure 61 Annual and seasonal rainfall variability of the station and individual models for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, p. 75.

Trends

The long-term trends of the observational data may indicate the local response to current climate changes and pre-empt further future changes. The model's ability to replicate the trends of the observational data indicates the model's adherence to the local climate forcing principles.

Nearly all the models simulate the increasing temperature trends noted in the El Carmen, Isla Arenas, and Tulum station data. There is some variability between the magnitude of the trends, but overall, most do a good job and see a trend with 0.1 to 0.2 °C of the station for each season. The trends in the station data for Dzilam de Bravo are higher than the others and are higher than some of the outlier models, and the models do not quite reach the higher trends noted in the station data. The best-performing models were access-esm1-5, canesm5, cmcc-esm2, and hadgem3-gc31-ll.

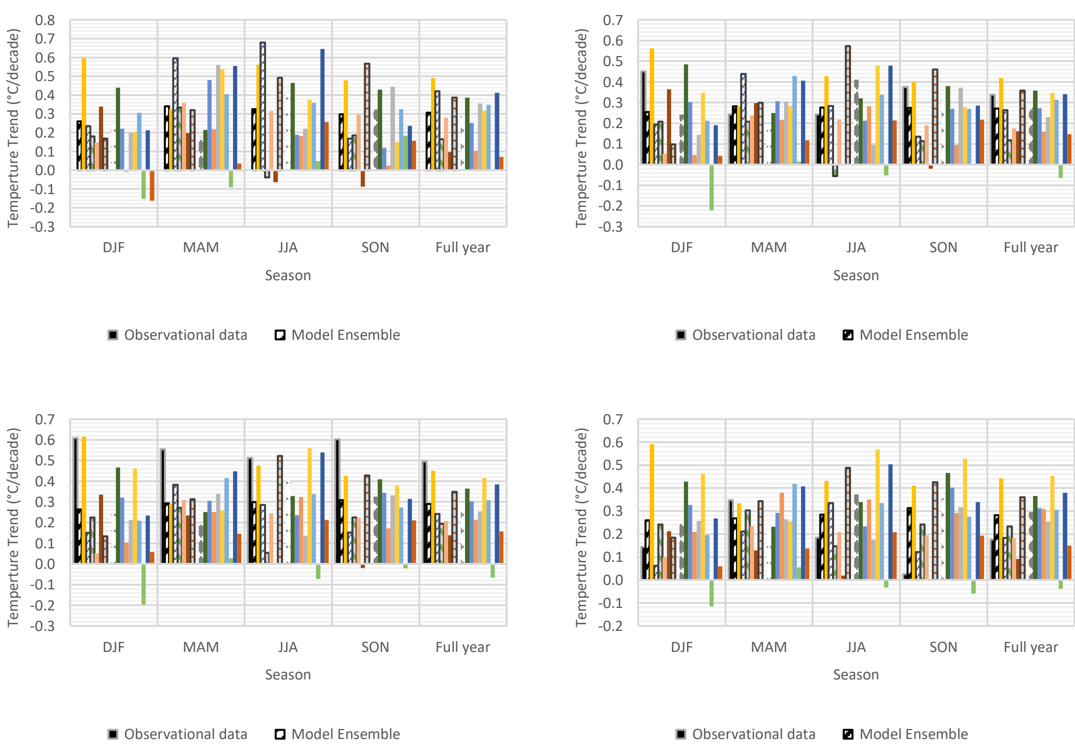


Figure 62 Long-term trends of station data, model ensemble, and individual model for El Carmen (top left), Isla Arenas (top right), Dzilam de Bravo (bottom left), and Tulum (bottom right). Source: Ogier, 2023, pp. 75-76

Model selection

The choice of models for the projected analysis needs to represent the observed climate, seasonal signal, variability, trends, and magnitude profile as near as possible and, where feasible, have as minor as possible bias correction. The combination of agreement of precipitation and temperature trends, seasonality, and bias will give the best possible representation of the localized climate.

No single model is the best at simulating all the aspects of precipitation and temperature relative to the four stations. However, the models that best and consistently reflected high adherence to the historical data, particularly for rainfall, were mpi-esm1-2-hr, ipsl-cm6a-lr, and cmcc-cm2-sr5. All analyses will use these models as an ensemble.

Timeframe and scenario selection

The UN Intergovernmental Panel on Climate Change (IPCC) released a report on August 9th, 2021, about the physical science of climate change using five possible scenarios for the future. The scenarios result from complex calculations that depend on how quickly humans curb greenhouse gas emissions. But the calculations are also meant to capture socioeconomic changes in areas such as population, urban density, education, land use, and wealth. For example, a rise in population is assumed to lead to higher demand for fossil fuels and water. Education can affect the rate of technological development.

Emissions increase when land is converted from forest to agricultural land. Each scenario is labeled to identify both the emissions level and the so-called Shared Socioeconomic Pathway, or SSP, used in those calculations (Climate Neutral Group. (2021).

Scenario 1 - Most optimistic: 1.5C by 2050 - SSP1-1.9:

- The IPCC's most optimistic scenario describes a world where global CO2 emissions are cut to net zero around 2050. Societies switch to more sustainable practices, with the focus shifting from economic growth to overall well-being. Investments in education and health go up. Inequality falls. Extreme weather is more common, but the world has dodged the worst impacts of climate change.
- This first scenario is the only one that meets the Paris Agreement's goal of keeping global warming to around 1.5°C above preindustrial temperatures, with warming hitting 1.5C but then dipping back down and stabilizing around 1.4C by the end of the century.

Scenario 2 - Next Best: 1.8C by 2100 - SSP1-2.6:

- In the next-best scenario, global CO2 emissions are cut severely, but not as fast, reaching net zero after 2050. It imagines the same socioeconomic shifts towards sustainability as SSP1-1.9. But temperatures stabilize around 1.8C higher by the end of the century.

Scenario 3 - Middle of the road: 2.7C by 2100 - SSP2-4.5:

- This is a "middle of the road" scenario. CO2 emissions hover around current levels before starting to fall mid-century but do not reach net zero by 2100. Socioeconomic factors follow their historic trends, with no notable shifts. Progress toward sustainability is slow, with development and income growing unevenly. In this scenario, temperatures rise by 2.7°C by the end of the century.

Scenario 4 - Dangerous: 3.6C by 2100 - SSP3-7.0:

- On this path, emissions and temperatures rise steadily and CO2 emissions roughly double from current levels by 2100. Countries become more competitive with one another, shifting toward national security, and ensuring their food supplies. By the end of the century, average temperatures have risen by 3.6C.

Scenario 5 - Avoid at all costs: 4.4C by 2100 - SSP5-8.5:

- This is a future to avoid at all costs. Current CO2 emissions levels roughly double by 2050. The global economy grows quickly, but this growth is fueled by exploiting fossil fuels and energy-intensive lifestyles. By 2100, the average global temperature is a scorching 4.4C higher.

The IPCC Sixth Assessment Report 2021(AR6) confirms that the world is on the verge of major tipping points and that immediate climate action is critical for our survival (IPCC, 2021). It emphasizes the most recent and sophisticated physical understanding of the climate system and climate change. It combines multiple pieces of evidence from past observations of the ecosystem, scientific and process understanding, and provides data and information to global and regional climate models to formulate advice on climate variables such as weather and climate extremes in a specific situation under various emissions criteria.

Despite the NDCs, recent global emissions indicate that we are unlikely to meet the SSP1 scenario milestones. SSP5 is the worst-case scenario and mitigation measures are anticipated to make this an avoided reality. This scenario is however presented as the extreme potential range along with the SSP3-70 scenario. **The majority of the assessment uses the SSP2-4.5 scenario as the most likely future.**

Climate modeling is the assessment of the long-term anticipated changes in the climate system. These are normally done for 30 years at the mid-century (2040-2069) and late-century (2070-2099) time intervals. However, the need for interventions to adapt to climate change requires the development of intervention actions in the short term. The planning and adaptation horizons should match the projected climate analysis timeframes. **The 30-year time frame of 2020-2050 with a mid-point of 2035 is therefore used for the assessment of the near future climate changes**. The baseline of the current climate used is 1990-2020 unless otherwise stipulated. Future anomalies are derived from this baseline. There are some datasets where varying institutions have used alternative baselines. These are noted in each scenario.

Climate change impacts

The described climatic changes directly affect vulnerable communities and ecosystems in the YP. Under future climate conditions, these communities will increasingly face vulnerability to climate change, especially the intensifying tropical cyclones already observed (CMCC, 2021). The costs associated with historical climate and hydro-meteorological impacts in Mexico have risen over time (Figure 63). In 2005, storms affected up to 3 million people; in 2011, storms, floods, extreme temperatures, and droughts impacted 3.5 million people. Damage costs have also escalated, peaking between 2004 and 2015, with fewer reported impacts earlier in the record. While the higher reported rates of damage are likely related to reporting bias, climate change is nonetheless directly affecting the occurrence of hydro-meteorological impacts in Mexico as a whole, as well as in the YP.

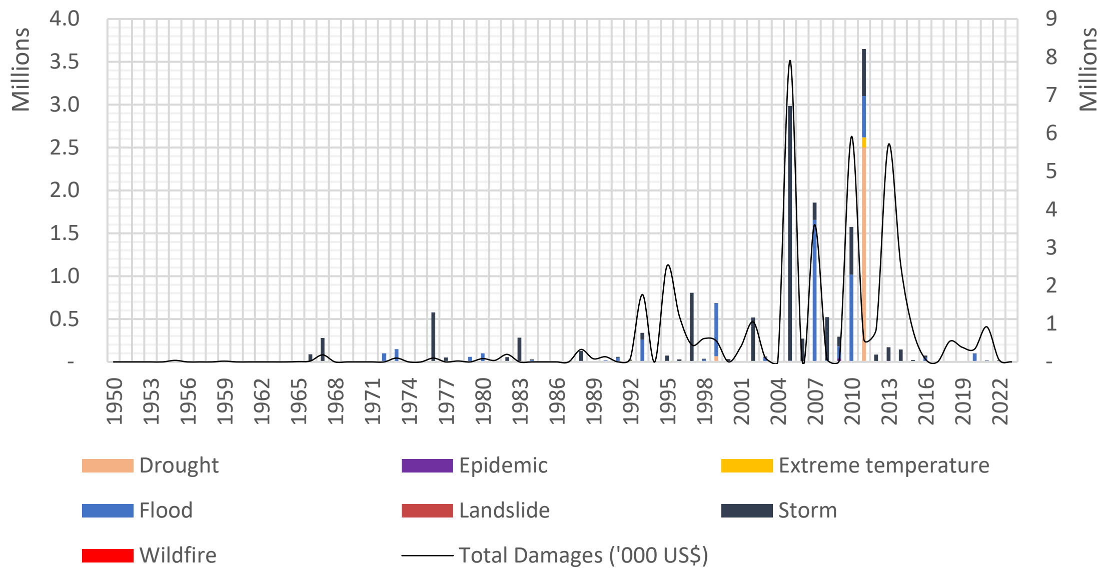


Figure 63 Changes over time in people affected by climate and hydro-meteorological events and estimated damage costs (based on Guha-Sapir et al., n.d.). Source: Ogier, 2023, p. 138.

A summary of specific observed and projected impacts of climate change in Mexico and the YP is presented below.

IMPACTS ON COASTAL AREAS

Mexico's coastline (particularly the YP) is highly vulnerable to the impacts of climate change. The effects of rising sea levels are increasingly threatening infrastructure and investments. Moreover, tropical cyclones and extreme weather threaten the lives and livelihoods of local communities that depend on coastal zones for their survival (NDC Partnership, 2018). As coastal ecosystems continue to be affected by climate change, projections indicate that an overall negative impact can be expected on Mexico's fisheries (Cisneros-Mata et al., 2019). Under low and high emissions scenarios, fish catch potential will decrease, respectively, by 6.8% and 17% by 2050 (CMCC, 2021). Along the coastline of the YP, climate change is already causing numerous impacts. These include the spread of invasive aquatic plants such as sargassum, which reduces the tourism value of the beaches, and coastal erosion caused by SLR and storm surges. Climate change also affects ecosystems in coastal areas that local communities depend on for their livelihoods, including more than 350,000 fishers around the country's coastal areas. Climate change is exacerbating the impacts of unsustainable fishing practices that threaten the sustainability of these communities' livelihoods.

IMPACTS ON WATER

Groundwater is a critical natural resource in the YP. a high dependence of local communities on groundwater, particularly during the dry season (Metcalfe et al., 2020). In the YP, groundwater availability is overall of more importance than surface water, and changing precipitation patterns will likely impact its availability, except for areas in the south of the YP. Projections indicate that as annual precipitation declines in most of the YP's eastern parts, important groundwater infiltration areas will become increasingly arid. By some estimates, groundwater recharge will decrease by up to 23% by 2030 (Rodríguez-Huerta et al., 2020). Some parts of the YP will likely see rising demand for water, while supply will become diminished due to climate change.

Along with changes in water availability for domestic and agricultural use, climate change also affects vulnerable local communities through intensifying floods. In the YP, there is currently a high risk of flooding. Under future climate conditions, floods will become more frequent and intense as tropical cyclones become more regular. Tropical cyclone activity in the Caribbean Sea and the Gulf of Mexico is expected to increase while drought conditions across the YP are expected to intensify. Flooding will be particularly severe in coastal areas.

Impacts on agriculture

In the YP, water stress caused by droughts directly impacts vulnerable local communities through impacts on agriculture. These communities (many lack piped water) have reported water shortages for human use and impacts on agricultural production (Metcalfe et al., 2020). In many communities, high temperatures and water stress have already caused crop damage, mainly where they are dependent on rain-fed agriculture. Even in areas where irrigation infrastructure is better developed, droughts have reduced the availability of irrigation water. Where water is still available, the quality is often lower due to higher salinity due to increased evaporation caused by temperature rise (Metcalfe et al., 2020).

Along with impacts on crop production, livestock productivity in the YP has also been adversely affected by climate change in recent decades. Droughts have already caused a decrease in grazing, a decline in cattle fertility, and a drying of water holes and wells across the peninsula, adversely impacting food security (Metcalfe et al., 2020). Climate change has also affected secondary agricultural activity, including a reported loss in honey production because of reduced flowering of key species being impacted by dry conditions. In addition, dry conditions have also caused increased crop damage by wild animals and pests, with some smallholders reporting losses of up to 50% (Metcalfe et al., 2020). Under future climate conditions, as temperatures continue to rise and climate hazards such as floods and droughts become more common, these impacts are expected to intensify. Along with the direct effects of climate change on agricultural productivity, projections also indicate a likely increase in agricultural water demand due to increased evapotranspiration rates. Under a low and medium emissions scenario, water demand will likely increase by 21.6% and 18.9%, respectively (CMCC, 2021).

Impacts on fisheries

According to a study by the Environmental Defense Fund (EDF), there will likely be a 50 to 80% decline in primary fishing productivity in Mexico by 2100 (EDF, 2021). This study warns that more than 80% of Mexico’s 25 most prominent fisheries could be gravely damaged by climate change. Under low and high emissions scenarios, fish catch potential will decrease by 6.8% and 17%, respectively, by 2050 (Cisneros-Mata et al., 2019; CMCC, 2021). Hence, climate change will upset the livelihoods of more than 350,000 fishers in the country who depend on coastal ecosystems for survival, exacerbating the impacts of unsustainable fishing practices that threaten the sustainability of these communities' livelihoods.

In addition, best and worst-case scenario projections estimate that oxygen levels in marine regions in Mexico will decrease by 2050. In particular, under the worst-case scenario, some areas of the Atlantic Ocean would experience a loss of 0.1 to 2.1 mol.m-3 of their dissolved oxygen (EDF, 2021), affecting fisheries since some aquatic organisms may not survive with low oxygen levels. Moreover, worst-case scenario projections gauge that ocean temperatures will increase by 4.5 degrees Celsius (Ramírez, 2021), lowering oxygen levels. Rising ocean temperatures endanger multiple marine organisms and alter fish migration patterns as fish banks migrate toward colder waters with more oxygen (Cisneros-Mata et al., 2019).

Increasing levels of ocean acidification caused by climate change will affect the abundance and diversity of fish available for fishing in the YP. A pH decrease can negatively impact many marine species, especially those with calcium carbonate shells and skeletons, such as coral reefs, shellfish, and some types of plankton. As the ocean becomes more acidic, it becomes harder for these organisms to build and maintain their shells, leading to decreased growth rates and increased mortality, which can ripple throughout the food chain, affecting the abundance and diversity of other species that depend on these organisms for food or habitat. Furthermore, changes in pH can also affect the behavior and physiology of many marine organisms, such as fish and squid.

Other factors affecting YP's fisheries are the projected decrease in calcite and aragonite concentrations; when their concentration decreases, organisms like corals, shellfish, and some planktonic species find it harder to maintain their shells and skeletons, altering the marine food chain, and leading to coral bleaching. The most significant changes in calcite and aragonite concentrations are expected in the southwestern region of the YP, with aragonite experiencing a decrease of up to -0.44.

IMPACTS ON TOURISM

Along the YP, climate change is already creating significant disruptions, such as coastal erosion and the spread of sargassum, which limit the touristic appeal and value of coastal destinations. For example, the state of Quintana Roo is one of the most popular tourist destinations in the country, but it's also one of the most climate-vulnerable areas in Mexico (USAID, 2017). In fact, according to the Mexican Secretary of Tourism (SECTUR), coastal erosion ranges from 1.2 to 4.9m per year in Quintana Roo, where beaches have been steadily vanishing (De Jong, 2022).

Coastal areas in the YP, particularly along the east coast, will be affected by increased tropical cyclone activity, affecting tourism infrastructure, such as beachfront accommodations and ecosystems upon which the ecotourism sector thrives.

Cozumel is also at risk in the region. Its economy revolves around tourism, retail, and fishing. There, coral reefs act as essential shelters for aquatic organisms. However, ocean acidification makes it harder for coral polyps to secrete calcium carbonate, which is necessary to build and maintain coral reefs, leaving fish with less shelter and causing changes in ocean biodiversity. Such alterations could impact the attractiveness of this destination and alter Cozumel's tourist and fishing revenue.

Increased water temperatures have also contributed to the spread of invasive aquatic plants like sargassum across the YP. Sargassum affects the aesthetic appeal of coastal destinations in the region since pieces of seaweed tend to decrease the transparency of seawater and emit an unpleasant smell when decomposing along the shore. Moreover, sargassum can increase fish mortality and significantly reduce the productivity of *T. testudinum,* a type of seagrass (Hendy et al., 2021, p.1), and change the distribution of marine species, further altering the YP's ecotouristic charm. The hospitality sector has invested millions of dollars to remove sargassum from the coasts of the YP; estimates show that hotels in Quintana Roo spend over US$50,000 every month to remove sargassum (Forsua, n.d.).

Moreover, climate change will cause an increase in average precipitation in the region, which could flood nesting grounds for American flamingos (*Phoenicopterus ruber)* in the YP (Tun, 2021). The American flamingo is one of the ecotourism attractions in Ría Lagartos, in the Yucatan state, and receives more than 2 million visitors annually (Valencia, 2023).

Impacts on forests

Forest productivity in the YP has shown a weak increase in recent decades due to the fertilizing effect of higher atmospheric CO_2 levels. Because of this effect, an increase in forest productivity is expected for the YP under future climate conditions (CMCC, 2021). Regardless of this potential positive effect, sea level rise poses a severe threat to coastal mangrove forests along the YP's coastline, which impacts these areas' capacity to buffer coastal zones against tropical cyclones and associated storm surges (CMCC, 2021). As the YP's population continues to grow and sea level rise continues to affect coastal ecosystems, mangrove forests will become increasingly degraded due to coastal development, and their capacity to provide ecosystem services under future climate conditions will become diminished.

Impacts on health

Climate change has, directly and indirectly, affected the health and well-being of the YP's population, including impacts related to the increase in temperatures and flooding caused by extreme rainfall and the direct effects of extreme climate events such as tropical cyclones. Rising average and maximum temperatures and flooding are increasing the prevalence of infectious and vector-borne diseases such as zika, dengue, and malaria, reducing agricultural productivity and therefore also affecting food security. Moreover, higher temperatures —particularly when heatwaves occur— directly affect labor productivity by reducing the number of hours a person can work and the productivity of workers during active work hours (CMCC, 2021). Under future climate conditions, these trends are projected to intensify. For example, the prevalence of infectious and vector-borne diseases will increase significantly. Estimates show that by 2050, under a medium emissions scenario, approximately 74% of the country's population will be at risk of dengue and 73.3% under a high emissions scenario. For zika, the percentage of the population at risk by 2050 will be 51.7% and 52.5% under a medium and high emissions scenario, respectively (CMCC, 2021). Under a low and high emissions scenario, the percentage of the population at risk of malaria will be 53.8% and 57%, respectively (CMCC, 2021). While these figures are for Mexico as a whole, the high vulnerability of local communities to climate change in the Yucatan means that they will likely be disproportionately impacted.

IMPACTS ON THE ECONOMY

The climate impacts described above will, directly and indirectly, affect the economy of Mexico, as well as that of the three states comprising the YP. Aggregate damages from climate change will reach approximately 5.54% of Mexico's GDP by 2100 (CMCC, 2021). Agriculture is predicted to be the most severely affected sector. In the YP, tourism will be severely affected by climate change in the absence of intervention. Coastal zones in the region, particularly along the east coast, will be directly impacted by sea level rise, increased tropical cyclone activity, higher temperatures, and more intense rainfall, all of which will affect ecosystems and infrastructure upon which the sector is dependent. Overall, climate change is projected to strongly influence the economy of all three states in the YP and will potentially increase the poverty rate in the region from approximately 15% to 18.8% by 2030 (CMCC, 2021).

III.2. Theory of Change

The Theory of Change (Figure 64) shows the close relationship between marine and coastal ecosystem functions and services and social-ecological resilience. It shows how climate-sensitive marine and coastal landscapes will be transformed by EbA measures to build resilience in the ecosystems that sustain local livelihoods.

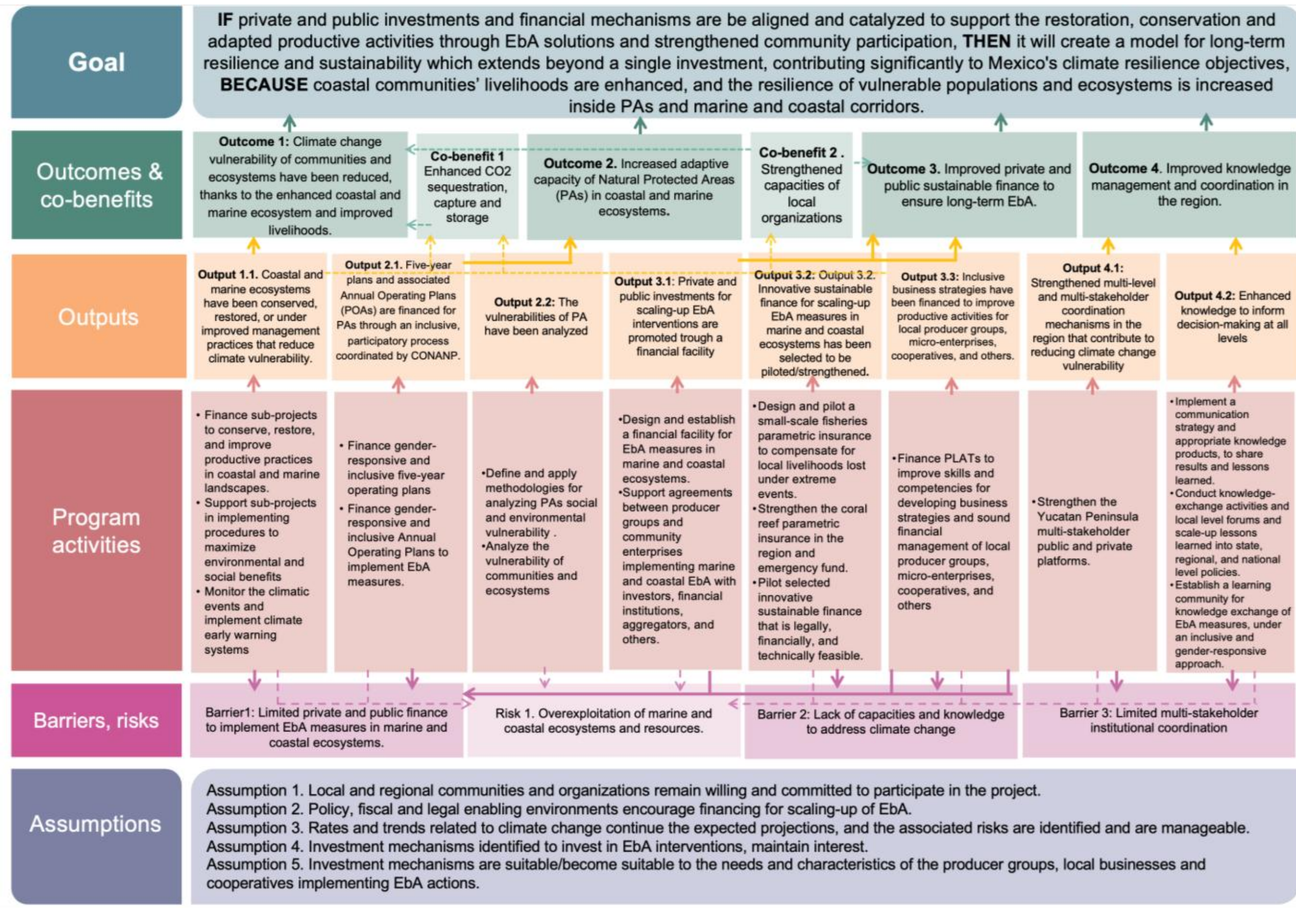


Figure 64 Theory of Change

III.3. Project objective, logic of action and components

III.3.1. Objective

ACCIÓN aims to increase the climate resilience of vulnerable communities, ecosystems, and productive systems on the coasts of the YP through ecosystem-based adaptation (EbA) and sustainable livelihoods.

III.3.2. Logic of action

The ToC shows that **IF** private and public investments and financial mechanisms are be aligned and catalyzed to support the restoration, conservation and adapted productive activities through EbA solutions and strengthened community participation, **THEN** it will create a model for long-term resilience and sustainability which extends beyond a single investment, contributing significantly to Mexico's climate resilience objectives, **BECAUSE** coastal communities' livelihoods are enhanced, and the resilience of vulnerable populations and ecosystems is increased inside PAs and marine and coastal corridors.

The ACCIÓN Project objective will be achieved by four outcomes: (i) increasing the adaptive capacity of communities for coastal and marine ecosystem management and climate change resilience through local EbA measures; (ii) increasing the adaptive capacity of PAs in coastal and marine ecosystems; (iii) improving sustainable finance to ensure long-term EbA; and (iv) improving knowledge management and coordination mechanisms in the region.

The supported activities will maintain and enhance ecosystem integrity to improve the provision of food, strengthen the protection against climate events (storms and hurricanes), and enhance the income to reduce the severity of negative socio-economic impacts of climate change, mainly on vulnerable and marginalized communities.

In equal circumstances, the additional selection criteria to be considered by the Coordination Committee are the following:

- ***Gender approach***. The proposal has an approach that favors equality in the relationship between men and women.
- ***Surface area***. The proposal addresses a larger area than the alternative proposal.
- ***Diversity of organizations***. The selected proposals come from the most extensive number of organizations; nevertheless, organizations that submit more than one proposal will be considered.
- ***Linkage between sub-projects***. The proposal includes synergies with other sub-project proposals that are territorially related.

EbA options and activities supported by the project

Table 29 EbA options and activities potentially supported by the project and expected impacts for increasing adaptation and reducing vulnerability to climate change

EbA Options	EbA intervention proposed	Climate change impacts	What are the expected adaptation outcomes (ie. Adaptation benefit)	Direct Beneficiaries	Expected impacts on target beneficiaries' resilience	Examples of activities supported related to subprojects to conserve and restore (Component 1 and 2)	Examples of activities supported related to small businesses and community businesses (Component 3, Output 3.3)	Examples of activities supported related to financing the EbA options (Component 3, output 3.2 and Component 4)
Coastal and marine ecosystems conservation and restoration	Coral reef rehabilitation	• Tropical cyclones • Increased sea-surface temperatures • Sea-level rise	• Maintain healthy coral communities. • Increase coral cover, reef accretion, and habitat complexity (functional groups). • Increase coral recovery potential through larval supply, settlement success and juvenile survival. • Sustain ecosystem goods and services.	• Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others.	• Capacity building for local stakeholders into marine conservation. • Implement a restoration strategy. • Initial funding to implement on the ground actions designed in the restoration strategy. • Improve ecosystem services provided by corals including food and protection to climatic events.	Capacity building, initial funding to: • Maintain corals. • Implement coral nursery techniques, cultivating coral fragments to be transferred to reef areas that have been degraded or damaged. • Applied techniques to restore corals.	Capacity building, initial funding to: • Finance ecotourism activities to promote coral-related sustainable tourism. • Train in business, administrative and finance aspects.	• Negotiate and establish of multi stakeholder agreements to maintain corals (including with hotels and others). • Parametric insurance to provide finance to restore coral reefs
	Forest restoration and rehabilitation, including mangroves, wetlands seagrass and cenotes	• Tropical cyclones • Increased sea-surface temperatures • Sea-level rise	• Protect coastal ecosystems. • Conserve and restore seagrass meadows, mangroves, dunes and cenotes. • Maintain ecosystem services and biodiversity.	• Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others.	• Reduce the vulnerability of communities to climate change impacts. • Maintain ecosystem services and functions. • Improve climatic cycles, increase sediment stabilizers and provide habitat refugia. • Improve ecosystem services provided by mangroves, including food (i.e. shrimp nurseries) and protection to climatic events	Capacity building, initial funding to: • Increase coverage with native species. • Beach and soil recovery (with no infrastructure). • Fire prevention and management. • Re-establish water flows.	Capacity building, initial funding to: • Ecotourism activities to promote mangrove-related sustainable tourism. • Train in business, administrative and finance aspects.	• Negotiate and establish of multi stakeholder agreements for conservation and restoration of mangroves. .
	Dunes rehabilitation	• Sea-level rise • Increased intensity and frequency of extreme meteorological events	• Dunes act as natural barriers against storms and hurricanes, absorbing the impact and protecting inland areas. • Dunes help in controlling beach erosion. • Dunes provide habitats for various species of plants and animals. These ecosystems support biodiversity and offer	• Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others.	• Reduce disturbance to beaches and coastal dunes by introducing physical barriers that trap sand, mechanically stabilizing dune ridges, and planting schemes using species adapted to the ecosystem to biologically fix or reforest the dune ridge.	• Establishment and maintenance of native plant nurseries for dune restoration. • Recovery of degraded areas with native plants to strengthen dune stability. • Sargassum early warning systems.	• Sargassum management, including alternative uses. • Technological innovation for alternative uses of sargassum.	• Negotiate and establish of multi stakeholder agreements for conservation and restoration of dunes

EbA Options	EbA intervention proposed	Climate change impacts	What are the expected adaptation outcomes (ie. Adaptation benefit)	Direct Beneficiaries	Expected impacts on target beneficiaries' resilience	Examples of activities supported related to subprojects to conserve and restore (Component 1 and 2)	Examples of activities supported related to small businesses and community businesses (Component 3, Output 3.3)	Examples of activities supported related to financing the EbA options (Component 3, output 3.2 and Component 4)
			nesting and feeding grounds for birds and other wildlife.		• Beach nourishment could also be utilised where beach sand is introduced to regions where coastal erosion is extensive. • Sand is transferred from a region of coastline where sand has been deposited, from quarries or offshore.	• Sargassum management, including cleanup • Technological innovation for effective management and alternative uses of sargassum.		
Sustainable fisheries management	Ecosystem-based approach to fisheries management (small-scale fisheries and aquaculture)	• Extreme temperatures • Extreme precipitation • Precipitation variability • Tropical cyclones • Increased sea-surface temperatures • Sea-level rise	• Maintain healthy ecosystems and sustainable livelihoods. • Preserve diversity of species and habitats. • Conserve and stabilizes fish stock levels. • Reduce overcapacity. • Has lower running costs and fuel consumption. • Promotes participatory management. • Empowers association or cooperatives of small-scale fishers and coastal communities for sharing the benefits of fish stocks. • Support the engagement of stakeholders across the value chain to improve full participation, ensuring gender equity and inclusion.	• Fishing cooperatives • Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others	• Improve understanding about the vulnerability of communities to impacts from climate change in the marine ecosystem. • Increase the engagement and empowerment of coastal communities and fishers to steward marine ecosystems. • Strengthen community-based fisheries management and governance. • Protect aggregation, reproduction, and nursing zones for the replenishment of species. • Fisheries as an integral part of disaster risk reduction and management. • Increase awareness and training of coastal communities and fishers to recover after disasters.	Capacity building, initial funding to: • Train small scale fisheries on sustainable techniques and systems. • Establishment of Fish Replenishment Zones or community-based reserves, supported. • Local surveillance, monitoring of indicator species.	Capacity building, initial funding to: • Finance aggregators and responsible intermediaries in strengthening the value chain and create added value (new products, link new buyers). • Small sustainable infrastructure, as solar refrigerators and improved sustainable energy systems. • Train in business, administrative and finance aspects.	• If applicable, link to sustainable credit lines/impact investment • Design and support insurance for small scale fisheries. • Negotiate and establish of multi stakeholder agreements
Diversification and protection of ecosystem-based livelihoods	Sustainable production systems that improve connectivity (agriculture,	• Increase temperature and precipitation variability. • Increase frequency and intensity of severe	• Reduce production levels benefitting sustainable crops that work in harmony with the landscape. • Increase diversity and complexity within the agricultural/agroforestry	• Cooperatives • Local organizations • Local communities including women and indigenous people	• Increase adaptive capacities and preparedness for climate variability. • Rehabilitation and recovery of degraded farmer fields.	Capacity building, initial funding to: • Capacity building and technical	• Non-timber forest products, including handicrafts • Train in business, administrative and finance aspects.	• Non-timber forest products, including handicrafts • Train in business, administrative and finance aspects.

EbA Options	EbA intervention proposed	Climate change impacts	What are the expected adaptation outcomes (ie. Adaptation benefit)	Direct Beneficiaries	Expected impacts on target beneficiaries' resilience	Examples of activities supported related to subprojects to conserve and restore (Component 1 and 2)	Examples of activities supported related to small businesses and community businesses (Component 3, Output 3.3)	Examples of activities supported related to financing the EbA options (Component 3, output 3.2 and Component 4)
	agroforestry and livestock)	weather events, such as floods and hurricanes. • Prolonged drought and water shortages. • Loss of agricultural biodiversity and ecosystem services.	ecosystem creating systems adapted to the new climatic patterns. • Foster diversity of domestic and wild species. Higher levels of biodiversity are linked to healthier crops. • Enhance the performance of the ecological cycles on which crops depend. • Promote better soil nutritional and microbiological conditions. • Increase energy and water use efficiency. • Relief solely on natural processes for input and recycles nutrients on-site to eliminate the use of non-renewable resources occurring, • Prevent soil erosion due to the more significant amount of plant material and biomass in the soil. • Involve relevant local knowledge, experiences, and social relations to foster change towards sustainability.	• Local producer groups, micro-enterprises, cooperatives, and others	• Buffer temperature extremes and erratic rainfall patterns. • Increase water- and nutrient use efficiency. • Reduce property damages and crop loss. • Increase of crop yield from the more extended growing season.	assistance that complements at landscape level sustainable agriculture, agroforestry and livestock mainly related to diversification and connectivity (not a solely activity itself, a complement with other EbA action) • Non-timber forest products, including handicrafts		
	Beekeeping	• Temperature differences and extremes. • Continuous rainfall. • Floods. • Drought. • Fires.	• Treat the bee colony as a complete organism. • Respect the natural processes of the bees. • Increase native bee-friendly flowers in meadows and verges provide pollen and nectar at crucial times of reproduction and winter preparation. • Increase tree cover for food and nest sites and shrubs for shelter and forage. • Ban pesticides. • Promote native bees adapted to local microclimates and the environment.	• Cooperatives • Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others	• Rehabilitation and recovery of degraded forests. • Diversify income-generating opportunities to rural farmers and benefit other relevant stakeholders. • Add value to honey and other bee products such as beeswax, propolis, and bee venom, as well as market access. • Promote systems of fair-trade production.	Capacity building, initial funding to: • Train on sustainable techniques. • Small inputs for apiculture, such as boxes from sustainable-sourced.	Capacity building, initial funding to: • Finance aggregators and responsible intermediaries in strengthening the value chain and create added value (new products, link new buyers). • Train in business, administrative and finance aspects.	If applicable, link to sustainable credit lines/impact investment

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EbA Options	EbA intervention proposed	Climate change impacts	What are the expected adaptation outcomes (ie. Adaptation benefit)	Direct Beneficiaries	Expected impacts on target beneficiaries' resilience	Examples of activities supported related to subprojects to conserve and restore (Component 1 and 2)	Examples of activities supported related to small businesses and community businesses (Component 3, Output 3.3)	Examples of activities supported related to financing the EbA options (Component 3, output 3.2 and Component 4)
			• Contribute to the genetic fitness of the bee population in their area by keeping only local bees and allowing natural mating. • Respect the colony life cycle. • Maintain appropriate colony density to forage availability and maintenance of health. • Intrusion into the colony is minimized. • Generate jobs.					
	Community and natural-based tourism	• Extreme temperatures • Extreme precipitation • Precipitation variability • Tropical cyclones • Increased sea-surface temperatures • Sea-level rise	• Preserve the environment. • Safeguard cultural and natural heritage. • Protect livelihoods and benefit local communities. • Improve community empowerment, ownership, accountability, and participation in decision-making. • Encourage natural leadership within the communities. • Foster full participation, ensuring gender equity and inclusion of vulnerable groups. • Creates new jobs and reduces outgoing migration.	• Cooperatives • Local organizations • Local communities including women and indigenous people • Local producer groups, micro-enterprises, cooperatives, and others	• Improve living conditions and economic diversification. • Enhance communities' abilities to maintain and improve the business. •	Capacity building, initial funding to: • Implement ecotourism activities that reduce the pressure in forest degradation • Improve ecotourism.	Capacity building, initial funding to: • Finance aggregators and responsible intermediaries in strengthening the value chain and create added value (new products, link new buyers). • Train in business, administrative and finance aspects.	If applicable, link to sustainable credit lines/impact investment and to the market.
INDICATOR		–				• # of local organizations benefiting from implementing EbA measures. • # of coastal and marine hectares restored, reforested, afforested, natural expansion, conserved or under improved management practices by local communities financed by the project.	• # of public or private financing plans to leverage private and/or public sources of funding submitted and/or approved. • # and level of innovative finance solutions piloted/strengthened • # business strategies financed and under implementation for local producer groups, micro-enterprises, cooperatives, and others that receive technical support for	• # business strategies financed and under implementation for local producer groups, micro-enterprises, cooperatives, and others that receive technical support for inclusive business strategies. • # of effective coordination mechanisms for

EbA Options	EbA intervention proposed	Climate change impacts	What are the expected adaptation outcomes (ie. Adaptation benefit)	Direct Beneficiaries	Expected impacts on target beneficiaries' resilience	Examples of activities supported related to subprojects to conserve and restore (Component 1 and 2)	Examples of activities supported related to small businesses and community businesses (Component 3, Output 3.3)	Examples of activities supported related to financing the EbA options (Component 3, output 3.2 and Component 4)
						• # of PA with a multi-year adaptation planning in place • # of PA with gender-responsive and inclusive POAs prepared and implemented.	inclusive business strategies.	EbA planning and management.

The set of activities presented in the table are merely indicative and were identified based on technical pre-feasibility studies to ensure adaptation benefits, and socialized in workshops with local stakeholders.

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III.3.3. Components

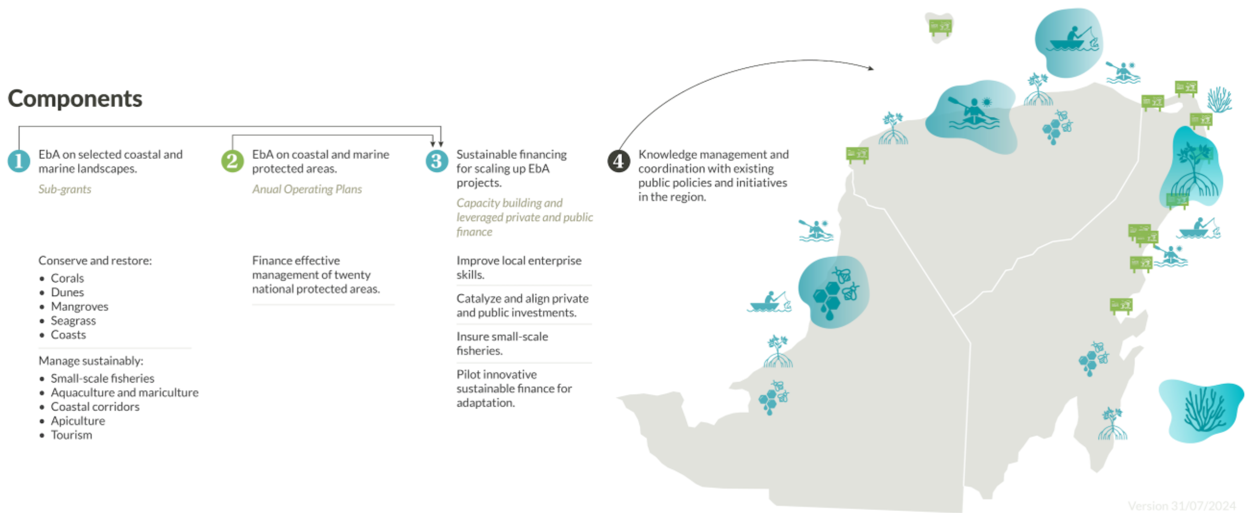


Figure 65 ACCIÓN illustration of Components

Component 1: Ecosystem-based adaptation (EbA) on selected coastal and marine landscapes.

Outcome 1. Climate change vulnerability of communities and ecosystems have been reduced, thanks to the enhanced coastal and marine ecosystem and improved livelihoods.

The coastal and marine ecosystems and communities in the YP are highly vulnerable to climate change; selected EbA measures have proven to be cost-effective and culturally appropriate, but finance and knowledge to implement these measures remain limited in the region. Component 1 of ACCIÓN focuses on finance the implementation of local actions using a Locally Led Adaptation approach to reduce the vulnerability of marine and coastal communities and ecosystems by adopting EbA measures. This component will channel GCF resources through sub-projects managed by legally constituted local organizations (OLLC by its acronym in Spanish) to carry out ecosystem conservation, ecological restoration, and sustainable production activities. OLLC will also provide technical assistance to focused on community capacity building. These efforts will bolster the community and ecosystem´s resilience. This local approach leverages the potential and creativity of local communities, including indigenous peoples, to develop and implement solutions. EbA interventions will be focused on the most vulnerable systems in the region and include economically effective measures and culturally appropriate to: (i) conserve and restore to improve the resilience of the systems: corals, dunes, mangroves, sea grass, coasts (including sargassum); and (ii) sustainable management for improving resilience through diversification, adaptation, and protection of ecosystem-based livelihoods of small-scale fisheries, aquaculture and mariculture, sustainable management of coastal corridors (forest, non-timber forest products, livestock, agriculture and agroforestry in coastal corridors), apiculture and tourism. The eligible area is the marine and coastal corridor, a buffer of 20 km inside and 20 km outside the coastline in all the YP and the PAs in that corridor and islands.

Output 1.1. Coastal and marine ecosystems have been conserved, restored, or under improved management practices that reduce climate vulnerability.

FMCN will launch a demand-based request for proposals (RFP) through the co-Executing Entity (EE) SSAC to OLLCs that group landholders and producers, including local communities, *ejido*s, small landowners, and community enterprises. The OLLCs will design the proposals based on the eligible activities of the RfP and their local needs, ensuring local appropriation and leveraging local creativity. Under the direction of SSAC, OLLC will finance the implementation of sub-projects and associated activities and deliver training to increase adaptive capacities of local producer groups and local communities on conservation, restoration, and sustainable management. These locally led adaptation interventions aim to reduce vulnerability and increase community engagement in EbA efforts (see Table 2 for examples of activities that were identified by technical studies and local consultations). The RFP will promote the inclusion of women and indigenous populations through dissemination in appropriate spaces and gender-sensitive activities and culturally appropriated (see Annex 4 Gender Action Plan -GAP, and the Indigenous peoples plan- IPP). Selected sub-projects will be linked to private and public financial sources aligned under Component 2. Sub-projects will be financed for up to four years, evaluating periodically their results to renovate contracts; the amount will be up to US$60,600 yearly, which has been analyzed by FMCN as the maximum that is possible to be absorbed by OLLCs.

The Coordination Committee will define the final selection criteria during the design of the RFP, and preliminary selection criteria include: (i) relevance: the sub-project is aligned with the objective and eligible activities of this call for proposals; (ii) strategic planning: the sub-project has a clear objective; (iii) financial planning and viability: the budget is coherent with the proposed activities and the resources requested are sufficient to ensure the implementation of the Project; (iv) impact: the proposal clearly defines area it will implement EbA actions; (v) social participation: the local community, the owners of the resources and / or the users participated in the preparation of the proposal and show clear ownership of the Project; (vi) organization and governance: the sub-project supports the community involved in its integration, strengthening and in transparent decision making around the management of natural resources; (vii) scientific / technical / social support: the proposed interventions have a clear scientific, technical, social, legal and / or economic basis; (viii) complementarity with additional initiatives: the project promotes or strengthens synergies and interinstitutional collaboration, for example, it is linked to other public or private investments and attracts them as counterpart funding; (ix) institutional capacity: the proposing organization has the experience and human, technical and administrative capabilities to successfully carry out the project; and (x) continuity: the strategy of the proposal contemplates actions that will allow the impact of the project to be long-term. FMCN will develop or adapt protocols for community-based early warning systems for climatic events. An early warning system for the eligible financed sub-projects will be stablished to plan and protect their resilient rural livelihoods, focused on dissemination in culturally appropriated media the existent information, identify the local needs and reflect them in sub-project level contingency plans, based on local community networks.

Activities:

1.1.1 Finance ten sub-projects to conserve, restore, and improve productive practices to increase communities' adaptive capacities in coastal and marine landscapes.

Under FMCN oversight, the Executing Entity (EE), in this case, SSAC, receives the proposals and conducts an initial review to ensure they meet the basic eligibility criteria. Then, an external group of experts is then assembled, comprising representatives from local academia, local government, civil society, and other relevant stakeholders. This group evaluates and scores the proposals. A minimum threshold for scoring is determined using statistical methods and expert advice. Under FMCN oversight, SSAC compiles the comments of all evaluators. If the number of proposals meeting the threshold exceeds the available resources, the Project Committee steps in to assess the landscape-level and aggregated impact. This ensures that selected sub-projects are aligned with the project's integrated vision and maximize overall impact. Based on this evaluation, the committee makes its final selection of sub-projects and PLATs (Proveedores Locales de Asistencia Técnica).Its comments are compiled by FMCN. After the selection process and under the supervision of FMCN, SSAC requests the proponents to integrate the comments both from the evaluators and the Project Committee. SSAC follows a due diligence process established by FMCN to ensure that the recipients meet the legal and administrative requirements established in the call for proposals. The package of selected sub-projects and the corresponding grant agreements to be signed by SSAC and the selected proponents are reviewed by FMCN before being formalized. The final decision on the grant agreements that can be signed is of FMCN. Sub-projects will be financed for up to four years, evaluating periodically their results to renovate contracts; the amount will be up to US$60,600 yearly, which has been analyzed by FMCN as the maximum that is possible to be absorbed by OLLCs.

1.1.2 Support ten sub-projects in implementing procedures to maximize environmental and social benefits, with a gender approach.

Safeguards identification and mitigation as well as gender mainstreaming is in all the steps of sub-project implementation, including: **(i) Dissemination of the Call**: The call for proposals specifies the topics and activities to be financed, the requirements for participation, the assessment criteria, and the required documentation. It also integrates the FMCN exclusion list and the principles of the 10 ESS of FMCN in its design, in order to gather relevant information to carry out the risk assessment. FMCN's Communication team develops a dissemination plan, tailoring it to the target population's socio-demographic characteristics, ensuring materials are culturally appropriate and gender-sensitive. **(ii) Assessment and Selection of Proposals**: After the call closes, the relevant Area reviews proposals for compliance. External specialists assess the proposals for technical, environmental, and social relevance. Proposals meeting the quality threshold are reviewed by the appropriate committee, with preference given to projects involving indigenous and vulnerable populations. **(iii) Support for Approved Sub-Projects**: Approved sub-projects undergo technical, administrative, and risk assessments by the Safeguards team. This includes identifying environmental and social risks and defining mitigation measures. Depending on the findings, proposed activities may be adjusted, eliminated, or supplemented to ensure compliance with ESS and based on the project-level ESAP. These measures are included in each sub-project's annual plan and monitored through FMCN's Project Tracking System (SISEP). **(iv) Follow-up on Sub-Projects**: During sub-project implementation, the Safeguards team provides ongoing monitoring and feedback, ensuring the proper execution of risk management measures. The compliance level is evaluated through reports, field supervision visits, and expert reviews. Adjustments are made as needed in response to unforeseen events or new risks. If necessary, FMCN provides training and assistance to ensure compliance. Non-compliant organizations face remedial measures, including potential cancellation of their sub-projects. The Safeguards team prepares annual reports on sub-project performance for donors, the Committee, and FMCN's Board.

1.1.3 Monitor the climatic events and implement climate early warning systems linked to sub-projects.

An in-depth analysis conducted during the PPF phase by the consultancy firm IDOM identified that identification of climate risks in the region was generally adequate. However, a gap existed in local knowledge and local risk management in the face of climatic events. In this way, ACCIÓN will be focused on community-based, sub-project-level risk management. The objective is to improve risk identification, prevention, and management, particularly through the development of localized action plans. The ideas for this community-based early warning system have been co-designed with xxx people that are current beneficiaries of the GEF Small Grant Project of UNDP, which have a similar profile than the potential beneficiaries of ACCIÓN (see SEP).

The selection criteria to support these activities are described below.

Selection criteria

The final selection criteria will be defined by the Coordination Committee during the design of the RFP. Some preliminary selection criteria are:

1. ***Relevance***. The sub-project, technical assistance interventions, or activities proposed to be funded are aligned with the objective and eligible activities in the request for proposals (RFP).
2. ***Strategic planning***. The sub-project, technical assistance interventions or activities proposed have a clear objective. The expected results and the activities are aligned with the project objective.
3. ***Financial planning and viability***. The budget is congruent with the proposed activities, and the resources requested are sufficient to ensure the implementation of the project.
4. ***Impact***. The proposal clearly defines the area it will conserve, use sustainably, or restore. The selected indicators are measurable and correspond to the results included in the plan.
5. ***Social participation***. Local communities, resource owners, and/or users participated in the proposal preparation and showed clear project ownership.
6. ***Organization and governance***. The sub-project supports the community involved in strengthening transparent decision-making around natural resources management.
7. ***Scientific/technical/social support***. The proposed interventions have a clear scientific, technical, social, legal, and/or economic basis.

8. ***Complementarity with additional initiatives***. The project promotes or strengthens synergies and inter-institutional collaboration; for example, it is linked to other public or private investments and attracts them as counterpart funding.
9. ***Institutional capacity***. The proposing organization has the experience and human, technical, and administrative capabilities to complete the project successfully.
10. ***Continuity***. The proposal's strategy contemplates actions that will allow the project's long-term impact. For example, the proposals include productive activities based on business plans, consider links with markets, or encourage the creation of revolving funds that ensure financing productive activities in the long term.

Outcome 2. Increased adaptive capacity of PAs in coastal and marine ecosystems.

A significant portion of the marine-coastal area in the region are PAs, and they remain some of the most vulnerable areas in the region, both due to a lack of sustainable financing and extreme climatic events. Using GCF funds, ACCIÓN will contribute to MEx30x30 initiative, a long-term financing mechanism following the PFP approach. This will ensure permanent funding for twenty national PAs that are highly vulnerable to the effects of climate change. These twenty PAs were selected because of their: (i) high vulnerability to the effects of climate change; (ii) crucial provision of essential ecosystem services that are critical for climate change adaptation and reducing vulnerabilities of local communities (storm protection, resilience of local livelihoods, floods protection); and (iii) lack of financing that allows the resilience of those key ecosystems. If during the project lifespan the criteria of lack of financing that allows the resilience is modified in a PA, the Technical Committee of the Protected Areas Fund (CTFANP) may select a different PA in the buffer that complies with the key criteria. For the municipalities within the project's coverage area, those with the highest inequality indices are located in the eastern part of Yucatán, while those with the lowest inequality are found in Campeche. Social disparities and gaps can significantly exacerbate climate vulnerabilities, affecting access and decision-making power related to natural resource management. Addressing these disparities is crucial to enhancing resilience. This requires challenging ingrained cultural norms, promoting gender equality, and creating tailored opportunities for vulnerable population to participate actively in decision-making processes. By leveraging women's unique perspectives, communities can forge more resilient and equitable approaches to conservation, ensuring the preservation of Mexico's natural heritage for generations to come. Participation in project activities will not be linked to land ownership and use, will foster women's engagement and empowerment during its lifespan. For example, gender-sensitive criteria should guide POA design and development, communication materials specially designed for women should be developed, and capacity-building should be provided to raise awareness of gender equality and its benefits. To ensure appropriate participation of both women and men in the activities and benefits of the Project, a Gender Assessment and a Gender Action Plan were conducted (Annex 4).

Output 2.1. Five-year plans and associated Annual Operating Plans (POAs) are financed for PAs through an inclusive, participatory process coordinated by CONANP.

Despite their pivotal role, federal PAs in Mexico face a significant challenge as they are dramatically underfunded. The root cause of threats to Mexico's protected areas, in the absence of management capacity reinforced through enhanced financing, is pressure for economic development throughout the country and especially in poor and marginalized rural areas; climate change further exacerbates pressure. This financial gap poses a threat to the effective management and conservation efforts. The financial resources to improve the operation of PAs generates important additionalities. FMCN has over 27 years successfully financing PAs with the model that will be implemented under ACCIÓN. The channeling of FMCN resources for the operation and management of the PAs will be through subgrants to OLLC, acronym in Spanish. Using inclusive, participatory processes that it has successfully used across Mexico's PA system, FMCN will support CONANP to engage PA managers, local communities and other important stakeholders to develop five-year plans that will frame the required financing to ensure PAs resilience through adoption of EbA actions that can be implemented to improve resilience of the communities and ecosystems. The plans will include monitoring indicators, and budget aligning the different public policy instruments that affect the PA, such as its Management Program, CONANP 2040 Strategy, and the National Program for PAs. Plans will also ensure that gender-responsive and inclusive elements are integrated into every aspect of the plan, with particular emphasis on how the plans can benefit women and marginalized members of the Indigenous Peoples and Local Communities (IP&LCs). The five-year plans will be used to develop Annual Operating Plans for each area (POAs for its Spanish acronym). Some examples of activities funded under the POA incudes: forest cover restoration; community reforestation/restoration of riverbanks; building capacities in communities for productive diversification (see Table 2); establishing community-led brigades and engaging local communities in monitoring programs.

Most Protected Areas in Mexico have an Advisory Council, through which government institutions, civil society, academic and research entities, and representatives of the people who inhabit, work, and use the ecosystems (e.g., ejidos, communities, Indigenous groups, and women) can be aware, participate, advise, and support decision-making of the pertinent strategies to address the priority needs of the PAs. The Advisory Councils or similar participatory bodies will be used as platforms to engage stakeholders, including women and Indigenous Peoples, in developing the POAs).

The average funding for each PA will be $566,000 yearly, based on the financial gap stablished. Priority components for each operating plan will include how the PAs can reduce the vulnerabilities of ecosystems and local communities. Through this output, ACCIÓN will contribute to the transition fund of MEx30x30 with the resources designated for activities 2.1.1 and 2.12. The transition fund under MEx30x30 will be of approximately $200M to cover the financial gap of the existing 226 PAs in Mexico, while public funding reaches its target. This approach will be similar to Heritage Colombia FP203 and Bhutan for Life GCF FP050.

Activities:

2.1.1. Finance gender-responsive and inclusive five-year operating plans of 20 PAs.

The channeling of FMCN resources for the operation and management of the PAs will be through subgrants to Legally Constituted Local Organizations (OLLC, acronym in Spanish). With support of FMCN and OLLC staff, CONANP develops strategic five-year plans that for all the PAs. GCF proceeds will finance the workshops required to design five-year plans. This five-year plan reflects the main results and actions that need to be taken to achieve the desired objectives. Most Protected Areas in Mexico have an Advisory Council, through which government institutions, civil society, academic and research entities, and representatives of the people who inhabit, work, and use the ecosystems (e.g., ejidos, communities, indigenous groups, and women) can be aware, participate, advise, and support decision-making of the pertinent strategies to address the priority needs of the PAs. The Advisory Councils or similar participatory bodies will be used as platforms to engage stakeholders in developing the five-year plans.

2.1.2. Finance gender-responsive and inclusive Annual Operating Plans of 20 PAs to implement EbA measures.

POAs will be derived from five-year plans. Using inclusive, participatory processes that it has successfully used across Mexico's PA system, CONANP will engage PA managers, IP&LCs and other important stakeholders, with outcomes of the processes being used to develop Annual Operating Plans for each area. The Advisory Councils or similar participatory bodies will be used as platforms to engage stakeholders in developing the Annual Operating Plans (POAs for its Spanish acronym). GCF proceeds will finance the workshops required to design POAs and will finance the activities in the POAs, these activities includes, for example implementing conservation, restoration, and sustainable management practices, creating community-based monitoring brigades and accessing capacity-building initiatives, job opportunities, and community driven development projects.

Output 2.2 The vulnerabilities status of PA have been monitored.

Conducting a vulnerability assessment PAs is essential to understand how climate change and other external stressors might impact ecosystems and biodiversity. This assessment helps identify specific risks to PAs, such as habitat degradation or species loss, and informs adaptive management strategies. By evaluating vulnerabilities, it can be prioritized the interventions to enhance resilience, safeguard biodiversity, and maintain the ecosystem services that PAs provide, ensuring long-term sustainability and protection of these critical areas. The project will complement the financing of implementing EbA activities in PAs by developing or adapting protocols for monitoring vulnerabilities' status, including monitoring and data collection (ecological conditions and human vulnerability); defining what data will be collected by technical experts under Component 2 and what by community members under Component 1. The participatory monitoring will engage of women, indigenous and other marginalized groups.

Activities:

2.2.1 Define and apply methodologies for analyzing PAs social and environmental vulnerability.

The goal of this activity is to create a comprehensive framework for understanding how marine and coastal protected PAs supported by the project are vulnerable to social and environmental threats. These threats may include climate change impacts such as the ones identified in the pre-feasibility studies. This could involve the design of methodologies that incorporate spatial data analysis and socio-economic assessments of communities relying on marine resources. It also includes ecological risk assessments, vulnerability indicators, and the exposure of ecosystems to stressors. FMCN, CONANP and hired experts, will select the methodologies to implement.

2.2.2 Analyze the vulnerability of communities and ecosystems using participatory and technical experts' methodologies in PAs.

Based on the selected methodologies, this activity will apply inputs from technical experts and/or local communities, indigenous peoples, and other stakeholders who depend on marine resources for their livelihoods. Their knowledge, combined with scientific expertise, enriches the understanding of vulnerabilities. This activity will then analyze, by a holistic assessment of how both communities and ecosystems in coastal and marine protected areas are affected by different vulnerabilities. This might lead to identifying key risks (e.g., depletion of fish stocks, coral bleaching, or the displacement of coastal communities) and setting priorities for conservation and adaptation measures.

Component 3: Sustainable financing for scaling up EbA measures.

Improved private and public sustainable finance to ensure long-term EbA.
Long-term sustainability of EbA efforts supported under ACCIÓN will depend partly on securing sustainable financing that ensures full implementation of adaptation activities. This finance is currently very limited. FMCN will work with stakeholders to develop and finance diverse mechanisms to support long-term implementation initiatives, including developing long-term public finance mechanisms for PAs, facilitating access to new markets for producer groups and community enterprises and identification and access to innovative funding sources, such as insurance mechanisms, offset mechanisms, credits, or other instruments from financial institutions, and impact investment. FMCN, through the co-EE SSAC and local providers of technical assistance (PLAT), will also finance the improvement of businesses and managerial capacities of local producer groups already implementing productive EbA activities. The eligible initiatives include those that improve resilience through diversification and protection of ecosystem-based livelihoods, including small-scale fisheries, aquaculture, and mariculture, sustainable management of coastal corridors (forest, non-timber forest products, livestock agriculture and agroforestry in coastal corridors), apiculture and tourism, among others.

Output 3.1. Private and public investments for scaling-up EbA interventions are promoted trough a financial facility.

ACCIÓN will establish a financial facility to catalyze and align private and public investments for scaling up EbA initiatives, prioritizing sub-projects supported under Component 1 and producer groups under Component 2. In relation to public investment mobilization, through this Output the project will support the mobilization of public resources to contribute covering the financial gap of the existing 226 PAs in Mexico, mainly in coastal and marine PAs. This funding will contribute to the MEx30x30 strategy lead by CONANP and supported by FMCN, that seeks to close the financial gap of the existing PAs. ACCIÓN will explore a variety of revenue streams, including federal appropriations, entrance and users' fees, payment for ecosystem services, and compensations to finance PAs. The aim is to contribute to the increase of public and private resources to cover the overall costs of PA management within fifteen years. It is expected that this will contribute to the leverage of US$80M public and private resources during the project lifespan. In relation to private investments, the Project will support local producer groups, micro-enterprises, and cooperatives to prepare them for investment pitches, structure investment rounds, and link them to the market and financing opportunities identified to ensure the sustainability of EbA efforts. Activities under Output 3.2 and 3.3 will also be part of this financial facility.

Activities:

3.1.1 Design and establish a financial facility for EbA measures in marine and coastal ecosystems.

Under this activity, FMCN will stablish a financial facility, which is a financial assistance program that strengthens local businesses and facilitates access to funding or financing. It can include technical assistance, improve businesses plans, contact with providers of lines of credit, loans, guarantee funds, or specialized financing designed to support specific EbA projects. The activity will include to explore financial mechanisms to contribute to leverage public and private resources aligned to the project, including: (i) financing agreements to the local producer groups, micro-enterprises, cooperatives, and others trough the facility; (ii) public investment mobilization such as new/improved revenue streams, including federal appropriations, entrance and users' fees, payment for ecosystem services, and compensations to finance PAs ,structured by the project; and (iii) philanthropic grants from private, multilateral and bilateral donors structured to complement ACCIÓN project in the ACCIÓN region and other PAs. The activity will incorporate 3.1.2, 3.2.1 and 3.2.2 under the facility.

3.1.2 Support five financing plans between producer groups/community enterprises implementing marine and coastal EbA with investors, financial institutions, aggregators, and others.

The project will finance the development of public and/or private financing plans, which refers to a set of actions required to obtaining the necessary economic resources to scale a specific activity, project or enterprise, such as enhanced value chain participation, access to new credit/investment, or access to particular government or other grant funding. It can be, for example, a financing request to a microfinance institution, a financing plan submitted to an investor, a subsidy proposal, or a grant proposal facilitated by the project. All of them will be linked to activity 3.1.2

Output 3.2. Innovative sustainable finance for scaling-up EbA measures in marine and coastal ecosystems has been selected to be piloted/strengthened.

ACCIÓN will pilot or strengthen innovations in financing EbA marine and coastal ecosystems. A parametric insurance product to protect small-scale fishers from bad weather periods that prevent them from fishing safely and effectively will be fully designed and piloted (see pre-feasibility for the feasibility study carried out for this activity). During the design phase of ACCIÓN, some potential financial mechanisms were not feasible due to legal and financial current conditions. FMCN will continue conducting financial, technical, and legal assessments to evaluate the possibility of piloting other innovative financial solutions. Innovative finance solutions include mechanisms such as insurance products (fisheries, mangroves, corals), offset strategies, and others that can leverage private capital, mitigate risks, and create long-term funding sources to support conservation and enhance climate resilience.

Activities:

3.2.1. Design and pilot a small-scale fisheries parametric insurance to compensate for local livelihoods lost under extreme events.

To date, there are no active risk financing instruments available to small-scale producers in Mexico within the fisheries, aquaculture and mariculture sectors that effectively address vulnerability from climate-related hazards. However, there is a demonstrated need and potential for such a product. As part of finishing the design, FMCN will finance analysis to further validate the model, engagement and training for fishers, demand assessment to refine structure of the product and understand willingness to pay for the product, outreach to the insurance industry on their underwriting capacity and structure the premium and pilot it for two years.

3.2.2. Pilot selected innovative sustainable finance that is legally, financially, and technically feasible.

Under this activity, FMCN will continue conducting financial, technical, and legal assessments to evaluate the possibility of piloting other innovative financial solutions. Innovative finance solutions include mechanisms such as insurance products (fisheries, mangroves, corals), offset strategies, and others that can leverage private capital, mitigate risks, and create long-term funding sources to support conservation and enhance climate resilience.

Output 3.3. Business strategies have been financed to improve capacities of local producer groups, micro-enterprises, cooperatives, and others.

SSAC will launch a RFP for financing capacity-building through technical support agents (PLATs) who work with local producer groups, micro-enterprises, cooperatives, and others to develop -using participatory approaches- local proposals, including reporting mechanisms that align with the financing facility's requirements. The Coordination Committee will agree on selection criteria for proposals disseminated in the calls for proposals, and preliminary include: (i) location and knowledge of the territories involved in the project; (ii) experience in working with enterprises in the region; (ii) experience of technical assistance services to similar production groups with a climate change adaptation focus; (iv) knowledge of the technical activities of the project, organizational aspects of production and business management; and (v) knowledge of producer organizations and government actors in the region. FMCN through SSAC will provide grants to enable the partnerships between PLATs to develop new or refine existing business strategies for producer groups, microenterprises, cooperatives, and others. The technical assistance provided to producers by PLATs is based on participatory approached, and will result in sustainable business strategies by the end of the project, with a focus on local design and implementation. Technical assistance will strengthen skills and competencies for developing business strategies and sound financial management. .

Activities:

3.3.1. Finance 14 PLATs to improve skills and competencies for developing business strategies and sound financial management of local producer groups, micro-enterprises, cooperatives, and others.

FMCN through SSAC will provide grants to enable the partnerships between PLATs to develop new or refine existing business strategies for producer groups, microenterprises, cooperatives, and others. The technical assistance provided to producers by PLATs is based on participatory approaches and will result in sustainable business strategies by the end of the project, with a focus on local design and implementation. Technical assistance will strengthen skills and competencies for developing business strategies and sound financial management. PLATs will be financed for up to four years, evaluating periodically their results to renovate contracts; the amount will be up to US$24,250 in the first tranche to focus on the diagnosis, and US$48,500 on the following three years to implement the plan to improve the skills. It is expected that 5 PLATs continue in the second tranche. The amounts have been analyzed by FMCN as the optimal for the objectives. The general areas of strengthening have been identified in prefeasibility studies and include business, administrative and finance aspects; using a participatory approach the PLATs will further refine a tailored plan to support the local businesses, based on their local needs and capacities.

Component 4: Knowledge management and coordination with regional public policies and initiatives.

Outcome 4. Improved knowledge management and coordination mechanisms in the region.

49. A critical gap in the YP coastal and marine landscape is the lack of knowledge on the available options to integrate EbA within natural resource management. At the local level, people are aware of the increasing climatic variability negatively affecting their livelihoods. However, they need to strengthen their understanding of the connection between the impacts of climate change, the importance of ecosystem integrity, and the link with their economic activities. ACCIÓN will have a strong learning and knowledge management Component to capture and disseminate lessons learned and to influence policy. Moreover, this knowledge will also strengthen at least two multi-level and multi-stakeholder coordination mechanisms in the region preliminary the Kanan Kay Alliance (AKK for its Spanish acronym) and Alliance for the YP (APY), and the YP Regional Commission on Climate Change..

Output 4.1 Strengthened multi-level and multi-stakeholder coordination mechanisms in the region that contribute to reducing climate change vulnerability.

FMCN and SSAC will support the development and/or strengthening of coordination mechanisms to serve as platforms that convene diverse stakeholders in planning processes, including government agencies at state and local levels, the private sector, smallholder farmers' producer groups and cooperatives, academia and local community representation. The project will focus on multi-stakeholder platforms that can convene, align, and scale knowledge: (i) AKK, an initiative of a network of 34 organizations, including the largest fishing cooperatives of the region, that have established fishing refugee zones (FRZ). FRZs make a significant contribution to climate change adaptation through the recovery and maintenance of fish stocks, protection of key biological processes (reproduction, spawning, recruitment), increases in abundance and size, larval dispersal and repopulation (connectivity), and the restoration of food chains and natural habitats (CONAPESCA, 2022). FRZ are a viable, low-tech, cost-effective adaptation strategy that offers a relatively simple nature-based solution, bundling many potential benefits for the environment and people into the future (Roberts et al., 2017). AKK seeks to recover small-scale fisheries and protect coastal marine ecosystems through organized efforts to efficiently use resources and with a focus on adaptation and resilience. This initiative began in Quintana Roo in 2010, and it has protected more than 19,000 ha, making it a reference at the regional level. The time is ripe to expand AKK through the YP, as its strategic plans for 2020-2024 and 2024-2030 consider. ACCIÓN will strengthen AKK by facilitating collaborative processes and shared actions of responsible fisheries management (fishing refugee zones in the three states of the YP) to recover the productivity of artisanal fisheries with a focus on increasing resilience to the effects of climate change; (ii) Alliance for the YP, an unprecedented inter-institutional collaboration that started in 2023 co-founded by the leading actors working in the YP in environment and climate change (FMCN, SSAC, World Wildlife Fund, The Nature Conservancy, Pronatura PY, United Nations Development Program (Small Grants Program and Biofin), and Amigos de Sian Ka'an); the objective of the alliance is to collaborate among its members and with other key actors, to strengthen the conservation and sustainable development of the territories and communities of the YP with a perspective of social justice, (iii) and the YP Regional Commission on Climate Change, a coalition of the three state governments that started in 2015, that seeks to foster cooperation and coherence in climate change policies in the region. ACCIÓN will support that these coordination mechanisms are effective, participatory, and inclusive and may support specific actions agreed upon under these mechanisms, such as sectorial, regional, or local adaptation strategies. During their design, the strategies will actively engage with women and Indigenous Peoples and Local Communities.

Activities:

4.1.1 Strengthen at least two YP multi-stakeholder public and private platforms.

FMCN and SSAC will support the development and/or strengthening of coordination mechanisms to serve as platforms that convene diverse stakeholders in planning processes, including government agencies at state and local levels, the private sector, smallholder farmers' producer groups and cooperatives, academia and local community representation. The project will focus on multi-stakeholder platforms that can convene, align, and scale knowledge: (i) AKK, an initiative of a network of 34 organizations, including the largest fishing cooperatives of the region, that have established fishing refugee zones (FRZ). FRZs make a significant contribution to climate change adaptation through the recovery and maintenance of fish stocks, protection of key biological processes (reproduction, spawning, recruitment), increases in abundance and size, larval dispersal and repopulation (connectivity), and the restoration of food chains and natural habitats (CONAPESCA, 2022). FRZ are a viable, low-tech, cost-effective adaptation strategy that offers a relatively simple nature-based solution, bundling many potential benefits for the environment and people into the future (Roberts et al., 2017). AKK seeks to recover small-scale fisheries and protect coastal marine ecosystems through organized efforts to efficiently use resources and with a focus on adaptation and resilience. This initiative began in Quintana Roo in 2010, and it has protected more than 19,000 ha, making it a reference at the regional level. The time is ripe to expand AKK through the YP, as its strategic plans for 2020-2024 and 2024-2030 consider. ACCIÓN will strengthen AKK by facilitating collaborative processes and shared actions of responsible fisheries management (fishing refugee zones in the three states of the YP) to recover the productivity of artisanal fisheries with a focus on increasing resilience to the effects of climate change; (ii) Alliance for the YP, an unprecedented inter-institutional collaboration that started in 2023 co-founded by the leading actors working in the YP in environment and climate change (FMCN, SSAC, World Wildlife Fund, The Nature Conservancy, Pronatura PY, United Nations Development Program (Small Grants Program and Biofin), and Amigos de Sian Ka'an); the objective of the alliance is to collaborate among its members and with other key actors, to strengthen the conservation and sustainable development of the territories and communities of the YP with a perspective of social justice, (iii) and the YP Regional Commission on Climate Change, a coalition of the three state governments that started in 2015, that seeks to foster cooperation and coherence in climate change policies in the region. ACCIÓN will support that these coordination mechanisms are effective, participatory, and inclusive and may support specific actions agreed upon under these mechanisms, such as sectorial, regional, or local adaptation strategies and plans

Output 4.2: Enhanced effective knowledge management to inform decision-making at all levels.

ACCIÓN seeks to facilitate learning, knowledge management, increased access to information, and exchange among stakeholders implementing EbA measures under the sub-projects and initiatives implemented under components 1, 2, and 3, as well as local and regional governments that can upscale the impact. A learning community for knowledge exchange coastal and marine EbA activities will be established and operated under an inclusive and gender-responsive approach. The results from Output 2.2 will be communicated under this Output, and scaled up to other coastal and marine PAs in Mexico.

Activities:

4.2.1 Implement a communication strategy and appropriate knowledge products, to share results and lessons learned.

FMCN will design a communication strategy and will lead documentation of lessons learned and preparation of knowledge products, and dissemination of these materials. Learning topics of interest include locally-lead adaptation, private innovative financing, long-term adaptation finance in PAs and others. Dissemination channels will include the FMCN's participation in networks such as the Network of Latin American an Caribbean Environmental Funds (RedLAC), the Community of Practice of Direct Access Entities of GCF, Yucatán Peninsula Alliance, and Mexico Conservation Funders Alliance.

4.2.2 Conduct knowledge-exchange activities and local level forums and scale-up lessons learned into state, regional, and national level policies.

This activity focuses on organizing knowledge-exchange events at the local level, such as forums, workshops, and discussions, where key actors can share lessons learned from implementing EbA measures or other actions covered under the different components. These forums will serve to share those insights to municipal, state, regional, and national agendas public actors. The ultimate aim is to ensure that the insights and effective practices from the field are integrated into public institutions' decision-making processes, leading to more informed and resilient policies that support sustainable and adaptive practices at a larger scale.

4.2.3. Establish a learning community for knowledge exchange of EbA measures, under an inclusive and gender-responsive approach.

FMCN and SSAC will create a learning community to facilitate the exchange of lessons learned from the practices implemented under Components 1-4, with a focus on Ecosystem-based Adaptation (EbA) measures. The learning community will enable national-level exchanges every two years to promote scaling up of successful experiences. These larger gatherings will serve as platforms to share best practices and challenges across regions, helping practitioners integrate these lessons into their respective areas. Additionally, regional peer-to-peer exchanges will foster collaboration among stakeholders in similar ecological and socio-economic contexts, promoting the adaptation of EbA measures to local conditions. The community will also host sector-specific exchanges, allowing participants to delve deeper into the particular challenges and solutions related to different sectors, such as fisheries, coral restoration, and ecotourism. Peer-to-peer learning, which has been proven in previous FMCN projects as a highly effective tool for adopting innovative practices, will be a key feature of these exchanges. By prioritizing peer-to-peer interactions, the community will ensure that knowledge is transferred efficiently, helping to replicate and scale successful practices across various regions and sectors.

III.4. Logical framework

For information related to this section refers to the project's logical framework in Annex 2a Programme-level logframe.

III.5. Timeline of the implementation

For information related to this section refers to the project's timeline of the implementation in Annex 2b. Timetable

III.6. Adaptation options and expected impacts

The Yucatan Peninsula is heavily affected by escalating temperatures, erratic rainfall patterns, intensified rain events, tropical cyclones, and evolving ocean dynamics. Adaptation requires a holistic approach to meet the adaptive requirements of vulnerable communities and diverse terrestrial and marine ecosystems. This approach must proficiently address the critical vulnerabilities arising from climate change, including, social, livelihood-related, and environmental concerns, as previously emphasized.

In this section, we delve into the specifics strategies and interventions designed to address the growing challenges posed by climate change in the YP. The core objective is to present a detailed examination of various adaptation strategies, tailored to meet the needs of the Peninsula´s vulnerable communities and marine ecosystems.

The proposed adaptation options are grounded in ecosystem -based adaptation (EbA) principles. These options also considered local knowledge and cultural practices in developing these adaptation strategies to ensure they are contextually relevant and socially inclusive.

Over the last ten years, there has been a growing understanding that nature plays a crucial role in shaping solutions and strategies for adapting to climate change. This has given rise to the formulation of ecosystem-based adaptation (EbA) strategies. As noted by Vasseur (2021), EbA focuses on enhancing resilience and lowering the vulnerability of local communities to climate change effects. It does this by taking into account the ecosystem services that communities rely on for climate change adaptation, thereby combining the sustainable utilization of biodiversity and ecosystem services into an all-encompassing adaptation strategy.

The premise of EbA lies on the principle that if an ecosystem is healthy, it is more resilient to any disturbance, and therefore the human component of this ecosystem should be capable to adapt to changes, i.e., more resilient as well (Andrade Perez, et al., 2010). Consequently, Ecosystem-based Adaptation (EbA) extends its scope beyond merely tackling the impacts of climate change through adaptation and short-term conservation of ecosystem services and biodiversity. It significantly lessens the vulnerability of the socio-ecological system, thereby enhancing the long-term sustainability of both human communities and ecosystems. To be successful, EbA needs to combine the efforts of society, decision makers at the community level, scientists, and other experts to ensure that adaptation strategies and solutions can be mainstreamed. (Vasseur, L. 2010).

Various approaches exist to address adaptation strategies. For ACCIÓN, Community-based adaptation (CbA) has been considered, as it has been promoted as an approach that can be more inclusive at the local level. It combines development with adaptation strategies that encourage communities to implement measures (Petzold, J. et al., 2010). This approach will allow communities to take ownership of the activities carried out to enhance resilience in ecosystems and, consequently, benefit the communities and their livelihoods. Since the actions are bottom-up, FMCN, in its fourth component, will ensure that government authorities recognize these practices and take them as lessons learned to integrate them into their policies.

The effectiveness of Ecosystem-based Adaptation (EbA) solutions, is attributed to their benefits and cost-efficiency. According to a USAID study (2017), EbA solutions are cost-effective due to their use of biodiversity and ecosystem services for adapting to climate change impacts (UNEP, 2016). For instance, coastal adaptation through EbA might involve mangrove restoration to combat sea level rise, contrasting with the construction of concrete seawalls as an engineering solution (Bertule et al., 2014). EbA methods, including sustainable forest management, reforestation, agroforestry, mangrove restoration, and rangeland management, are often long-term and effective on a landscape scale (Doswald et al., 2014).

Furthermore, EbA's emphasis on integrating adaptation into broader policy and development frameworks enhances resilience and sustainability while addressing current and future climate risks. However, the effectiveness of EbA measures largely depends on the methods of implementation. One successful method that is well known is Participation Action Research (PAR) as a tool to implement Eba in communities. According to Campos et al. (2016), Participatory Action Research (PAR) is a dynamic and iterative process that evolves from the collaborative efforts of practitioners and researchers. This methodology is distinguished by its flexibility and the continuous co-evolution of both theory and practice through the mutual engagement of all participants involved in the research process.

This methodology's objective is to collaboratively define key issues, explore potential solutions, analyze them, and make decisions or recommendations that are typically socially, economically, and environmentally viable. Given that ACCIÓN operates from a comprehensive approach, PAR can be an effective means to implement the previously mentioned EbA solutions. This approach ensures inclusive and integrated problem-solving, aligning well with the holistic nature of EbA strategies.

On the other hand, it's essential to actively prevent maladaptation in climate change strategies, which involves avoiding actions that inadvertently elevate vulnerability rather than diminishing it. This requires a focused approach to identify and mitigate actions that could lead to unintended harmful effects, ensuring that climate adaptation efforts are both effective and beneficial. One key example of a bad practice is when qualitative information about adaptation effectiveness is translated into quantitative indicators. According to Schipper (2022), this practice can lead to over-reliance on proxies that may not accurately reflect reality. This could potentially sideline descriptive, contextual evidence, contributing to maladaptation because inaccurate indicators hinder the assurance of effective adaptation Outputs in projects.

In a recent study, Alexandre Magnan has developed a set of eleven guidelines aimed at preventing maladaptation to climate change within coastal regions. These guidelines are presented in a table format and offer a structured approach to ensure that adaptation strategies enhance resilience rather than inadvertently increasing vulnerability to climate impacts.

Table 30 Eleven guidelines for avoiding maladaptation to climate change in coastal areas

Avoiding environmental maladaptation
Avoid degradation that causes negative effects in situ.
Avoid displacing pressures onto other environments (neighboring areas or areas that are connected ecologically or socio-economically).
Support the protective role of ecosystems against current and future climate-related hazards
Integrate uncertainties concerning climate change impacts and the reaction of ecosystems.
Set the primary purpose as being to promote adaptation to climate-related changes rather than to reduce greenhouse gas emissions
Avoiding sociocultural maladaptation
Start from local social characteristics and cultural values that could have an influence on risks and environmental dynamics.
Consider and develop local skills and knowledge related to climate-related hazards and the environment
Call on new skills that the community is capable of acquiring
Avoiding economic maladaptation
Promote the reduction of socio-economic inequalities
Support the relative diversification of economic and/or subsistence activities.
Integrate any potential changes in economic and subsistence activities resulting from climate change.

Source: Magnan, A. K. (2014) Avoiding maladaptation to climate change: towards guiding principles. European Climate Adaptation Platform (Climate-ADAPT). Available at: https://journals.openedition.org/sapiens/1680#tocfrom1n3

Identification of benefits and co-benefits

The ACCIÓN project encompasses various marine and coastal ecosystems that are vital for the well-being of communities. The following ecosystems aim to describe the benefits and co-benefits they provide, and part of the interventions is to maintain, restore, and strengthen these benefits:

Corals

Benefits:

– Biodiversity and Marine Habitat: Coral reefs are often described as the "rainforests of the seas" due to their rich biodiversity. They are home to about 25% of all marine species, despite covering only a small fraction of the ocean floor. This makes them one of the most diverse ecosystems on the planet (National Geographic Society, 2023).

– Protection Against Coastal Erosion and Storms: Coral reefs act as natural barriers, protecting coastlines from the impact of waves and storms. This is particularly important for low-lying island nations and coastal communities.

– Economic Value: Reefs contribute significantly to local economies through tourism and recreation. People travel from all over the world to dive and snorkel in these vibrant ecosystems. Furthermore, they provide habitat for many species that are vital for commercial fisheries.

Co-benefits: They attract tourism, driving local economies, and are sources of substances for medicines.

Seagrasses

Benefits: They stabilize the seabed, reducing erosion, and acting as breeding grounds for fish and other marine species.

Co-benefits: They significantly contribute to carbon capture and improve water quality by filtering pollutants.

Together, these ecosystems form an interconnected web that sustains marine and terrestrial life, regulates the climate, protects against natural disasters, and supports local economies. It is crucial to conserve and restore these ecosystems to maintain their benefits and co-benefits.

By enhancing the connectivity and functionality of coastal ecosystems, ACCIÓN will boost the ecosystem services provided by mangroves, dunes, seagrass, and coral reefs. This, in turn, will increase the benefits that society derives from these ecosystems. Coastal and marine ecosystems play a crucial role in sustaining livelihoods and various commercial activities, including artisanal and commercial fisheries, aquaculture, tourism, recreation, and carbon credit generation.

Coastal Dunes

Benefits:

1. Storm Protection: Dunes act as natural barriers against storms and hurricanes, absorbing the impact and protecting inland areas. They have been found to significantly reduce property damage during such events. For example, a study demonstrated that dunes saved an average of $8,200 per property during Hurricane Ike in 2008 on the Texas coast (Wang, M. 32023).
2. Erosion Control: Dunes help in controlling beach erosion. They are formed by the accumulation of sand, which is bound together by vegetation. This structure helps to hold the sand in place, reducing the rate of erosion caused by wind and water.
3. Habitat for Wildlife: Dunes provide habitats for various species of plants and animals. These ecosystems support biodiversity and offer nesting and feeding grounds for birds and other wildlife.

Co-benefits: They offer habitats for various plant and animal species and assist in the recharge of coastal aquifers.

Mangroves

Benefits:

- They protect against erosion and natural disasters: Their complex root systems help prevent erosion and retain and filter sediments. They can even facilitate soil growth, which can be crucial in keeping pace with sea level rise. Particularly in the face of climate change, mangroves serve as a natural barrier against flooding and storm surges. A study highlighted those mangroves reduce annual flood damages from tropical cyclones by about $60 billion and protect around 14 million people globally. Additionally, mangroves also provide significant protection against non-cyclonic conditions (Spalding, Mark D and Leal, Maricé, 2021).
- Carbon sequestration and climate mitigation: According to The State of the World´s Mangroves, they are highly effective in sequestering carbon, doing so at four times the rate of terrestrial forests. They have a unique ability to convert carbon dioxide into organic carbon at higher rates than many other habitats. The carbon storage capacity of healthy mangrove forests and the potential increase in carbon sequestration through mangrove restoration is substantial, highlighting their importance in climate change mitigation strategies (2021).
- Biodiversity conservation: Mangroves are habitats for a diverse range of species, including many that are threatened. They provide critical habitats for terrestrial wildlife as well as aquatic species like fish, mollusks, and crustaceans. This biodiversity is not only crucial for the ecosystems themselves but also supports local communities through fisheries and other means of livelihood (Carugati, et al. 2018).

Co-benefits: They serve as breeding grounds and habitats for various marine species, contribute to carbon capture and storage (mitigating climate change), and purify water by filtering pollutants.

Cenotes

Benefits: They are sources of freshwater in the peninsula and hold cultural and historical value for the Mayan civilization.

Co-benefits: They are tourist attractions and house endemic species.

Wetlands

Benefits: They assist in water regulation, reduce flooding, and act as natural filters for wastewater.

Co-benefits: They are areas of high biodiversity, provide pollination services, and are essential for the reproduction of migratory birds.

IV. Implementation arrangements

IV.1. Stakeholders analysis and evidence of consultations and Stakeholder Engagement Plan

The Stakeholder Engagement Plan (SEP) for the project "Sustainable Communities for Climate Action in the Yucatan Peninsula (ACCIÓN)" aims to describe the differentiated measures that will be applied to ensure the effective participation of the project's main stakeholders, including men, women, and those identified as disadvantaged or vulnerable. The SEP was developed based on FMCN's Environmental and Social Management System and is aligned with the Environmental and Social Safeguards (ESS) of the Green Climate Fund (GCF). Its goal is to ensure dynamic and meaningful engagement with stakeholder groups by identifying various participation mechanisms, particularly for local communities and vulnerable groups. Engagement is recognized as a key element in establishing strong and lasting relationships that support the proper management of the positive and negative environmental and social impacts of a project, and to foster a sense of belonging and ownership that contributes to achieving the desired outcomes. In this sense, the SEP promotes the free, full, informed, timely, and effective participation of key actors in the project's areas of influence through the design of mechanisms, strategies, and actions that foster collaboration among the various actors interacting in the project's intervention area.

The specific objectives of the SEP are:

- Identify and analyze stakeholder groups, including their profiles, interests, relevant issues/impacts, and concerns regarding the project.

- Establish specific measures to promote meaningful engagement with the various stakeholder groups, ensuring the process is transparent, accessible, and culturally appropriate, with a particular focus on vulnerable groups.

- Facilitate building a relationship with project stakeholders based on mutual respect and trust.

- Ensure the appropriate and timely dissemination of information to stakeholders in a manner that respects cultural norms.

- Implement systems for the prior dissemination of information and consultations, including seeking and incorporating inputs from affected individuals or groups, and providing feedback on how their contributions were considered.

- Establish mechanisms for stakeholders to provide comments, ask questions, raise concerns, and resolve disputes.

- Create a system to document activities carried out and conduct the corresponding reporting and monitoring.

It is important to note that the actions mentioned imply an ongoing process of identifying impacts and outcomes rather than a one-time initial activity. Therefore, the SEP should be considered a living document that is periodically updated based on emerging needs and engagement patterns with the various stakeholders.

The topics shared with stakeholders during the design phase aim to gather their opinions and suggestions regarding relevant aspects of the project that may affect their interests, to analyze and address them appropriately:

- A summary of the project in accessible language for stakeholders.

- Location of the areas or spaces planned for project actions.

- Risks and adverse impacts the project may generate, and proposed mitigation and control measures (Environmental and Social Management Plan).

- Positive impacts or project benefits and opportunities to enhance them.

- Content and scope of the Stakeholder Engagement Plan.

- Procedures for the Grievance Redress Mechanism (GRM) and its availability and accessibility (phone line, email, etc.).

- Calls for applications, participation, or access to project resources.

The expected result of the engagement activities is the strengthening of relationships with affected communities, the ratification or modification of the project based on inputs, suggestions, and proposals from affected stakeholders, as well as the commitment of communities to the implementation and monitoring of the project.

This section describes the multi-stakeholder engagement process, and the participation plan carried out so far as part of the project design during the Environmental and Social Assessment. Stakeholders for this plan were identified based on this prior engagement, ensuring an inclusive gender approach. The participation activities conducted to date were essential for identifying stakeholders and formulating the SEP for the remainder of the project's lifecycle. FMCN, Sureste Sostenible, and various consulting teams have coordinated the engagement activities with the involved actors. A total of 27 engagement exercises took place between May 2023 and September 2024, and a total of 296 people participated in those exercises.

As a result of this socialization process, local stakeholders confirmed that the general perception of the project is positive. The main concerns raised were related to the project timeline, eligible activities, operational mechanisms, and the quantity and types of expected benefits for each sector.

The relative influence of these different people and groups on the project, as well as the project's influence on them, was examined through a stakeholder mapping process. The importance of a stakeholder group is categorized by considering the magnitude of the project's impact on them or the degree of influence (power, proximity) a group has over the project's functioning. Below is an initial categorization and brief profile of the most relevant stakeholders identified, according to their potential interest and influence. However, stakeholder groups will be expanded and updated as the project evolves to identify complementary groups.

As one of the guiding principles of inclusive engagement, the project commits to working with hard-to-reach stakeholders such as:

- Women

- Youth and the elderly

- People with disabilities

- Indigenous stakeholders

ACCIÓN will ensure that Indigenous peoples present are able to participate in project activities, so an appropriate strategy will be developed to promote their participation. For example, culturally appropriate materials will be translated and disseminated through accessible means to increase their knowledge of the project and its activities, participation channels, and the Grievance Redress Mechanism (GRM). All of this will be framed within the Indigenous Peoples Plan (IPP) developed for the project.

Based on the identification of stakeholders and the engagement activities described, the project will carry out regular actions to promote effective and culturally appropriate interaction with them. Participation in all local-level activities will be voluntary and based on the principles of Free, Prior, and Informed Consent. Various participation methods will be employed to address the different profiles, concerns, and expectations of the identified stakeholder groups, among other aspects.

The processes are designed to be adaptable, adjusting to both national and local conditions and requirements. As the SEP is a dynamic document, the participation activities, their frequency, and functioning will be modified as necessary throughout the project, considering stakeholder monitoring and feedback. For more information, see the Stakeholder Engagement Plan annex under the Annex 12. Environmental and Social Action Plan (ESAP) and Environmental and Social Safeguards risk screening if changed from Part A and B of the concept note submitted.

IV.2. Capacity assessment and due diligence on the executing entities

The Accredited Entity (AE) is the Mexican Fund for the Conservation of Nature A.C. (FMCN), and the Co-Executing Entities FMCN and one of its Regional Funds (RFs), Sureste Sostenible A.C. (SSAC).

FMCN is an environmental fund created on January 26th, 1994, with 30 years of experience financing climate change adaptation and mitigation actions in Mexico by catalyzing resource mobilization, building partnerships to engage various actors and sectors, and searching for innovative conservation mechanisms. FMCN has become a key actor in regional and international networks, such as the Latin American and Caribbean Network of Environmental Funds. FMCN has been an AE by the Green Climate Fund since 2019, In April 2021 FMCN received approval for the Green Climate Fund (GCF) Project RIOS (SAP023), currently in interim review. In 2024 GCF upgrade FMCN accreditation from micro to small-size projects and Environmental and Social Risk Category B.

SSAC is a Mexican regional conservation fund (RF) whose purpose is to finance and operate conservation, sustainable use and climate change projects through the establishment of strategic alliances in the Yucatán Peninsula (YP) Region of Mexico. SSAC is officially registered in Mexico since December 2020. SSAC currently manages programs of economic, social and environmental relevance to the region, including the Mesoamerican Reef System Leadership Program, MAR+Invest, Kaanbal Suut and Alianza Kanan Kay, that ACCIÓN seeks to scale-up. In 2023, in the framework of a Readiness initiative, the Global Green Growth Institute (GGGI) conducted an external due diligence on Mexico's

RFs, including SSAC, to assess their level of institutionalization following GCF standards (See the SSAC Due Diligence Annex of the full proposal). The due diligence and capacity assessment of SSAC has been carried out as part of the readiness project to Mexico, implemented by GGGI in 2023 and the results showed that SSAC has the capacity to be EE of ACCIÓN.

SSAC has operated since 2021 in the states of Campeche, Yucatan, and Quintana Roo and the Mesoamerican Barrier Reef System, the second largest barrier reef in the world shared by Mexico, Honduras, Belize, and Guatemala. It aims to achieve a more sustainable and resilient southeast through financing and promoting socio-environmental initiatives, projects, collaborations, and comprehensive and impactful actions. A strong fund, with clear rules and solid institutional foundations, can build long-term strategies with effective, efficient, and sustainable results. This is also indispensable for building trust and creating alliances that translate into coordinated environmental projects. Also, a robust Regional Fund becomes an example and permeates its capacities in grassroots organizations and collaborators in the field, who are the first hands that transform the resources received into concrete actions. On an annual basis, the Regional Funds and FMCN have generated a series of spaces and activities to strengthen institutional capacities, such as applying the Conservation Trust Funds standards, organizing FMCN technical advisories for Regional Fund Directors on identified needs, face-to-face meetings of the RedFAM, and applying due diligence in the framework of new projects. These have had positive results in the Regional Funds, which have shown significant progress in consolidating their institutional capacities.

Within the framework of a Readiness financed by GCF, in 2023, GGGI proposed to carry out due diligence of Mexico's Regional Funds. This due diligence aims to diagnose the institutional level of the funds following GCF standards. These standards were divided into three main areas: fiduciary, safeguards, and gender. In total, 84 criteria were evaluated, organized as follows:

Criteria	Number of criteria reviewed
General and contact information	6
Legal framework	3
Governance	14
Organizational structure and culture	4
Financial management	10
Procurement	5
Project management	7
Resource mobilization	15
Environmental and social safeguards	5
Gender	15

The compliance evaluation was done in two phases. Each Regional Fund received an Excel questionnaire format and assigned a person responsible for responding to each criterion, mentioning and justifying their compliance or degree of progress, and attaching the supporting information. The first information survey was done in September2023, during which GGGI's consultant reviewed it and sent specific questions to the Regional Funds to complement the information provided. The second information survey was carried out between October and November2024. A detailed analysis of the responses and sound practices implemented by the

Regional Funds was generated using the information received. At the end of the year, FMCN received the gap analysis of the fiduciary, safeguard, and gender criteria, as well as the documentary evidence provided by the Regional Funds. The deliverables provided were:

•A Gap Assessment. Excel document with the responses provided by Regional Funds to each criterion, followed by an evaluation of compliance from the consultant. If there is non-compliance, a recommendation from the consultant is introduced.

•An Action Plan. Excel document with only those criteria not met by Regional Funds and that, therefore, require specific attention for their fulfillment. GGGI's consultant assigned each criterion a priority, a timeframe for recommended attention, and a person responsible for follow-up.

•Finally, the GGGI consultant briefly compared the criteria evaluated in the 2023 due diligence and the Conservation Trust Funds due diligence applied annually to the Regional Funds. The table shows that all the Conservation Trust Funds criteria are reflected in the GCF standards that were the basis of the 2023 due diligence.

The due diligence on SSAC was conducted between September and November 2023. Maria Eugenia Arreola, the executive director of SSAC, was the main point of contact for providing information. Based on GGGI's due diligence results, SSAC successfully met 49 criteria out of 84. The requirements to be strengthened, the consultant's recommendation for meeting the criteria, and the relevance of these criteria to project operations are detailed below.

Criteria	Consultant's comment	Indispensable necessity for the operation of project
TRUSTEE		
Existence of specialized committees	Form committees relevant to FAR activity.	N/A
Regulatory compliance process	Finalize the development and approval of the irrigation control manual.	N/A
Existence of a strategic and financial plan	Complete the design and proceed with the approval of the strategic plan.	N/A
Presence of a strategic planning process	Approve the Strategic Plan and implement a strategic planning process.	N/A
Existence of internal audit	Implement an internal audit unit.	N/A
Endorsement and approval authority levels	Establish a Procurement Committee.	N/A
Anti-fraud practices, corruption, etc.	Proceed with the approval and application of the Risk Control Manual.	N/A
Eligibility criteria for the selection of suppliers	Proceed with the approval and application of the Risk Control Manual.	N/A
Existing security protocols	Proceed with the approval and application of the Risk Control Manual.	N/A
Guidelines for field supervision of projects	Include field project supervision guidelines in the Risk Control Manual.	N/A
Existence of strategies to diversify and multiply their financing sources	Develop and implement strategies to diversify sources of financing.	N/A
Resource mobilization strategies	Develop and implement strategies to diversify sources of financing.	N/A
Donor selection policy	Proceed with the approval and application of the Risk Control Manual.	N/A
Search for additional sources of green financing	Design and implement the fundraising strategy.	N/A
Ability to demonstrate support for ANP	Continue with the institutional development processes to achieve the goal of interaction with ANP.	N/A
Existence of an equity generation strategy	Design and implement the fundraising strategy.	N/A
Grant award process	Develop the grant award process to be implemented.	N/A
Existence of a cost-sharing regime	SSAC is in the process of developing its counterparty policy.	N/A
SAFEGUARDS		
Environmental and Social Policy	Approval of the SAS and the Institutional Strategic Plan.	N/A
Environmental and Social Risk Management (E&S)	Approve the environmental and social risk management procedure.	N/A
Environmental and Social Risk Monitoring	Approve the procedure for monitoring environmental and social aspects of projects.	N/A
External Communication Mechanism (ECM) and Disclosure of Information	Strengthen and disseminate the SCM in informative workshops / Disseminate E&S information on projects in newsletters.	It will be carried out within the framework of the project.
Organizational Capacity	Train a staff member on the application of SAS.	It will be carried out within the framework of the project.

GENDER		
Gender Policy endorsed by senior management	Finalize the development of a Gender Policy for this fund.	N/A
SH Document	Develop workshops to socialize the Policy against Sexual Harassment in the workplace.	It will be carried out within the framework of the project.
Diagnosis of labor segregation	Conduct a vertical and horizontal job segregation analysis.	N/A
Labor segregation plan	If wage gaps exist, it is recommended that an Action Plan be established to reduce the gaps.	N/A
Communication Campaign with inclusive, non-sexist language	Develop an inclusive and non-sexist language manual.	N/A
Annual gender training plan (general)	Identify free courses from various organizations and develop an annual calendar for all funds.	N/A
Annual training plan for mainstreaming PEG in the work of the funds	Identify which actions of the FMCN Gender Action Plan could be co-responsibility of the regional Funds.	N/A
Cross-cutting gender budget	Elaborate specific and cross-cutting gender budgets.	N/A
Manual with tools for incorporating PEG into projects	Develop a manual for incorporating the PEG in the fund's projects.	N/A
Existence of M&E mechanism on PEG impacts	Develop an E&M mechanism on PEG impacts.	It will be carried out within the framework of the project.
Identification of good gender practices	Identify good practices and develop a decalogue on these gender practices.	N/A
Dissemination of successful cases where PEG has been implemented.	Create and disseminate a log of successful cases of PEG implementation.	N/A

It is worth mentioning that many of the criteria evaluated in 2023 were addressed by SSAC in 2024. Although not reflected in this evaluation, the Action Plan presented below considered this progress and reflected only those items remaining to be resolved in 2024-2026.

Action Plan

FMCN, in conjunction with the Regional Funds, developed an Action Plan in 2024 to address those criteria not met by at least one of the Regional Funds. The Institutional Strengthening Plan for Regional Funds 2024-2026 aims to improve the institutional capacities of the Regional Funds to generate better results in the field to sustain Mexico's natural treasure. The Institutional Strengthening Plan seeks constant collaboration and exchange between the Regional Funds that have met the criteria and those in the process of meeting them.

The document's participatory preparation made it possible to integrate each Regional Fund's needs and approve responsibilities for strengthening each of them. Likewise, the Plan established deadlines for the fulfillment of each accompaniment, corresponding to the timeframe and priority deemed pertinent by the GGGI consultant and agreed upon by the Regional Funds.

SSAC will participate in implementing the Institutional Strengthening Plan, either as a Fund providing or receiving certain accompaniments. According to the established schedule, SSAC will participate in 22 accompaniments: two as a provider (these being "*anti-fraud practices*" and the "*existence of a strategy to generate own resources*") and 20 as a recipient.

Final positioning

Following the above, FMCN recognizes SSAC as a Regional Fund with institutional capacities for properly implementing conservation and sustainable development projects. The results obtained during the 2023 due diligence and the progress made by SSAC in the first half of 2024 are positive for properly coordinating and implementing projects in the field as a sub-recipient.

Likewise, SSAC's participation in preparing the Institutional Strengthening Plan for Regional Funds 2024-2026 was of significant substantive contribution. With this Plan, SSAC has committed to acquire assistance and accompaniment obligations, allowing us to determine that SSAC will continue strengthening its institutional capacities. FMCN will continue to apply annual due diligence based on the criteria of the Conservation Trust Funds, which will allow to measure the progress made by SSAC. These may be shared, when deemed necessary, to the GCF. **For more information, see the SSAC Due Diligence Annex of the full proposal.**

IV.3. Implementation arrangements and governance of the project

The accredited entity (AE) is the Mexican Fund for the Conservation of Nature (FMCN), which has a strong structure and capacities for implementing multilateral-financed projects. For example, FMCN has the adequate capacity to carry out the administration and supervision of the Project, given its trajectory in implementing projects financed by international institutions such as the World Bank, the State Development Bank of the Federal Republic of Germany (KfW) and the Inter-American Development Bank (IDB), among others. FMCN's internal control is solid since it has manuals, policies, and operating procedures for executing international projects.

FMCN will play the role of both Accredited Entity (AE) and co-Executing Entity (EE). The Regional Fund (RF) SSAC will be co-Executing Entity along with FMCN. The roles and responsibilities of each party clearly defined in Table 31. SSAC is one of the five funds created by FMCN in the past ten years. These RFs and FMCN are part of the Mexican Network of Environmental Funds (RedFAM). The use of RFs for project execution has reduced operation costs by working closer to community-based enterprises and local organizations, developing capacities to finance projects, strengthening partners in the field, joining efforts by creating programs and strengthening coalitions. The due diligence and capacity assessment of SSAC has been carried out as part of the readiness project to Mexico, implemented by GGGI in 2023.

Table 31 Activities and execution

Component	Output	Activities	Sub-activities	Executing Entities	
				Leads	Co-EE
Component 1. Ecosystem-based adaptation on selected coastal and marine landscapes.	Output 1.1. Coastal and marine ecosystems have been conserved, restored, or under improved management practices that reduce climate vulnerability.	1.1.1 Finance ten sub-projects to conserve, restore, and improve productive practices to increase communities' adaptive capacities in coastal and marine landscapes.	1.1.1.1 Design and disseminate the RFP for Sub-projects for EbA solutions	SSAC	FMCN
			1.1.1.2 Evaluation of RFP by external evaluators.	SSAC	FMCN
			1.1.1.3 Selection of simplified proposals by the Coordination Committee.	FMCN	
			1.1.1.4 Provide technical assistance to selected sub-projects to develop a full proposal	SSAC	FMCN

			1.1.1.5 Award contracts to organizations whose Sub-projects were selected.	SSAC	FMCN
			1.1.1.6 Provide technical and administrative support to EbA Sub-projects.	SSAC	FMCN
			1.1.1.7 Evaluate where appropriate, extend annual contracts with the organizations in charge of the Sub-projects.	SSAC	FMCN
		1.1.2 Support ten sub-projects in implementing procedures to maximize environmental and social benefits, with a gender approach.	1.1.2.1 Supervise administrative management of sub-projects	SSAC	FMCN
			1.1.2.2 Supervise the implementation of the Environmental and Social Action Plan	SSAC	FMCN
			1.1.2.3 Supervise the implementation of the gender action plan	SSAC	FMCN
		1.1.3. Monitor the climatic events and implement climate early warning systems linked to sub-projects.	1.1.3.1 Adjust existing early warning systems to be focused on sub-projects needs	FMCN	
			1.1.3.2 Create partnerships to monitor and communicate early warning systems	SSAC	FMCN
			1.1.3.3 Implement early warning systems, including training and communicating	SSAC	FMCN
Component 2: Ecosystem-based adaptation on coastal and marine Protected Areas (PAs).	Output 2.1. Five-year plans, and associated Annual Operating Plans (POAs), are financed for PAs through an inclusive participatory process coordinated by CONANP.	2.1.1. Finance gender-responsive and inclusive five-year operating plans of 20 PAs.	2.1.1.1 Design and disseminate the RFP for PA financing	FMCN	
			2.1.1.2 Present to for approval to the CTFANP and MEx30x30 Committee.	FMCN	
			2.1.1.3 Award contracts to OLLCs for POAs.	FMCN	
			2.1.1.4 Support the government to develop five-year plans	FMCN	
		2.1.2. Finance gender-responsive and inclusive Annual Operating Plans to implement EbA measures in 20 PAs.	2.1.2.1 Supervise administrative management of POAs	FMCN	
			2.1.2.2 Supervise the implementation of the Environmental and Social Plan	FMCN	
			2.1.2.3 Supervise the implementation of the gender action plan	FMCN	
	Output 2.2 The vulnerabilities status of PA have been monitored	2.2.1 Define and apply methodologies for analyzing PAs social and environmental vulnerability.	2.2.1.1 Adapt methodologies to assess the vulnerability of communities and ecosystems using participatory and technical experts' methodologies in PAs.	FMCN	
		2.2.2 Analyze the vulnerability of communities and ecosystems.	2.2.1.2 Analyze the vulnerability of communities and ecosystems using participatory and technical experts' methodologies in PAs.	FMCN	
Component 3: Sustainable financing for scaling up EbA measures.	Output 3.1. Private and public investments for scaling-up EbA interventions are promoted trough a financial facility. .	3.1.1 Design and establish a financial facility for EbA measures in marine and coastal ecosystems.	3.1.1.1 Design the detailed procedures to operate a financial facility for marine and coastal ecosystems EbA.	FMCN	
			3.1.1.2 Convene and coordinate existing institutions and mechanisms to implement the financial facility	FMCN	
			3.1.1.3 Convene and coordinate institutions and mechanisms to leverage public and philanthropic finance to fiancé effective PAs	FMCN	

		3.1.2 Support ten financing plans between producer groups /community enterprises implementing marine and coastal EbA measures with investors, financial institutions, aggregators, and others. .	3.1.2.1 Organize events, workshops and investors rounds to link local producer groups, microenterprises, cooperatives, and others with investors, financial institutions, aggregators and others.	FMCN	
			3.1.2.2 Provide technical, financial and legal support to improve the investment and commercial agreements	FMCN	
	Output 3.2. Innovative sustainable finance for scaling-up EbA measures in marine and coastal ecosystems has been selected to be piloted/strengthened	3.2.1. Design and pilot a small-scale fisheries parametric insurance to compensate for local livelihoods lost under extreme events.	3.2.1.1 Continue the small-scale fisheries parametric insurance to compensate for local livelihoods lost under extreme events.	FMCN	SSAC
			3.2.1.2 Pilot the parametric insurance	FMCN	SSAC
			3.2.1.3 Provide training to small-scale fisheries related to the insurance	SSAC	FMCN
			3.2.1.4 Provide training to potential buyers of the insurance	SSAC	FMCN
		3.2.2. Pilot selected innovative sustainable finance that is legally, financially and technically feasible.	3.2.2.1 Conduct legal, financial, and technical assessments to evaluate the possibility of supporting at least two innovative financial mechanisms, such as insurance and offsets.	FMCN	
			3.2.2.2 Pilot selected innovative sustainable finance that is legally, financially and technically feasible.	FMCN	
	Output 3.3. Business strategies have been financed to improve capacities of local producer groups, micro-enterprises, cooperatives, and others.	3.3.1. Finance 14 PLATs to improve skills and competencies for developing business strategies and sound financial management of local producer groups, micro-enterprises, cooperatives, and others	3.3.1.1 Design and disseminate the RFP for PLATs to improve business skills of sustainable local producer groups, micro-enterprises, cooperatives, and others	SSAC	FMCN
			3.3.1.2 Evaluation of RFP by external evaluators.	SSAC	FMCN
			3.3.1. Selection of proposals by the Coordination Committee.	FMCN	
			3.3.1.4 Assess the local producer groups, micro-enterprises, cooperatives, and others needs and develop tailored plan.	SSAC	FMCN
			3.3.1.5 Finance PLAT´s plan to strengthen business capacities of local producer groups, micro-enterprises, cooperatives, and others	SSAC	FMCN

			3.3.1.6 Supervision of PLAT´s plan implementation to strengthen business capacities of local producer groups, micro-enterprises, cooperatives, and others and monitor the impact.	SSAC	FMCN
Component 4: Knowledge management and coordination with regional public policies and initiatives.	Output 4.1 Strengthened multi-level and multi-stakeholder coordination mechanisms in the region that contribute to reducing climate change vulnerability.	4.1.1 Strengthen at least two YP multi-stakeholder public and private platforms	4.1.1.1 Support the operation of at least two multi-level and multi-stakeholder platforms	SSAC	FMCN
			4.1.1.2 Finance at least two selected plans or strategies for adaptation in the YP	FMCN	SSAC
	Output 4.2: Enhanced knowledge to inform decision-making at all levels.	4.2.1 Implement a communication strategy and appropriate knowledge products, to share results and lessons learned.	4.2.1.1 Design a communication strategy to share results, lessons learned, and relevant information on ecosystem- based adaptation promoted by this project.	FMCN	SSAC
			4.2.1.2 Develop appropriate knowledge products, including photo stories, videos, leaflets, presentations and briefing notes, for use in policy advocacy activities.	FMCN	SSAC
		4.2.2 Conduct knowledge-exchange activities and local level forums and scale-up lessons learned into state, regional, and national level policies.	4.2.2.1 Promote the incorporation of lessons learned from field actions implemented under Component 1, 2 and 3 into the agendas of the respective public institutions	FMCN	SSAC
		4.2.3. Establish a learning community for knowledge exchange of EbA measures, under an inclusive and gender-responsive approach.	4.2.3.1 Establish a regional learning community that will be linked to national projects, to scale-up the experiences	FMCN	
			4.2.3.2 Establish system learning communities for specific EbA measures	SSAC	FMCN

The governance structure of ACCIÓN includes a Coordination Committee (CC) with the participation of CONANP, representative of the state governments of YP, FMCN, and a representative of each sector: (a) civil society, (b) private; (c) social; and (d) academia. The Ministry of Finance (SHCP) will participate as NDA as an observer. FMCN will be the technical secretary of the CC. The CC will provide strategic guidance in coordinating efforts with CONANP, the state governments and other to support community enterprises. It will also identify public investments to enhance and scale up the sub-projects. The CC will make the recommended decision regarding the selection of sub-projects and PLATs; however, FMCN retains the ultimate decision. The committee's legal structure will be FMCN, and the legal responsibility of its decisions will fall to the FMCN.

The Technical Committee of the Protected Areas Fund (CTFANP), established within FMCN, oversees and guides projects focused on PAs. It consists of nine members appointed by the National Council of Natural Protected Areas (CONAP) and ratified by the FMCN Board of Directors. To ensure broad representation of society interests in biodiversity conservation, its members must come from the following sectors, with no more than three representatives per sector: private sector, federal government, academia, civil society conservation organizations, and social organizations, including Indigenous and campesino groups. CTFANP will oversee the activities under Component 2, such as the preparation and approval of the Annual Operational Plans (POA). Every year, the CTFANP will inform on advances to the MEx30x30 Donors Committee (in process to be created with expected representation of GEF, GCF and other donors), which will oversee the closing of the financial gap for protected areas (PAs) by 2030. CONANP, the federal agency in charge of managing protected areas, will provide fundamental technical inputs during project implementation in protected areas and ensure coordination with the national government, promoting scaling up the local strategies and lessons learned. CTFANP's decisions are made within FMCN´s operational mandate, and are thus aligned with FMCN's overall governance structure, policies, and legal framework. FMCN provides oversight to ensure that all decisions adhere to applicable legal and operational standards. Should any disputes or issues arise regarding CTFANP's decisions, FMCN is the legal entity to address them. In ACCIÓN, the CTFANP will hold the recommended decision in selecting the OLLCs to be awarded subgrants for supporting the operation and management of the PAs, while FMCN will retain ultimate decision.

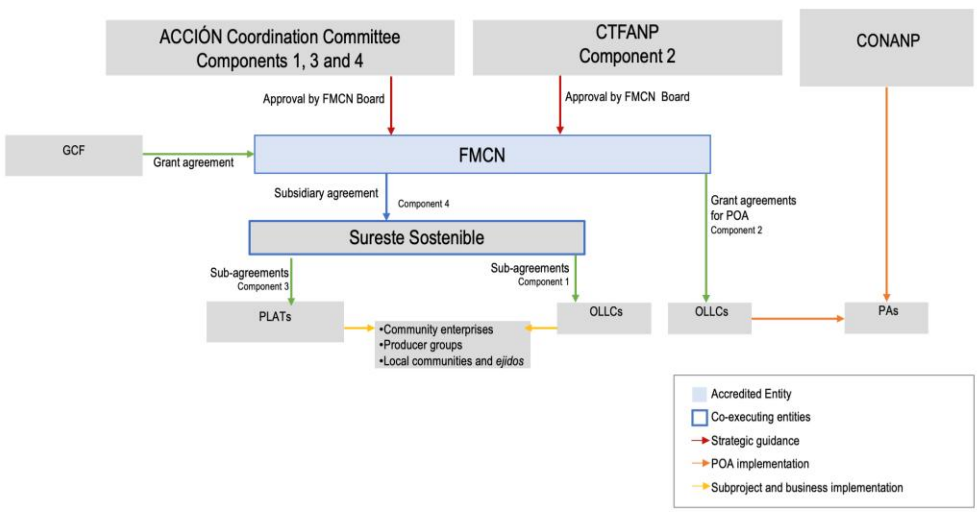
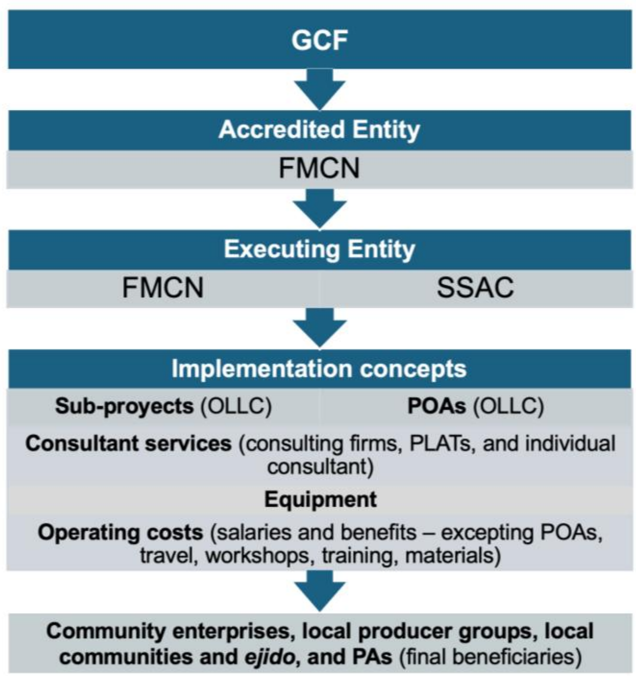


Figure 66 Implementation structure and financial flows

Based on the institutional arrangements that are in place, contractual arrangements will be made, which begin with the signing of a Specific Funded Activity Agreement (Grant Agreement) between GCF and FMCN. This contract will be the framework agreement for the project. Once this agreement is signed and operating, FMCN will sign a subsidiary agreement with SSAC, who will have the responsibility to carry out the supervision of the direct operation in the field, as are the sub-projects with civil society organizations. CONANP and the state governments will ensure country appropriation and long-term sustainability.

The post-implementation arrangements have been delineated, with comprehensive Operation and Maintenance (O&M) Plans established to ensure the sustained effectiveness of the project's outcomes. The three states of the YP—Yucatán, Campeche, and Quintana Roo—will support to guarantee the continuity of the activities implemented under this project. This commitment ensures that the initiatives undertaken will remain functional and effective in the long term, securing the resilience and sustainability goals of the project (see Annex 16 for support letters).

The financial structure of ACCIÓN ensures that resources are efficiently distributed to support EbA activities at different levels. The following diagram illustrates the financial flow process.



IV.4. Institutional and programme/project level grievance redress mechanism(s)

The Grievance Redress Mechanism (GRM) is a fundamental component to guarantee the effective participation of individuals, groups, collectives, organizations and communities throughout the life of a project.

The GRM allows the building of trust between the different parties involved in an initiative and prevents small disagreements from escalating into major conflicts.

FMCN has a tiered mechanism for receiving and addressing complaints and reports, which comprises two levels of action:

1. An institutional-level Grievance Mechanism for the prevention and detection of fraud, acts of corruption and non-compliance with the Code of Ethics; institutional procurement disputes; personnel nonconformities; and environmental and social issues of a project.
2. A project-level Grievance Mechanism, included in FMCN's Operations Manual, which handles project-related complaints and reports.

GRM have recently been assessed and approved by the Green Climate Fund through the Update to the FMCN Scope of Accreditation, approved in October 2024, where it states that the applicant's external communications system, consultations, information disclosure, and GRM, supported by evidence of their track record, fully comply with the revised environmental and social policy of the GCF.

Institutional level GRM

Objective

The purpose of the GRM at the institutional level is to provide a free, accessible, inclusive and structured procedure for receiving, evaluating and making recommendations for the resolution of complaints and reports related to the projects that FMCN finances.

Guiding principles

The GRM respects human rights and follows national and international human rights standards, with the following guiding principles:

Table 32 The guiding principles of FMCN´s grievance mechanism

Accessibility	• Volunteer. • Known to all stakeholders. • With multiple channels: phone, email, SMS, WhatsApp, through contact with FMCN staff or follow-up field visits.
Predictable	• Provides a clear and known procedure to interested parties.
Transparency	• Respectful of confidentiality, when necessary and requested. • Keeps interested parties informed of the progress of the complaint or report.
Compatible with the rights	• The resolution is consistent with the national and international rights recognized.
Equity	• Fair, informed, respectful and professional treatment, in accordance with due process. • Does not restrict the right to use other available grievance mechanisms.
Based on commitment and dialogue	• Focuses on dialogue as a means of addressing and resolving complaints and reports.
Continuous learning	• Stakeholder consultation for improvement • Periodically evaluates its performance, complaint trends and the way in which resolution is implemented.

Legitimacy	• Enables stakeholder's trust.

Structure and management

The GRM at the institutional level is under the responsibility of FMCN's Internal Auditor and is supported by three collegiate bodies: the team of directors, the Institutional Accompaniment Committee (IAC) and the Board of Directors (BD), all of which are responsible for its effective and efficient operation.

In the case of complaints, the Internal Auditor, with the knowledge of the General Director, receives a written complaint, initiates an investigation and submits a file to the corresponding collegiate body, which takes the appropriate actions and supervises, through its designee, the implementation of the agreements reached.

If the person involved in the complaint is the Internal Auditor, the General Director initiates an investigation and submits a file to the IAC.

If the person involved in the complaint is the General Director, the Internal Auditor initiates an investigation and submits the file to the BD.

In the case of complaints, the team of directors is responsible for the inquiries to respond to admitted complaints. If the person involved in the complaint is an area director, he/she will be separated from the analysis and resolution of the complaint.

The Regional Funds, which function as support for the implementation of FMCN projects (see description in the Organizational Manual) will have their own complaints and report mechanisms, appropriate to the scale and purpose of the projects to which they are related, and will inform interested individuals or groups of individuals of the existence of procedures for presenting complaints and reports. FMCN will share best practices and provide guidance to support capacity building of the Regional Funds' complaints and report mechanisms.

In the case of inquiries about general reports, the Communication Area is responsible for responding to the person concerned. In the event that the Communication Area receives a report or complaint, it will forward it to the Internal Auditor and General Director.

Scope

The institutional-level GRM applies to all FMCN-funded projects and operates throughout their life cycle; it is not a court of appeals or a legal mechanism.

The GRM at the institutional level receives complaints and reports from:

a. Individuals or groups of two or more individuals, communities or organizations that believe they have been or may be affected by the adverse impacts of an FMCN-funded project.

b. The legitimately authorized representative(s), provided that he/she submits written proof that he/she is authorized to represent the persons or groups of persons, communities or organizations on whose behalf he/she is acting.

c. Individuals or entities executing projects, sub-projects or Annual Operative Plans (AOP) financed by FMCN.

d. Workers linked to projects, sub-projects or AOPs, regardless of their position or seniority. In accordance with the Whistleblower Protection (see Organizational Manual), whistleblowers will not receive any retaliation for their complaint or report.

e. Individuals who are members of the committees related to the projects.

f. Persons providing consulting services or goods and services related to projects, sub-projects and AOPs.

g. FMCN collaborators.

The person or persons filing the complaint or report may indicate whether they wish to keep their identity and the reasons for invoking it confidentiality. In this regard, the GRM at the institutional level will not supplant the judicial remedies available to the person filing the complaint or report.

The GRM at the institutional level is aligned, at all times, to FMCN's relevant operational policies, such as the Code of Ethics, Privacy Notice, Whistleblower Protection Policy; Procurement Dispute Resolution Policy; Prohibited Practices Policy; Protection against Sexual Exploitation, Abuse and Harassment Policy; Prevention of Money Laundering and Terrorist Financing Policy; Zero Tolerance Statement; Fraud and Corruption Clauses; and Environmental and Social Policy; which aim to prevent, avoid and mitigate negative activities or institutional misconduct.

Exclusions

The GRM at the institutional level does not process complaints or reports when:

a. FMCN is not responsible for the financing of the project to which the complaint is appealing;

b. the specific issues or topics have already been reviewed and concluded by the hotline in another process, unless the request presents new information, material or evidence that was not available at the time the complaint or report was previously considered;

c. is unfounded;

d. seeks to gain a competitive advantage;

e. is submitted 24 months after the closing of the project, sub-project or AOP;

f. is anonymous.

Information that a complaint or report should contain (criteria of eligibility)

No specific format is required to file a complaint or report. However, to be considered by the GRM at the institutional level it must contain the following:

- The name, address, telephone number, e-mail address or other contact information of the person or persons filing the complaint or report.

- If the complaint or report is issued through a representative, the representative must include written proof that he/she is empowered to represent the persons or group of persons, communities or organizations on whose behalf he/she is acting, as well as provide the identification of the person(s) on whose behalf he/she is submitting the request.

- Clear and explicit indication if the applicant(s) wish to preserve the confidentiality of their identity and the corresponding justification, if applicable.
- The name, location and nature of the project, sub-project or AOPs that has caused or may cause adverse impacts.
- A brief explanation of the situation presented.
- A proposal of how the complaint or report could be resolved (if any, but this is an optional requirement).
- Any other information it deems relevant, including documents, media reports, photographs, videos and recordings, which may assist or facilitate the processing of the complaint or report by the GRM at the institutional level.

Procedure

Complaints and reports may be submitted in writing by mail (Francisco Sosa # 102, Santa Catarina, C.P. 04010, Coyoacán, Mexico City); by e-mail (denuncia@fmcn.org) or by telephone (55 5611 9779 and 55 3701 3801).

FMCN also receives complaints and reports as a result of monitoring procedures, such as field visits, interviews, or personal and direct observation. Complaints and reports may be submitted in writing in Spanish or in the language of the applicant(s), accompanied by a Spanish translation. Complaints and reports may be received by any member of the project's operational or administrative team, who must immediately forward them to the Internal Auditor and General Director.

Upon receipt of the complaint or report within a period not exceeding five working days, the Internal Auditor and the General Director review whether the complaint or report is eligible or not, issue an institutional response on the eligibility or ineligibility of the same and on the procedure to be followed to the person or group filing the complaint or report. The review verifies that it contains all the information required in section (vi) and that it is not clearly linked to any of the exclusions established in section (v). The eligibility determination is an element of the care process and does not represent a judgment on the merits of the complaint or report. During this process, the requesting individual(s) may be offered the opportunity to provide additional information to meet the eligibility criteria for their complaint. The Internal Auditor assigns a folio in the Register of Complaints and Reports, where she will record the data and date of receipt. The Register will be the log that will keep track of subsequent steps.

If the complaint or report is eligible, one of the following approaches will be adopted to provide a solution (see following flowchart):

1. When the complaint is minor, i.e., it does not involve the operational team and doesnot require further information, the team of directors analyzes the complaint and issues a resolution. As it is a minor complaint, a detailed action plan is not required and the area director keeps

Internal Audit informed. The maximum response time is 20 working days. If the person involved in the complaint is an area director, he/she will be separated from the analysis and resolution of the complaint.

2. When the complaint or report requires an investigation[8], the Internal Auditor prepares an investigation file, compiles the necessary documentation and conducts the interviews she deems appropriate. The Internal Auditor keeps the General Director informed. The investigation file is submitted for analysis and resolution by the IAC when the complaint or report is related to: violations of the Code of Ethics; conflict of interest; procurement disputes; situations of exploitation, abuse and sexual harassment; retaliation. The investigation file is submitted for analysis and resolution by the Board of Directors when the complaint or report has an institutional impact; when the person involved in the report is a member of a technical committee, Board of Directors or General Assembly of Associates. The Board Member and Associated Person involved in a report is separated from the process of analysis and resolution of the same. The deadline for issuing a preliminary resolution is 20 working days. A final resolution will be considered when FMCN determines an action plan with defined timeframes and deadlines. In the event that the report does not provide the basic information for the compilation of the time limit will be extended to 20 working days and will be renewable until information, documentation and evidence supporting the report is obtained. When all internal and external remedies have been exhausted and the report remains unfounded, it will be dismissed.

3. When the complaint or report involves the General Director, the Internal Auditor immediately refers the case to the Board of Directors. The deadline for issuing a preliminary resolution is 20 working days.

[8] Investigation is the integration of evidence to make a decision of significant magnitude.

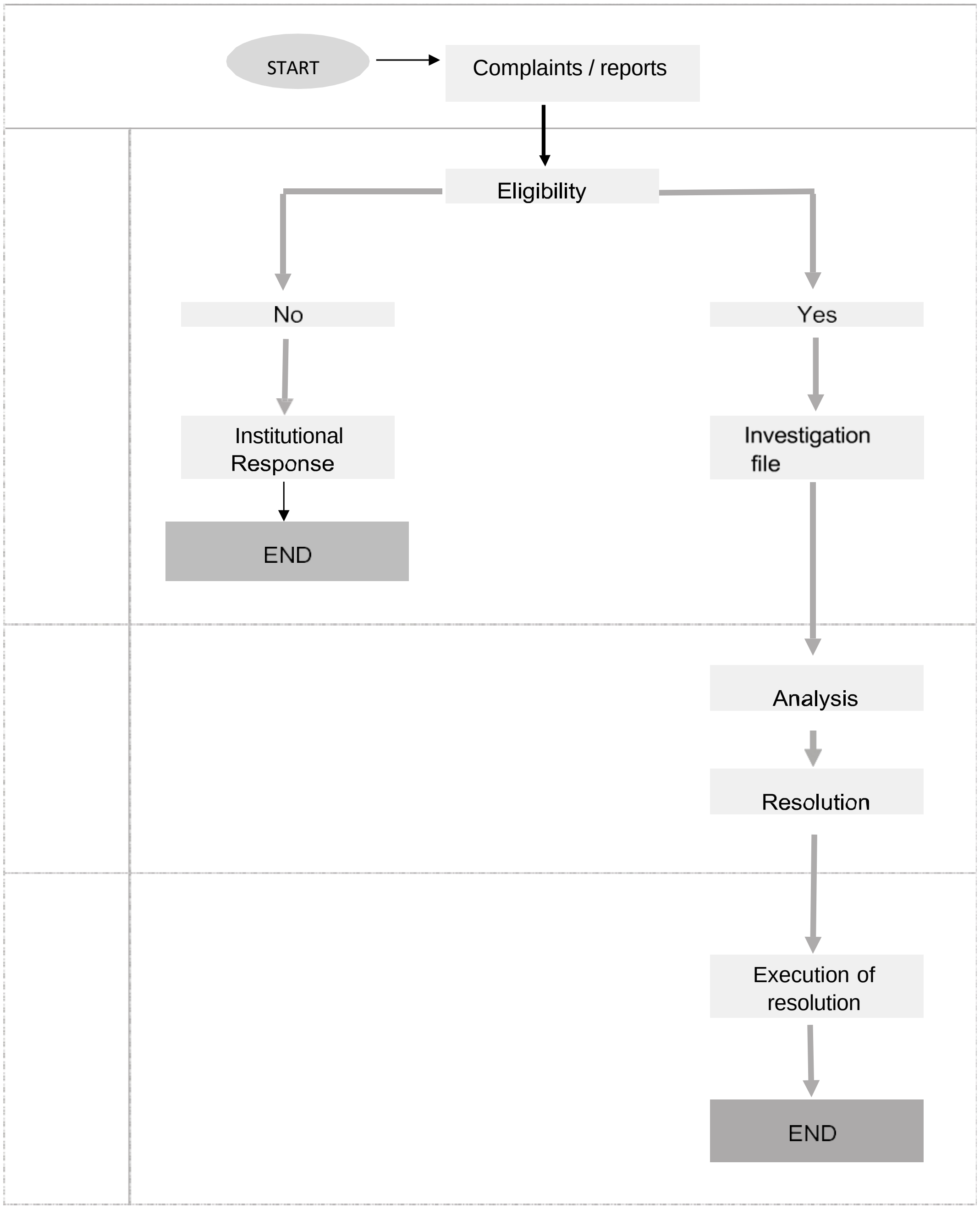


Figure 67. Figure 1. Flowchart on the operation of the GRM at the institutional level

Collegiate bodies in charge of analysis and resolution		
Team of directors	**Institutional Accompaniment Committee**	**Board of Directors**
Classification by topic to be dealt with:		

Complaint	Report related to:	Report with institutional impact
	Violations of the Code of Ethics	
	Conflict of interest	
	Acquisition disputes	
	Sexual abuse, harassment and exploitation	
	Retaliation	
Classification if the complaint or report involves the following positions regardless of thesubject matter:		
Director*	Internal Auditor	General Director
		Committee Member
		Counselor* Person
		Associated Person

**Without the person involved*

In the event that an investigation is required, the corresponding collegiate body issues a resolution and the Internal Auditor executes it, i.e., follows up on the observations, recommendations and actions to be taken, as well as the execution schedule and the persons or entities responsible for carrying it out. It also communicates the resolution to the applicant(s) within a maximum period of three working days following the final resolution. The Internal Auditor follows up and documents the execution of the resolution and closes the complaint or report file. All this documentation is included in the Register of Complaints and Reports.

When there is no joint agreement to resolve the complaint or report, the Internal Auditor may resort to an impartial body, chosen or selected by agreement with the person or persons filing the complaint or report, to investigate the facts and mediate between the parties until a settlement is reached. If efforts to resolve the complaint or report are unsuccessful or inappropriate, the Internal Auditor may terminate the process after consulting with and providing written notice to the person(s) who filed the complaint or report and informing the appropriate collegial body.

The Regional Funds will have their own mechanisms for dealing with complaints and reports, appropriate to the scale and purpose of the projects, sub-projects and POAs to which they are related, but always aligned with the GRM at the FMCN project level. The Regional Funds and partner organizations will keep the area director responsible for the project informed throughout the process, while the area director, depending on the scale and nature of the complaint or report, will seek advice from the Internal Auditor.

Evaluation

The Internal Auditor prepares an annual report on the institutional-level GRM and project-level GRM for submission to the IAC. The IAC, in turn, may request an independent review of the mechanism at any time, or every five years, which may include a detailed assessment of the institutional and project-level GRM guidelines and procedures. Based on the assessment, the IAC decides on appropriate modifications.

Inputs for the annual report come from three sources: i) the Communications Area provides statistics on consultations on general reports; ii) the team of directors provides statistics on minor complaints related to projects at the institutional and Regional Fund levels; and iii) the Internal Auditor provides statistics on reports. The information is consolidated in January for presentation at the first committee meeting.

ACCIÓN Project-level GRM

Objective

The purpose of the GRM at the project level is to provide a free, accessible, inclusive and structured procedure for receiving, evaluating and making recommendations for the resolution of complaints and reports related to the projects that FMCN finances.

Guiding Principles

The GRM at the project level must be as transparent as possible in order to contribute effectively to accountability. For this reason, it operates in parallel and independently from FMCN's Environmental and Social Management System.

The GRM respects human rights and follows national and international human rights standards, with the following guiding principles:

Accessibility	• Voluntary • Known to all stakeholders • With appropriate assistance for those who face particular barriers to access • With multiple channels: phone, email, SMS, WhatsApp, through contact with FMCN personnel or follow-up field visits.
Transparency	• Respectful of confidentiality, when necessary and requested. • Informs affected, potentially affected and other stakeholders about its operation and the handling of complaints and reports during the participatory processes. • Makes a register documenting responses to all complaints and reports received publicly available

Equity	• Fair, informed, respectful and professional treatment, in accordance with due process. • Does not restrict the right to use other available report mechanisms.
Efficiency	• Clear procedures to address complaints and reports quickly and effectively within specific timeframes • Timely response to complaints and reports
Culturally appropriate	• Relies on traditional, locally effective and credible systems for complaint resolution
Continuous learning	• Stakeholder consultation for improvement • Periodically evaluates its performance, complaint trends and the way in which results are implemented

Structure and management

The GRM at the project level is in charge of FMCN's Internal Audit, who, in collaboration with the Area Directorates in charge of project implementation, is responsible for the effective and efficient functioning of the mechanism. In the event of serious complaints or reports, the relevant Committee will oversee the activities of the project-level GRM, take appropriate action, and monitor, through its representative, the implementation of agreements reached with the individuals who made the complaints or reports. This will be done through problem-solving methods and the implementation of decisions made in response to the recommendations of the project-level GRM. If there is a conflict of interest with the relevant Committee, the complaint or report will be handled by the Institutional Support Committee.

The different areas of FMCN will cooperate with the GRM at the project level in the inquiries carried out to respond to the complaints and reports admitted.

The Regional Funds that support the execution of FMCN projects (see description in the Organizational Manual) will have their own mechanisms for handling complaints and reports, appropriate to the scale and purpose of the projects to which they are related, and will inform interested persons or groups of persons of the existence of the procedures for presenting complaints and reports. FMCN will share best practices and provide guidance to support capacity building of the Regional Funds' complaints and reports mechanisms.

Scope

The project-level GRM applies to all FMCN-funded projects and operates throughout the life cycle of the project, but it is not a court of appeals nor a legal mechanism.

The GRM at the project level receives complaints and reports from:

a. Individuals or groups of two or more individuals, communities or organizations that believe they have been or may be affected by the adverse impacts of an FMCN-funded project.

b. The legitimately authorized representative(s), provided that they submit written proof that they are authorized to represent the persons or groups of persons, communities or organizations on whose behalf they are acting.

c. Persons or entities executing projects, sub-projects or AOPs financed by FMCN.

d. Workers linked to projects, sub-projects or AOPs, regardless of their position or seniority. According to the Whistleblower Protection Policy (see Organizational Manual), whistleblowers will not receive any retaliation for their complaint or report.

e. Individuals who are members of the committees related to the projects.

f. Persons providing consulting services or goods and services related to projects, sub-projects and POA.

The person or persons filing the complaint or report may indicate whether they wish to keep their identity and the grounds for their complaint confidential. In this regard, the GRM at the project level will not supersede the judicial remedies available to the complainant.

The GRM at the project level is aligned, at all times, to FMCN's relevant operational policies, such as the Code of Ethics, Privacy Notice, Whistleblower Protection Policy, Procurement Conflict Resolution Policy, Prohibited Practices Policy, Fraud and Corruption Statement, Prevention of Money Laundering and Terrorist Financing Policy, Protection from Sexual Exploitation, Abuse and Harassment Policy, and Environmental and Social Policy, which aim to prevent, avoid and mitigate negative activities or institutional misconduct.

(i) Exclusions

The GRM at the project level does not process complaints or reports related to an FMCN-funded project, sub-project or AOP when:

a. FMCN is not responsible for the financing of the project to which the complaint is appealing;

b. the specific issues or matters have already been reviewed and concluded by the GRM in another proceeding, unless the request presents new information, material or evidence that was not available at the time the GRM previously considered the complaint or report;

c. they are unfounded;

d. they seek to gain a competitive advantage;

e. they are submitted 24 months after the closing of the project, sub-project or AOP.

(ii) Information that a complaint or report must contain (eligibility criteria)

No specific format is required to file a complaint. However, to be considered by GRM at the project level it must contain the following:

- The name, address, telephone number, e-mail address or other contact information of the person or persons filing the complaint or report.
- If the complaint or report is issued through a representative, the representative must include written proof that they are empowered to represent the persons or group of persons, communities

or organizations on whose behalf they are acting, as well as provide the identification of the person(s) on whose behalf they are submitting the request.

- Clear and explicit indication if the applicant(s) wishes to preserve the confidentiality of their identity and the corresponding justification, if applicable.
- The name, location and nature of the project, sub-project or AOP that has caused or may cause adverse impacts.
- A brief explanation of the situation presented in the project, sub-project or AOP.
- A proposal of how the complaint or report could be resolved (if any, but this is an optional requirement).
- Any other information they deem relevant, including documents, media reports, photographs, videos and recordings, which may assist or facilitate the processing of the complaint or report by the GRM at the project level.

Procedure

Complaints and reports should be addressed to FMCN's GRM and can be submitted in writing via postal mail (Francisco Sosa # 102, Santa Catarina, C.P. 04010, Coyoacán, Mexico City), by e-mail (denuncia@fmcn.org) or by telephone (55 5611 9779 and 55 3701 3801).

FMCN also receives complaints and reports as a result of supervisory procedures, such as field visits, interviews or personal and direct observation. Complaints and reports may be submitted in writing in Spanish or in the language of the applicant(s), accompanied by a Spanish translation. Complaints and reports may be received by any member of the project's operational or administrative team, who must immediately forward them to the project's Area Director.

Upon receipt of the complaint or report within five working days, the Area Director of the corresponding project, with the advice of Internal Audit, reviews whether the complaint or report is eligible or not, and informs the person or group filing the complaint or report of the acknowledgement, eligibility and the procedure to be followed. The review verifies that it contains all the information required in paragraph (vi) and that it is not clearly linked to any of the exclusions established in paragraph (v) of this section. The eligibility determination is an element of the care process and does not represent a judgment on the merits of the complaint or grievance. During this process, the applicant(s) may be offered the opportunity to provide additional information to meet the eligibility criteria of their complaint. The Internal Audit then assigns a folio in the Register of Complaints and reports, where it will record the data and date of receipt. The Register will be the log that will keep track of the subsequent steps.

If the complaint or report is eligible, one of the following approaches will be adopted to provide a solution (see Figure 5):

1. When the complaint or report is simple, does not involve the operational team and does not require further information, the Area Director proposes the solution and, together with the person(s) filing the complaint or report, decides whether the option proposed is acceptable to both parties.

Being a simple complaint or report, a detailed action plan is not required and the Area Director keeps Internal Audit informed. The maximum term for response is 20 working days.

2. When the complaint or report requires an investigation, the Area Director requests support from Internal Audit to analyze, assess the magnitude of the adverse effect, compile the necessary documentation and conduct the interviews deemed appropriate. Internal Audit will keep General Management informed. After analysis, Internal Audit issues a recommendation, which may include the issuance of an administrative report; a warning; cancellation or modification of a project, sub-project or AOP; dismissal of the person involved; escalation of the complaint or report to the Committee corresponding to the project; or presentation of the matter to the Institutional Support Committee. Where appropriate, the proposed solution for complaints or reports related to the field execution of projects, sub-projects or AOPs is made jointly with the corresponding Area Directorate, while those of an administrative nature, disputes over acquisitions and the management of financial resources related to projects, sub-projects and AOPs will additionally involve the Finance Directorate. When the complaint or allegation involves FMCN's operational or administrative team, Internal Audit carries out this process independently. In both cases, the implementation of the recommendation requires authorization from General Management in order to be considered an institutional resolution. The deadline for issuing a resolution is 20 working days.

3. When the complaint or report involves FMCN's General Management or an Area Director, Internal Audit immediately refers the case to FMCN's Institutional Support Committee or to the Board of Directors, depending on the nature of the complaint or report. The deadline for issuing a resolution is 20 working days.

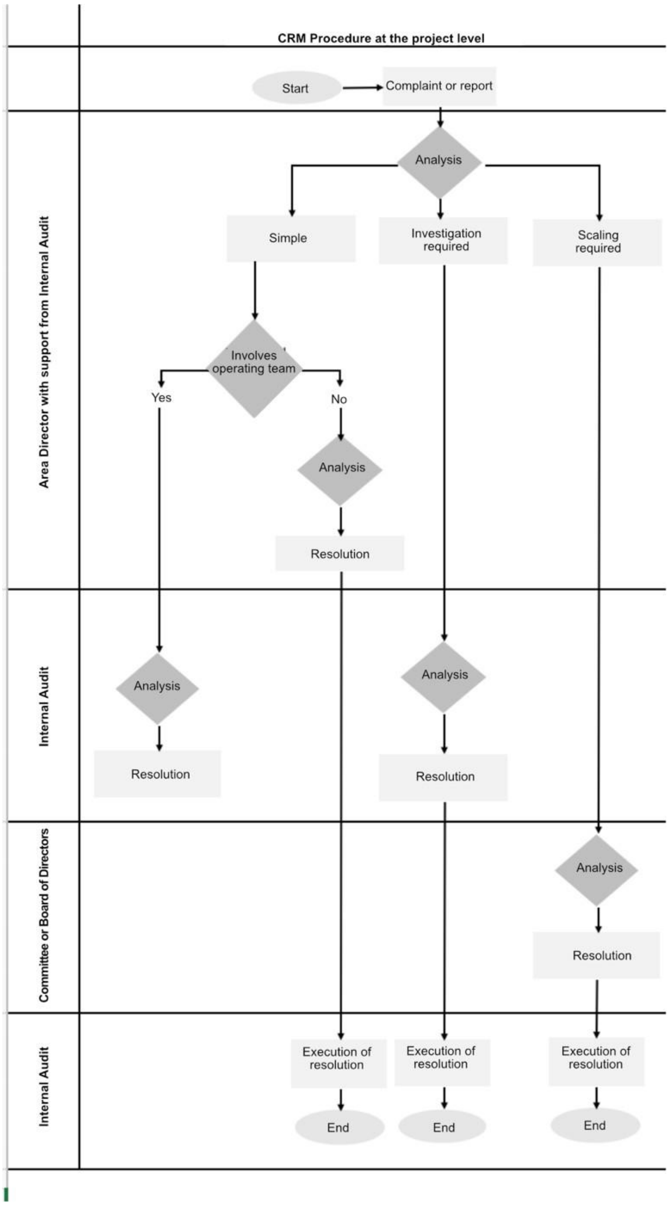


Figure 5. Flowchart on the operation of the Complaints and reports Mechanism at the project level.

In cases where an investigation is required, Internal Audit prepares an action plan to execute the resolution. This plan includes observations, recommendations, and actions to be taken, an implementation schedule, and the individuals or entities responsible for carrying it out. The resolution is communicated to the applicant(s) within a maximum period of three working days following the decision. Internal Audit monitors and documents the execution of the action plan and closes the complaint or report file. All relevant documentation is recorded in the Register of Complaints and Reports.

If a joint agreement can not be reached to resolve the complaint or report, Internal Audit may engage an impartial body selected in agreement with the person(s) filing the complaint or report. This impartial body investigates the facts and mediates between the parties until an agreement is reached. If efforts to resolve the complaint or allegation are unsuccessful or inappropriate, Internal Audit may terminate the process after consulting with and providing written notice to the complainant(s) and informing General Management, the Institutional Support Committee, and, if necessary, the Board of Directors.

The Regional Funds will have their own mechanisms for addressing complaints and reports, appropriate to the scale and purpose of the projects, sub-projects, and AOPs they are associated with, while remaining aligned with the FMCN's GRM on a project-level (see Figure 6). Throughout the process, the Area Director responsible for the project is kept informed by the Regional Funds and partner organizations. Depending on the scale and nature of the complaint or report, the Area Director may seek support from Internal Audit.

GRM assessment at a project level

Internal Audit prepares an annual assessment report on GRM's performance at the project level for presentation to the Institutional Support Committee. This Committee, in turn, may request an independent review of the Complaint Mechanism at any time, or every five years, which may include a detailed assessment of the GRM guidelines and procedures at the project level. Based on the assessment, the Institutional Support Committee decides on the pertinent modifications to the Mechanism.

Specificities for ACCIÓN project

As previously mentioned, for the ACCION project, Sureste Sostenible (SAAC), playing a crucial role in the grievance mechanism by serving as the first point of contact for receiving and handling complaints related to the project, but always aligned with the GRM at the FMCN project level. They are responsible for recording, classifying, reporting, and processing grievances, as mentioned before, SSAC supports the formulation of complaints, including providing translation for indigenous languages if needed, and investigate the validity of each grievance through interviews and dialogue with stakeholders. They prepare reports with findings and recommendations, maintain ongoing communication with the complainant, and utilize traditional community grievance mechanisms when appropriate. SSAC will keep the area director responsible for the project informed throughout the process, while the area director, depending on the scale and nature of the complaint or report, will seek advice from the Internal Auditor.

If a complaint or report requires an investigation, regardless of whether it originates at the executing or implementing entity level, the FMCN Project Director will notify the GCF Project Manager. Upon request from the GCF Project Manager, the matter may also be referred to the Independent Integrity

Unit (IIU) or the Independent Redress Mechanism (IRM), depending on the nature of the issue[9], as outlined in clause 8.02 of the AMA signed between FMCN and GCF. The case will be communicated to GCF's project manager within two working days after the investigation begins.

After FMCN has concluded the investigation and the collegiate body has issued a final resolution, it will be communicated to the person who filed the complaint or report within three working days. The resolution will be delivered using the communication channel initiated by the person who submitted the complaint or report. It will include the following statement in Spanish: "If you are not satisfied with the final resolution communicated by FMCN, you may file a complaint or report regarding the project-related environmental and social grievance to GCF's Independent Redress Mechanism at the following link: | Independent Redress Mechanism | Green Climate Fund.".

For complaints or disagreement related to irregularities committed by public servants or in contracting procedures related to public resources

For complaints or disagreement related to irregularities committed by public servants or in contracting procedures related to public resources, people will be encouraged to contact the Internal Control Body (OIC) at the Secretariat of Environment and Natural Resources (SEMARNAT) or the Secretariat of Public Function (SFP).

Internal Control Body in the Secretariat of Environment and Natural Resources

By phone: Within Mexico at 01 800 00 00 247 and in Mexico City 5490 0900 and 5490 0988

In person: At the offices of the OIC at SEMARNAT, located at Av. Ejército Nacional 223, Col. Anáhuac, Del. Miguel Hidalgo, C.P. 11320, Mexico City.

By mail: Free letter addressed to the Head of the OIC at SERMARNAT, with address at Av. Ejército Nacional 223, Col. Anáhuac, Del. Miguel Hidalgo, C.P. 11320, Mexico City.

By email: Email sent to the email addresses oic.quejas@semarnat.gob.mx or atencion.ciudadana@semarnat.gob.mx

Secretary of the Public Service

By phone: Within Mexico 01 800 11 28 700 and in Mexico City 2000 2000 and 2000 3000 extension 2164

In person: At the SFP Citizen Contact space, located at Av. Insurgentes Sur No. 1735, PB Module 3, Col. Guadalupe Inn, Del. Álvaro Obregón, C.P. 01020, Mexico City.

[9] FMCN acknowledge IIU attends complaint or report involving fraud, corruption, misconduct, or other prohibited practices, while the IRM review complaints made by individuals who feel adversely affected by the ACCIÓN project.

By mail: Free written communication addressed to the General Directorate of Complaints and Investigations of the SFP, with address at Av. Insurgentes Sur No. 1735, Floor 2, North Wing, Col. Guadalupe Inn, Del. Álvaro Obregón, C.P. 01020, Mexico City.

By mail: Email sent to the email address reclamaciones@funcionpublica.gob.mx or contactociudadano@funcionpublica.gob.mx

By chat: Contact through the chat of this system.

GRM report to GCF

The complaints in the GRM are often deeply rooted in cultural and local contexts. Addressing such matters at the local level ensures an appropriate and effective resolution. For this reason, the GRM acknowledges the importance and proportionality at different levels. Based on this FMCN GRM, under ACCIÓN project:

1. Complaints and reports received by the co-executing entity or those submitted through the executing entity's GRM (in this case, Sureste Sostenible GRM) will be shared with FMCN in the project reports from SSAC-FMCN. They will also be shared in the annual project report from FMCN to GCF.

2. Project and institutional complaints and reports presented through FMCN's GRM will be shared in the annual project report from FMCN to GCF.

3. If a complaint or report requires an investigation (independent of whether it occurs at the executing or implementing entity level), the FMCN project director will inform GCF's project manager and—if requested by the GCF project manager—the Independent Integrity Unit or the Independent Redress Mechanism, depending on the issue concerned (as agreed in clause 8.02 of the AMA signed between FMCN and GCF). Communication of the case to GCF's project manager will take place less than two working days after the investigation begins.

Once a resolution is agreed upon and the complaint or report is attended to, the FMCN project director will send a final report to the agreed area from GCF: GCF's project manager, Independent Integrity Unit, or the Independent Redress Mechanism. FMCN will be available for any additional information GCF requests concerning the case.

FMCN believes this will contribute to a direct and clear mechanism in the territory for concerns or inquiries related to daily operations and more efficient attention to the complaint or report received.

V. References

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ANNEX A. Complementary projects and synergies with ACCIÓN

Project	Lead Organization	Donor	Participating Organizations	Starting Year	Countries	States	Area of Influence	Description	Focus	Type of Ecosystem (Marine, Land, Both)	ACCIÓN Synergies	ACCIÓN Outcomes	Source
Conservation of Maritime Resources in Central America III	MAR Fund	KfW		2015	Mexico, Belize, Honduras, Guatemala	Quintana Roo	Manatee Sanctuary State Reserve, Bahía Chetumal, Mexico	To pursue the conservation and sustainable use of natural resources in and between the selected Marine-Coastal Protected Areas (APMC) of the MRS, focusing on the consolidation of marine and coastal protected areas, the protection of biological diversity, the sustainable use of their components, the promotion of economic well-being, and the improvement of the quality of life for resident populations.	Conservation	Marine	Lessons Learned	2, 4	https://marfund.org/es/conservacion-recursos-Marines/#AnnualWorksPhaseII

Forest Biomes	IUCN	GEF		2024	Mexico, Guatemala, El Salvador, Nicaragua Honduras, Panamá		Selva Maya	To conserve the primary forests of Mesoamerica through the strengthening of governance, protection, restoration, regional cooperation, and the mobilization of stable long-term financing, ensuring a sustainable flow of ecosystem services for people and the planet.	Conservation	Land	Lessons Learned	4	https://iucn.org/es/articulo/202309/la-huella-de-mesoamerica-en-la-7a-asamblea-del-gef-en-ruta-para-proteger-los-biomas
DGM For Indigenous People and Local Communities	Rainforest Alliance	World Bank	CIF	2017	Mexico	Campeche, Jalisco, Quintana Roo, Oaxaca, Yucatán		To combat the causes of deforestation and degradation, while also ensuring the livelihoods of the people who depend on the forests.	Conservation	Land	Lessons Learned	1, 4	https://www.mde-mexico.org/
FOMAFUR	FMCN	US Forest Service	CONANP, CONAFOR, UNAM, U Autónoma Chapingo,	2004	Mexico	Various		To ensure the continuity of fire management activities through the allocation of a permanent fund.	Conservation	Land	Lessons Learned	4	https://fmcn.org/es/proyectos/manejo-de-fuego

			Uni de Guadalajara										
FANP	FMCN	GEF, World Bank, Ford Foundation, Gonzalo Río Arronte Foundation	CONANP, Pronatura Yucatán Peninsula, Fonnor, Golf of Mexico Fund, and others	1997	Mexico	Various	Yucatán Peninsula and others	To support the efficient use of financial resources channeled to Mexico's protected natural areas (ANP) to strengthen their operation, management, and ensure the long-term conservation of representative ecosystems.	Capacity Development	Both	Lessons Learned	4	https://fmcn.org/es/proyectos/fanp
From Bait to Plate	WWF	GEF, GIZ, KfW	FAO, CONANP, CONAPESCA	2021	Mexico	Nayarit, Quintana Roo, Baja California Sur		To ensure the conservation of marine ecosystems and biodiversity and secure the sustainable livelihoods of fishing communities through innovative co-management approaches in three priority marine landscapes.	Biodiversity	Marine	Lessons Learned	2, 4	https://www.fao.org/environmental-social-safeguards/project-detail/from-bait-to-plate--strengthening-sustainable-fisheries-to-safeguard

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ADAPTUR	GIZ	BMUV	AMEXCID, CONANP, INECC, IKI, KfW	2017	Mexico	Jalisco, Quinatna Roo, Guanajuato	Rivera Maya, San Migue de Allende, Rivera Nayarit	To reduce business risks for tourism companies and protect their natural assets.	Ecotourism	Both	Lessons Learned	4	https://adaptur.mx/
Smart Coasts	WWF	IKI	CONANP, CZMAI, MARN, KfW	2018	Mexico, Belize, Guatemala, Honduras	Yucatán, Quintana Roo	Ría Lagartos Biosphere Reserve (Yucatán) and Yum Balám Protected Area of Flora and Fauna; Belize, the Northern Regional Planning Zone, the Ambergris Caye Regional Planning Zone, and the Southern Regional	Seeks to establish "climate-smart" principles in the management of marine protected areas and coastal development policies in the countries of the Mesoamerican Reef System, with the aim of enhancing the adaptive capacities of coastal communities in the region.	Capacity Development	Marine	Lessons Learned	4	https://iki-alliance.mx/portafolio/costas-listas/

							Planning Zone; Guatemala, the Río Sarstún Multiple Use Area; Honduras, the focus will be on four protected areas: Cuyamel-Omoa National Park, Jeannette Kawas National Park (Punta Sal), and Punta Izopo National Park						
Forest Legality and Transparency Strategy	US Forest Service	USAID	CONAFOR		Mexico			The strategy includes implementing a set of practical actions to support the Government of Mexico in strengthening its control and monitoring	Capacity Development	Land	Lessons Learned	4	https://usfsmex.org/img/pdf/fact_sheet_estrategia_de_legalidad_y_transparencia_for

								instruments for forest exploitation authorizations, as well as its inspection and surveillance efforts.					estal_WEB.pdf
FINANP	IUCN Phase 1; FMCN Phase 2	KfW	CONANP, IUCN	2021	Mexico	Baja California Sur, Quintana Roo	Reserva de la Biosfera Islas del Pacífico de la Península de Baja California, Parque Nacional Revillagigedo, Reserva de la Biosfera Caribe Mexicano	Aims for the included protected natural areas (ANP) to have effective management and to strengthen their connectivity strategy and sustainable financing.	Conservation	Both	Lessons Learned	4	https://fmcn.org/es/proyectos/finanp
Resilience	CONANP	GEF	UNDP	2014	Mexico	Various		To reduce the direct and indirect adverse impacts of climate change on globally significant biodiversity and human communities.	Biodiversity	Both	Lessons Learned	4	https://www.gob.mx/conanp/documentos/proyecto-resiliencia?state=published

Mangrove Conservation	WWF	Bezos Earth Fund		2021	Mexico	Nayarit, Yucatán, Quintana Roo	Marismas Nacionales, in Nayarit; the Río Lagartos Biosphere Reserve and the Dzilam State Reserve, in Yucatán; as well as the Yum Balam Flora and Fauna Protection Area, in Quintana Roo.	Seeks to strengthen and consolidate regional and national efforts for the conservation and restoration of mangroves, which, according to the National Commission for the Knowledge and Use of Biodiversity (Conabio), cover 905,086 hectares of coastline.	Mangroves	Both	Lessons Learned	1, 2, 4	https://www.wwf.org.mx/?368191/WWF-y-Bezos-Earth-Fund-se-unen-para-proteger-los-manglares-de-Mexico#:~:text=WWF%20y%20Bezos%20Earth%20Fund,los%20manglares%20de%20M%C3%A9xico%20%7C%20WWF&text=La%20colaboraci%C3%B3n%20beneficiar%C3%A1%20a%20miles,Nayarit%2C%2

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													0Yucat%C3%A1n%20y%20Quintana%20Roo.
MAR2R	WWF	GEF	CCAD	2014	Belize, Guatemala, Honduras, Mexico	Quintana Roo, Yucatán	Mesoamerican Reef System	To support regional collaboration for integrated management from the ridge to the reef of the transboundary Mesoamerican Reef, demonstrating its benefits and enhancing regional, national, and local capacities for integrated management and governance of its freshwater, coastal, and marine resources.	Coral	Marine	Lessons Learned	4	https://www.thegef.org/projects-operations/projects/5765

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Maya Forest	TNC	TNC			Mexico, Belize	Quintana Roo	Yucatán Peninsula (Chetumal)	To work with all sectors at the local, state, and national levels to promote sustainable practices in key areas such as agriculture, livestock, and forestry, as well as to help implement science-based conservation actions. The Mexico-REDD Alliance in the Yucatán Peninsula for regional management of the Maya Forest; influencing policies and practices to promote natural solutions to climate change, focused on reducing emissions from deforestation and degradation; promoting sustainable production and green growth in	Conser vation	Land	Lessons Learned	4	https://www.nature.org/es-us/sobre-tnc/donde-trabajamos/tnc-en-latinoamerica/mexico/selva-maya/selva-maya-como-trabajamos/

								agriculture, forestry, silvopastoral livestock, and agroforestry; and working with local communities to enhance improved practices and conserve their natural resources.					
Monitoring and Reporting System for Projects in the Maya Forest	WWF	GIZ, BMUV	CONANP, CONABIO, CCAD, KfW, WCS	2016	Mexico	Quintana Roo	Selva Maya	To ensure that the results of biological diversity and climate change monitoring in the Maya Forest, agreed upon at the regional level, are increasingly integrated into political decision-making processes.	Capacity Development	Land	Lessons Learned	4	https://selvamaya.info/proyecto-monitoreo/
Marine Conservation Program	Biodiversity Funders Group			2019	Mexico			To ensure lessons learned and collaboration among foundations with programs that support coastal marine conservation work in Mexico, providing	Conservation	Marine	Aligned Finance	1, 4	https://biodiversityfunders.org/programs/mexico-conservation/

								opportunities to share information, engage in dialogue, and develop complementary grant-making strategies.					
RAÍCES	WWF	Bezos Earth Fund, WWF	PNUD, Governments of Yucatán and Nayarit	2023	Mexico	Nayarit, Yucatán	Tizimín, San Felipe, Río Lagartos, and Dzilam de Bravo in Yucatán; Lázaro Cárdenas in Quintana Roo; Tecuala, Tuxpan, Rosamorada, Acaponeta, and Santiago Ixcuintla in Nayarit.	Seeks to protect, restore, and strengthen the management of 2.47 million acres (around one million hectares) of mangroves, thereby safeguarding an estimated 2 billion tons of carbon and protecting 300,000 people who live alongside these coastal forests.	Mangroves	Both	Aligned Finance	3, 4	https://www.undp.org/es/mexico/noticias/programa-de-wwf-y-pnud-mexico-le-permitira-municipios-costeros-de-la-peninsula-de-yucatan-actuar-frente-al-cambio-climatico

Mexican Alliance of Blue Carbon			CINVESTAV-IPN, Unidad Mérida, CEMDA, COSTASALVAJE, FMCN Pronatura Sur, TNC, Sureste Sostenible		Mexico			Aims to strengthen inter-institutional and public-private collaboration for the development of a national Blue Carbon initiative. It is built on four pillars: a) Environmental policy, b) Financing schemes, c) Science, and d) Territorial management.	Blue Carbon	Marine	Scale-up	1, 3	https://fmcn.org/es/noticia/ciencia-y-conservacion-del-carbono-azul-en-norte-america-un-taller-trinacional-de-expertos
Climate Risk and Resilience Initiative	TNC	TNC y Government of Quintana Roo	MAR Fund, CINVESTAV, INAPESCA, UNAM, SEMA, CONANP	2018	Mexico	Quitana Roo	Sian Ka'an	Seeks to integrate the use of natural systems for coastal protection as a cost-effective solution.	Corals	Marine	Aligned Finance	2, 4	
Surges	Palladium Group	USAID		2022	Mexico	Campeche, Chiapas, Oaxaca, Quintana Roo, Tabasco, Yucatán, Veracruz		Aims to strengthen market systems to increase investment in sustainable productive and natural ecosystems, boost employment, and expand sales for	Employment and Sustainability	Both	Aligned Finance	4	https://pdf.usaid.gov/pdf_docs/PA0211NW.pdf

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								producers in southern and southeastern Mexico.					
Sustainable Landscapes Ventures	CI	USAID	Minkadev, CI Ventures, SVXMX, El buen socio y Kotiva	2020	Mexico	Yucatán, Quinatna Roo, Campeche, Oaxaca, Chiapas	Calakmul, Sierra Madre, Sierra Sur	Aims to increase the hectares under sustainable and profitable productive systems with access to markets, contributing to reducing deforestation and greenhouse gas emissions, as well as improving the livelihoods of producers.	Value Chains	Land	Aligned Finance	3	https://www.conservation.org/mexico/emprendimientos
Small Grant Program	PNUD	GEF	FMCN currently presides over the board	2019	Mexico	Península de Yucatán, Chiapas, Tabasco		To promote community participation in solving global environmental problems and improving the quality of life in the communities where it operates, through legally recognized organizations.	Agriculture	Both	Aligned Finance	1, 4	https://www.ppdmexico.org/

MAR+ Invest	MAR Fund	GFCR	New Ventures, Healthy Reefs, Mar Leadership, FMCN, Sureste Sostenible	2022	Mexico, Belize, Honduras y Guatemala	Varios		A financing and business development mechanism that supports the conservation, protection, and restoration of coral reefs and associated ecosystems by developing and financing commercially viable projects that generate positive outcomes for coral reefs.	Coral	Marine	Aligned Finance	3	https://mar-invest.org/es/
Yucatán Vive	WWF	WWF	Government of Yucatán, Municipality of Mérida, Pronatura Yucatán Peninsula, The Nature Conservancy, Biofin		Mexico	Yucatán	San Juan Bautista Tabi, Kabah, Lagunas de Yalahau, Dzilam de Bravo, El Palmar, Ciénegas y Manglares de la Costa Norte de Yucatán, Biocultural del Puuc, Anillo de Cenotes,	To strengthen effective management, equitable governance, and secure perpetual financing for more than 500,000 hectares of protected natural areas, contributing to sustainable and resilient livelihoods for the communities living in these areas.	Conservation	Both	Aligned Finance	1, 3, 4	https://www.yucatan.gob.mx/saladeprensa/ver_nota.php?id=7600

							Ich Kool Blamtún, and Cuxtal, of municipal character, as well as the El Zapotal Reserve and others						
Project Mapping	Claudia and Roberto Hernandez Foundation	Claudia and Roberto Hernandez Foundation			Mexico		Yucatán Peninsula				Aligned Finance	4	
Emblematic Landscape Restoration	CI	MasterCard	WRI	2022	Mexico	Oaxaca, Chiapas	Sierra Sur and Istmo, Oaxaca; Sierra Madre, Chiapas; South Pacific Coast, Oaxaca-Chiapas	Seeks to implement restoration actions that contribute to increasing socio-environmental resilience and strengthening local environmental governance for the conservation of biological and productive diversity, the reduction of emissions from	Conservation	Land	Aligned Finance	1, 3	https://www.conservation.org/mexico/restauracion

								deforestation, and the maintenance of biological connectivity.					
Reef Rescue Initiative	MAR Fund, CCAD	KfW	FMCN, ORRAA, InsuResilience	2017	Mexico, Belize, Guatemala, Honduras	Quintana Roo	Mesoamerican Reef System	Seeks to increase the resilience and recovery capacity of the Mesoamerican Reef and the environmental and cultural services it provides.	Coral	Marine	Co-finance	2, 4	https://marfund.org/es/iniciativa-rescate-sam/
RE3CO	WRI	HSBC	PPD	2021	Mexico	Yucatán, Campeche, Tabasco, Oaxaca	Sisal, Yucatán; Isla Arena, Isla Aguada, Sabancuy, San Antonio Cárdenas, Isla del Carmen, Campeche; Centla, Tabasco; San Isidro Bajos del Palmar and Chacahua, Oaxaca	Seeks to integrate community development with the restoration of mangrove ecosystems, demonstrating that environmental protection and economic development can not only coexist but also mutually strengthen each other.	Mangroves	Both	Aligned Finance	1, 4	https://es.wri.org/proyectos/re3co-restauracion-y-conservacion-de-humedales-costeros-y-desarrollo-comunitario

Sustainable Landscapes	Conservation International (CI)	GEF	CONANP		Mexico	Oaxaca, Chiapas	Sierra Sur and Istmo, Oaxaca; Sierra Madre, Chiapas; South Pacific Coast, Oaxaca-Chiapas	To strengthen the conservation of globally significant biodiversity within the national system of protected areas and corridors, through the integrated management of culturally diverse coastal and terrestrial landscapes in Oaxaca and Chiapas.	Conservation	Land	Aligned Finance	2	https://www.conservation.org/mexico/proyectos/paisajes-sostenibles
Building Coastal Resilience	The Ocean Foundation	IDB	WRI	2021	Mexico, Belize, Guatemala, Honduras		Yucatán Peninsula	Aims to estimate the economic value of ecosystem services provided by coral reefs in Mexico, Belize, Guatemala, and Honduras, as well as to explain the importance of conserving the Mesoamerican Reef (MAR) to better inform decision-makers.	Coral	Marine	Aligned Finance	3, 4	https://oceanfdn.org/presentation-of-the-results-economic-valuation-of-the-ecosystem-services-of-the-mesoamerican-reef-system/

Sustainable Prosperous Communities	TNC	USAID	Technoserve, Nuup, Findeca, Dalberg	2023	Mexico	Campeche, Yucatán, Quintana Roo, Chiapas, Oaxaca	Yucatán Peninsula, Sierra Madre, Selva Lacandona, Sierra Sur	Seeks to increase the area under sustainable and profitable productive systems with access to markets in southern Mexico, contributing to reducing deforestation and greenhouse gas emissions, as well as improving the livelihoods of producers and promoters of community-based nature tourism.	Sustainable Markets	Land	Aligned Finance	2	https://www.tncmx.org/sobre-tnc-mx/comunidades-prosperas-y-sostenibles/
Climate Action and Blue Finance	IUCN	GCF	MAR Fund, Sureste Sostenible, FMCN	2022	Mexico, Belize, Guatemala, Honduras		Yucatán Peninsula, Mesoamerican Reef System	The project will build resilience and reduce vulnerability to the impacts of climate change on the ecosystems and communities of the Mesoamerican Reef (MAR) by transforming policy and financial sectors into more resilient ones.	Coral	Both	Aligned Finance	1, 2, 3, 4	https://www.greenclimate.fund/document/climate-action-and-blue-finance-mesoamerican-reef-system

Kaanbal Suut	Sureste Sostenible	FMCN, The David and Lucile Packard Foundation	FMCN	2021	Mexico	Quinatna Roo, Yucatán	Yucatán Peninsula	Seeks to strengthen the capacities, leadership, and networking opportunities of organized civil society groups in the Yucatán Peninsula to enhance the reach of their projects, thereby advancing the impact on conservation and the sustainability of natural resources in the region.	Capacity Development	Both	Scale-Up	1, 4	https://kaanbalsuut.mx/
L-SAM	Sureste Sostenible	The Summit Foundation, MAR Fund, FMCN	GlobalGiving, Marisla Foundations, Oak Hill Fund	2010	Mexico, Belize, Guatemala, Honduras	Quinatna Roo, Yucatán	Yucatán Peninsula	It seeks to develop young talent in the four countries of the Mesoamerican Reef System (MAR): Mexico, Belize, Honduras, and Guatemala, by providing technical skills, leadership abilities, and networking opportunities to launch conservation	Capacity Development	Both	Scale-Up	4	https://fmcn.org/es/proyectos/liderazgo-en-el-sistema-arrecifal-mesoamericano-lsam

								projects and promote the sustainable use of marine and coastal resources.					
MEx30x30	FMCN	GEF	CI, CONANP	2025	Mexico	Campeche, Nayarit, Chihuahua, Yucatán, Guerrero	Balam-Ku, Campeche; Riego 043, Nayarit; Papigochic, Chihuahua; Bajos del Norte, Yucatán; Tecuani, Guerrero	The MEx30x30 project aims to help Mexico progress toward the 30x30 target of the Global Biodiversity Framework by securing long-term sustainable financing for existing national protected areas (ANP).	Capacity Development	Both	Scale-Up	2, 4	https://fmcn.org/es/proyectos/mex30x30
Alliance for the YP	TNC		FMCN, WWF, Pronatura, Sureste Sostenible, Amigos de Sian Ka'an	2022	Mexico		Yucatán Peninsula	Coordinate efforts to align interests and scale up what already exists.	Capacity Development	Both	Scale-Up	4	
Kanan Kay Alliance	Sureste Sostenible	David and Lucile Packard Foundation	FMCN, Claudia and Roberto Hernández Foundation, The Walton	2011	Mexico	Quintana Roo, Yucatán	Yucatán Peninsula	Seeks to strengthen responsible fisheries management to restore the biological wealth and productivity of small-scale	Aquaculture	Marine	Scale-Up	1, 4	https://fmcn.org/es/proyectos/alianza-kanan-kay#:~:text=La%20Alianza

			Family Foundati on					fisheries in the Yucatán Peninsula.					%20Kana n%20Kay %20busc a,compar tidas%20 a%20trav %C3%A9 s%20de %20ZRP.
KALAN		USAID	FMCN, CONANP	2025	Mexico			This project aims to contribute to the conservation of 30% of Mexico's territory by 2030 through the effective management of federal, state, and voluntary protected natural areas in southeastern Mexico, and to strengthen the FMCN institutionally to scale its impact.	Conser vation		Co-finance	2	
Proyectos del Base de Datos que no estuvieron en el PPT													

Taab Ché	Resiliencia Azul	The Ocean Foundation	UNAM-ENES y PMC		Mexico	Quintana Roo	Yum Balam Flora and Fauna Protection Area and the Natural Areas of Cozumel Island	To support and advise the carbon credit certification process	Blue Carbon	Marine	Aligned Finance		https://resilienciaazul.org/taab-che/
Blue Carbon	Resiliencia Azul	MAR Fund, FMCN	CINVESTAV-UNAM-PMC		Mexico	Quintana Roo		Implementing conservation and restoration of mangroves to be part of the carbon voluntary market.	Mangroves	Marine	Lessons Learned		https://www.facebook.com/10871619096433/videos/3235860229796222
Conservation and Sustainable Use of Biological Diversity in Priority Landscapes of Oaxaca and Chiapas	Conservation International (CI)	GEF	National Commission of Natural Protected Areas (CONANP)		Mexico	Oaxaca, Chiapas		Strengthening the conservation of globally significant biodiversity in the national system of protected areas and corridors, through integrated management of culturally diverse coastal and Land landscapes of Oaxaca and Chiapas, Mexico	Biodiversity	Both			

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Mexican Caribbean: Conservation and sustainable use of marine biodiversity in the Mexican Caribbean	GIZ	KFW	CONANP, AMEXID		Mexico			Improve cooperation between government, private sector, and civil society actors for the conservation and sustainable use of marine biodiversity in the Mexican Caribbean, by strengthening the management capacity of CONANP, governance based on territorial planning, the execution of model projects, and promoting the value of ecosystem services in political planning	Conservation	Marine	Lessons Learned		
Mexico Conservation Grantmaking Analysis Platform	Mexico Conservation Funders	Mexico Conservation Funders			Mexico			Generating the information that contributes to a better understanding of the funding ecosystem for coastal-marine conservation in Mexico. The	Coastal Ecosystems	Marine	Lessons Learned		https://app.powerbi.com/groups/64afeeeb-421e-43e5-bd88-0d7eb9deb684/re

								analysis of the data can be useful for the following purposes: i) Identifying partnership and leverage opportunities, ii) Communicating funding landscape to Boards and management, iii) Understanding funding trends, when this process is conducted on an annual basis, and iv) Identifying opportunities and priorities to strengthen the data and analyses.					ports/5733d7f2-1cc9-48c5-a749-d7d8e9516db0/ReportSection6cf43d5c918e12275b01
Partnership for Net zero Cities	RTI	USAID			Mexico		Mérida, Mexico City, Nuevo León, Sonora	Support Mexico's work to achieve its goal of net-zero emissions by 2050.		Land			https://www.rti.org/impact/supporting-mexicos-net-zero-emissions-goals-through-climate-smart-actions

ANNEX B. Results on the Assessment and Design of Insurance Mechanisms for Coastal Ecosystems

Introduction

As part of FMCN's ACCION project, WTW was selected to evaluate the feasibility of insurance
concepts for ecosystems and communities in the Yucatán Peninsula

(YP).The ecosystems and communities include:

1. Coral Reefs
2. Small-scale fishers and aquaculture/mariculture producers
3. Mangroves

This report aims to highlight key findings of each concept, any gaps or challenges faced in analysis and what FMCN could consider when submitting a full-scale funding proposal to the GCF. Additional details and references can be found in the individual Component reports submitted to FMCN separately from this final report.

' Conservation and Restoration

Coral Reefs

For the coral reefs component, the scope of work was: evaluate the feasibility of expanding the MARInsurance Programme to protect coral reefs in Campeche and Yucatán and recommend next steps for FMCN to consider for supporting the conservation of these ecosystems. The four sites included in the analysis were informed by Consultancy 1.1.2, namely two reef areas in Campeche Bank (in Campeche) and two reef areas in Campeche Bank (in Yucatán).

Key findings on coral reefs

WTW conducted a hurricane wind risk assessment on four sites in the YP (informed by Consultancy 1.1.2 and validated by FMCN) and applied a parametric structure (see Figure 1) to identify how manytimes a possible product would have paid out (also known as how many events would have triggered).

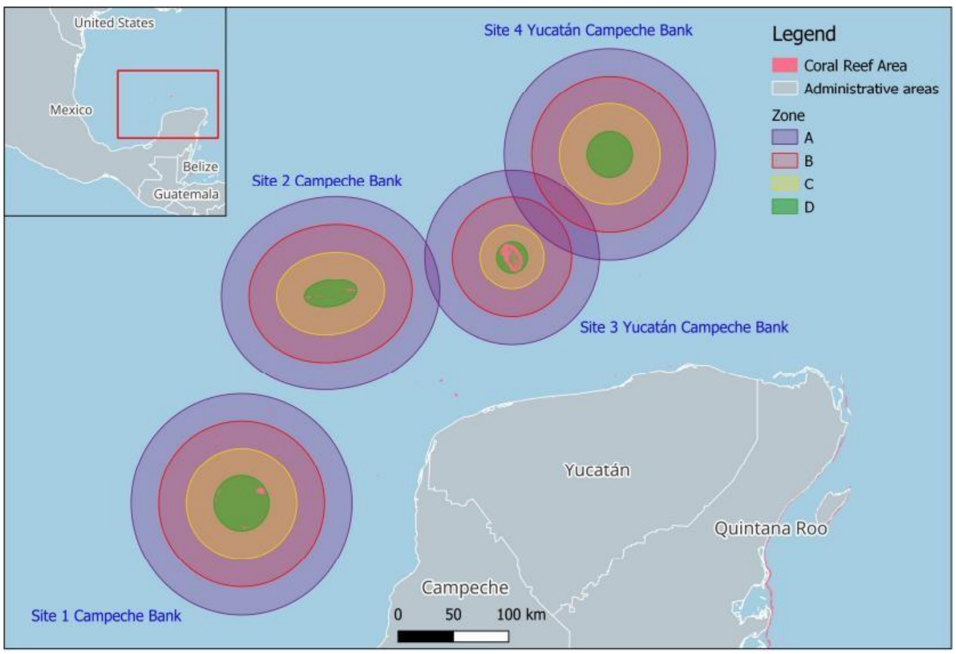


Figure 1. A visual representation of what the Cat-in-Nested-Circles parametric structure lookslike across the four sites in the YP where each circle represents 25km from the coral reefs to track hurricane damage and capture potential pay-outs.

Source: WTW (2023)

Both the average number of triggering events per site between 1900-2022 (where Campeche's was 4.5 and Yucatán's was 0.75) and the annual average pay-out rate per site based on full history of 1900-2022 (Campeche's was 0.45% and Yucatán's was 0.16%) are considerably lower than the averages for the MAR Insurance Programme (respectively, at 8.4 and 4.74%).

- Even when taking into account changes in future hurricane risk due to climate change, the risk remains minimal.

- No site would have paid out more than 40% in the full history since 1900.

Conclusion: The level of hurricane risk in Campeche and Yucatán is minimal and therefore it wouldbe hard to justify expansion of the MAR IP to Campeche and Yucatán.

The reefs in Campeche and Yucatán are composed of corals with low vulnerability to hurricane-associated damage so post-hurricane debris removal is not suitable for these selected reef sites. A previous consultancy on coral reef vulnerability under the ACCION project notes that shoreline protection value of reefs in Campeche and Yucatán is negligible compared to Quintana Roo (reefs are farther out and patchier) therefore the economic benefits of restoring Campeche and Yucatán'sreefs are not matched with QR.

The same consultancy on coral reef vulnerability found in a survey that the main perceived threats to Campeche and Yucatán reefs were thermal stress (coral bleaching) and overfishing. This Consultancy also identified that the corals in Campeche are particularly vulnerable to coral bleaching.

Conclusion: Post-hurricane reef restoration in Campeche and Yucatán would have limited economicand ecological benefits if a hurricane causes reef damage. Also given prioritisation of reef threats, itis unlikely there would be a strong demand for hurricane coral reef insurance at this time.

Although the MAR Fund is the currently policyholder for the MAR IP, results from the discussion conclude that Yucatán and Campeche fall outside of their geographical mandate (see Figure 2). TheMAR Fund is also based out of Guatemala with no legal ability to operate in Mexico or employ any staff there (currently any work conducted by MAR Fund outside Guatemala is through project partners). There is a lack of capacity in Campeche and Yucatán regarding documented reef restoration projects as well as trained brigades to undertake rapid response efforts.

Figure 2. The Mesoamerican Reef Ecosystem and MAR Fund's geographical scope of work shaded in grey, which shows Campeche and Yucatán outside of MAR Fund's jurisdiction.

Source: WTW (2023)

Conclusion: MAR Fund would not be able to take on the policyholder role but, should a parametricinsurance programme be designed for the YP, MAR Fund would be well-positioned to advise local partners and a to-be-identified policyholder.

Conclusion

For the following reasons, we find it not feasible to expand the MAR Insurance Programme to include Campeche and Yucatán:

- Low hurricane wind risk.
- Lack of coral species and composition that would benefit from post-hurricane reef restoration activities as undertaken in the MAR IP.
- Uncertain demand for hurricane coral reef insurance in Campeche and Yucatán.

Next Steps

Should FMCN wish to continue exploring a **parametric insurance solution to support coral reefs inCampeche and Yucatán**, possible avenues for future research could include:

- Further analysis on coral bleaching and whether a product that responds to the hazard of marine heatwaves could be feasible.
- Further analysis on whether MPAs in the YP would benefit from a parametric product (e.g.,to protect against business interruption from lack of tourism revenue after an event).
- Further research on avenues through which a parametric insurance product could help reduce overfishing.
- Maintaining strong relationships with local partners in Campeche and Yucatán that aim to build the technical capacity of coastal populations and/or community-based organizations that seek to restore and conserve the reef ecosystems.

As found in WTW's final report, should FMCN pursue the development of alternative parametric insurance products designed to better meet the needs of the reefs around Campeche and Yucatán,particularly when drafting a GCF funding proposal, we propose the following activities be included:

Table 1. Suggested activities to consider when developing alternative parametric products*

Component	Tas k
1. Engagement, Capacity Buildingand Enabling Environment	1. Stakeholder Engagement
	2. Awareness-raising and training with reef beneficiaries and users
	3. Review of regulatory landscape and insurance market; engagement withinsurers
	4. Site and hazard selection based on 1.1 and desk-based analysis
2. Product Developme nt	1. Data collection based on 1.4
	2. Response plan and costing
	3. Insurance product design and structuring
	4. Insurance product pricing
	5. Follow-up engagement to inform final product option
3. Operationalisation	1. Identification of policyholder
	2. Design of pay-out distribution protocols
	3. Development of long-term premium financing strategy
	4. Proof-of-concept insurance product marketing and placement

** Note: these components/tasks are not necessarily sequential.*

For the **small-scale producers** component, the scope of work was: evaluate the feasibility of developing insurance product(s) for small-scale producers on the coasts of the Yucatán Peninsula within the fisheries, aquaculture and mariculture sectors. The sites included in the analysis are:

- Aguada Island, Campeche
- Celestún, Yucatán
- Punta Allen, Quintana Roo

III.1. Key findings on small-scale producers

There are limited risk financing instruments available to SSPs within the sectors of interest including: micro-insurance (life), lines of micro-credit, parametric agriculture insurance, government social protection programs and sovereign disaster risk funds (combined catastrophe bonds and insurance).Of those available, none are explicitly designed to mitigate the negative impacts of climate hazards,though some have the potential of doing so. None actively target vulnerability to climate-related hazards or adequately address women and vulnerable groups' unique needs.

Conclusion: To-date, there are no active risk financing instruments available to small-scale producers in Mexico within the fisheries, aquaculture and mariculture sectors that effectively address vulnerability from climate-related hazards. However, there is a demonstrated need and potential for such a product.

After discussions with FMCN, Sureste Sostenible, numerous fisheries experts and academics, and through surveys with fishing associations convened by Alianza Kanan Kay (AKK), it became apparentthat inclement weather is a strong driver of lost income for fishers across the Yucatán Peninsula. This loss of income due to prolonged periods of bad weather for many fishers who rely regularly onmulti-species fishing (such as red octopus, lobster, grouper, sea cucumber and snapper) is a major hurdle amplified by the impacts of climate change and anthropogenic pressures. Developing a parametric product requires a hydrometeorological hazard threshold, but multiple species have unique characteristics that are not uniform to develop one trigger (for example, reproductive performance, seasonality, etc.). We therefore propose a parametric product focusing on **the ability of fishers to fish safely** rather than hydrometeorological impacts on a particular species.

Conclusion: Validated through interviews and academic literature, the relevant hazards faced by fisherfolk which directly impact a fisher's ability to fish are high winds, significant waves and / or rainfall, which together contribute to low visibility and unstable conditions.

WTW has experience with demonstrating feasibility of risk financing products that respond to bad weather periods from our work in the Philippines, Indonesia and Honduras. By monitoring wind, wave height and rainfall (parameters), it is possible to identify periods that a fisher faces

Multiple days of bad weather in a row, and consequently resulting in income loss. A risk financing product that protects against and pays out for this would make up for lost income from not fishing in unsafeweather.

Using ERA5 – a data source that is publicly available, internationally recognized and accepted by riskmarkets – using this historically-available data, we created an index that captures the three parameters that represent bad weather and sea conditions that may impact fishing activities over a5-day period, or pentad. Using standard deviation from the mean, the index captures whether thosecombined parameters are more or less extreme than what they normally would be expected basedon historical and modelled experience.

ERA5 data is available on a 0.25-degree (or ~30km) grid and after validating with FMCN and partnershow far out fishers go out to fish, we established that fishers travel up to 50km from the coastline in Quintana Roo, while fishers in both Campeche and Yucatán travel out up to 75km from the coastline. Figure 3 shows the three sites overlain with ERA5 grid cells which capture the three parameters of interest. The red box establishes the boundaries that fishers go out to fish and wherethe product will apply to. Boxes can be iterated in future project stages.

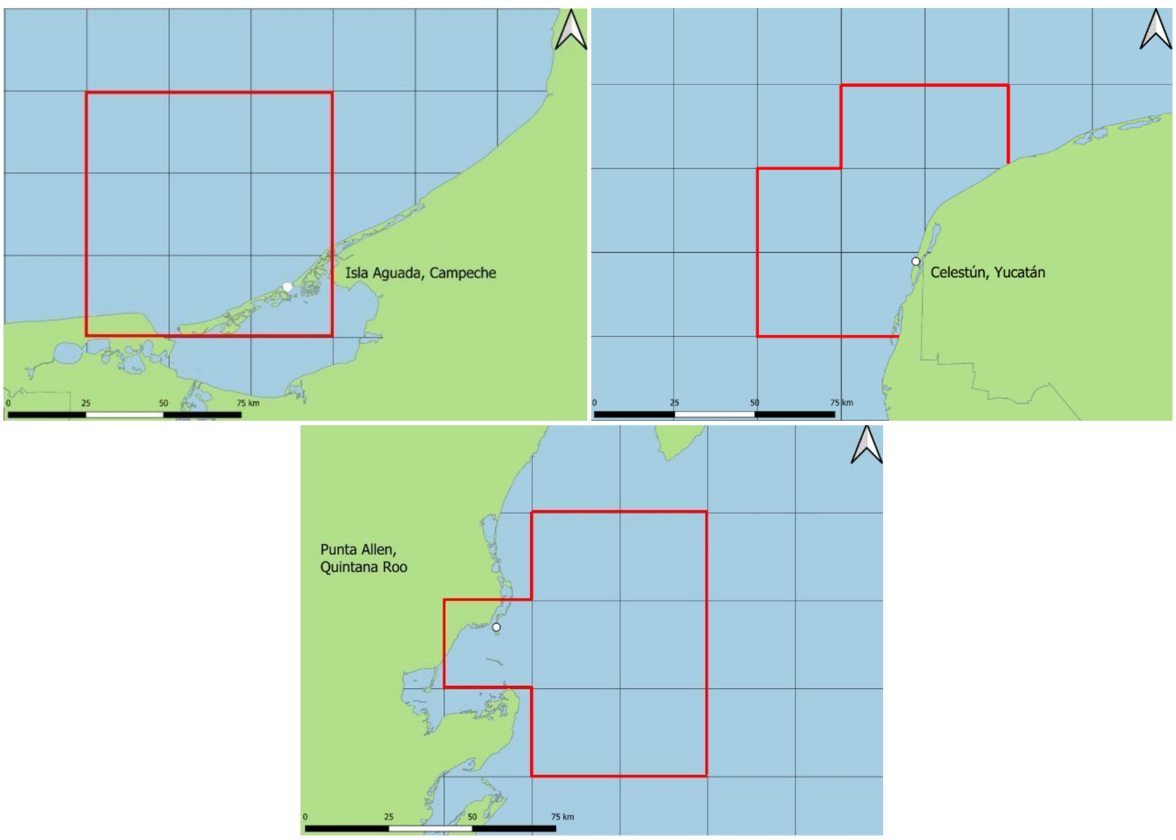


Figure 3. An illustration of the proposed ERA5 grid cells (in red) that best-represent how far outfishers travel to fish across the selected sites.

Source: WTW (2024)

WTW identified trigger thresholds based on historical, stochastic and modelled data that would balance how expensive the coverage would be (premium costs) with how often the product wouldpay out (annual limit).

For the purposes of this analysis, we structured the product to pay out once every four years (or a 25% annual pay-out probability), therefore setting the number of pay-outs over the entire 40-year dataset history (1980-2019 inclusive) at 10 (since the product pays out once every 4 years over a 40-year history). To demonstrate what the product could look like, we developed an illustrative – or "strawman" – structure which proposes a maximum annual pay-out per fisher of USD 500 (based on average monthly income data reported by AKK members in Celestún) and this figure can be refined during consultations in the future. We also provide a breakdown of estimated costs that would inform the total premium request, including Expected Loss, Load, Broking and Calculation Agent fees, Fronting fees and Local Taxes in the Component report. We propose validating these figures through engagement with insurers and assessing insurance market regulations and legislations related to parametric products in the full GCF proposal. The annual estimated premiumwould be $73 USD per fisher (for a total of 1,937 fishers across Campeche, Yucatan and Quintana Roo), and a total annual premium of $145,885 USD for the programme with the hope that premiumfinancing will be subsidized by the GCF for a two-year pilot.

Conclusion: An estimated premium and annual pay-out has been developed based on a preliminarystructure that would be refined with more data and feedback (i.e. from fishing cooperatives, insurers), noting the ultimate premium will only be known once the product goes to market.

Conclusion

For the following reasons, we find it feasible to further explore a "bad weather periods" product in
the Yucatán Peninsula:

- Fisher livelihoods indeed suffer economically from the impacts of prolonged periods of poorocean and weather conditions (wind speed, wave height and rainfall – also known as the 3 parameters).
- These hazards are neatly captured by data source, ERA5, which accurately reflects/proxies the parameters, is reliable, historically amd publicly available and accepted by risk markets.
- The index is structured to capture deviation from average weather conditions, and therefore automatically adjusts to seasonal trends.
- Fisher feedback can be used to refine the structure to balance premium and annual pay-outlimits and frequency.

Next Steps

Should FMCN wish to continue exploring a **parametric insurance solution for bad weather periods**,suggestions for future activities could include:

- Validation of the selected ERA5 grid cells to both represent fishing areas and fishers' distance travelled from the coastline per site.
- Engagement and training for fishers
- Demand assessment to refine structure of the product and understand willingness to pay for the product.
- Outreach to the insurance industry on their underwriting capacity and pricing (including costs like taxes, capital provision margins, etc.) to get a better sense for likely premium perfisher.
- Securing premium finance for the pilot.

As found in WTW's final report, should FMCN pursue the development of a parametric "bad weatherperiods" product designed to safeguard livelihoods of small-scale fishers and fisherfolk in the Yucatán Peninsula, particularly when drafting a GCF funding proposal, we propose the following activities under four key Components in this implementation roadmap be conducted:

Table 2. Implementation Roadmap Timeline

Component	Sub-Component	Y 1	Y 2	Y 3	Y 4	Y 5
1. Enabling Conditions and Pilot Scope	1. Insurance Market Assessment	X				
	2. Pilot Phase Scope	X				
	3. Financial Literacy Training	X				
	4. Survey	X				
2. Product and Pilot Programme Development	1. Product and Program Design	X				
	2. Product distribution	X				
3. Pilot	1. Product Finalization and Placement		X	X		
	2. Monitoring for Triggering Events		X	X		
	3. PELC Implementation*		X	X		
	4. Pay-out Distribution*		X	X		
4. Expansion and Long-term Programme Sustainability	1. Long-term Premium Finance Strategy			X		
	2. Agree Scope Expansion				X	
	3. Product and Program Expansion				X	
	4. Placement				X	
	5. Monitoring and PELC					X
	6. PELC Implementation*					X
	7. Pay-out Distribution*					X

** Only if a triggering event occurs.*

Mangroves

For the **mangroves** component, the scope of work was: develop a Mangrove Damage Model (MDM)and evaluate the feasibility of an insurance concept designed for mangrove ecosystems in the Yucatán Peninsula. The sites included in the analysis are:

- Reserva de la Biósfera los Petenes (RBLP), Campeche
- Reserva Estatal Dzilam de Bravo (REDB), Yucatán
- Área de Protección de Flora y Fauna Manglares de Nichupté (APFFNM), Quintana Roo
- Reserva de la Biósfera Sian Ka'an (RBSK), Quintana Roo

IV.1. Financial mechanisms that protect mangrove ecosystems

Two financial mechanisms that ultimately enhance the resilience of mangrove ecosystems to extreme hazard events as well as support mangrove-dependent livelihoods are:

1. Parametric insurance: which is well-suited to provide funds following acute hydrometeorological events. Parametric insurance products can be designed to protect mangroves particularly if pay-outs are directed towards mangrove restoration efforts. This is better suited against indemnity insurance which has a lengthier damage assessment process.
2. Blue carbon credit programmes: which can incentivize ongoing conservation and restoration activities. There are successful blue carbon credit programmes globally that generate revenue through credit sales, are rooted in the local community, and support the co-benefits that mangrove ecosystems provide to coastal communities and mangrove- dependent livelihoods. In Mexico, a blue carbon credit programme with demonstrated success is the San Crisanto Mangrove Restoration Project. However, the regulatory and legallandscape to develop such a programme in Mexico is complex.

Conclusion: There are insurance products that exist, demonstrating it is feasible to protect mangrove-linked investments such as carbon credits, or to protect the livelihoods of communities who depend on mangrove ecosystems, through risk financing.

The Development of a Mangrove Damage Model (MDM)

WTW conducted a literature review to understand the mechanisms through which hurricane wind and associated sub-perils (hurricane driven precipitation and storm surge) cause damage to mangroves.

Hurricane winds are the sub-peril responsible for the greatest damage to mangroves through physical damage to the structure and composition of mangroves (e.g., uprooting of trees, trunk breakage, breaking of branches, defoliation of the mangrove canopy, reduction in the structural and floristic characteristics of the forest, changes in species dominance). These changes interrupt the hydrological regime, and cause changes to sediment dynamics and nutrient cycles, often leading tosecondary mortality of trees.

Hurricane driven precipitation primarily causes damage through interruption of the hydrological regime of mangroves (e.g., extensive flooding deposition of sediments, changes in salinity, changes in oxygen concentrations, leading to mortality of mangroves).

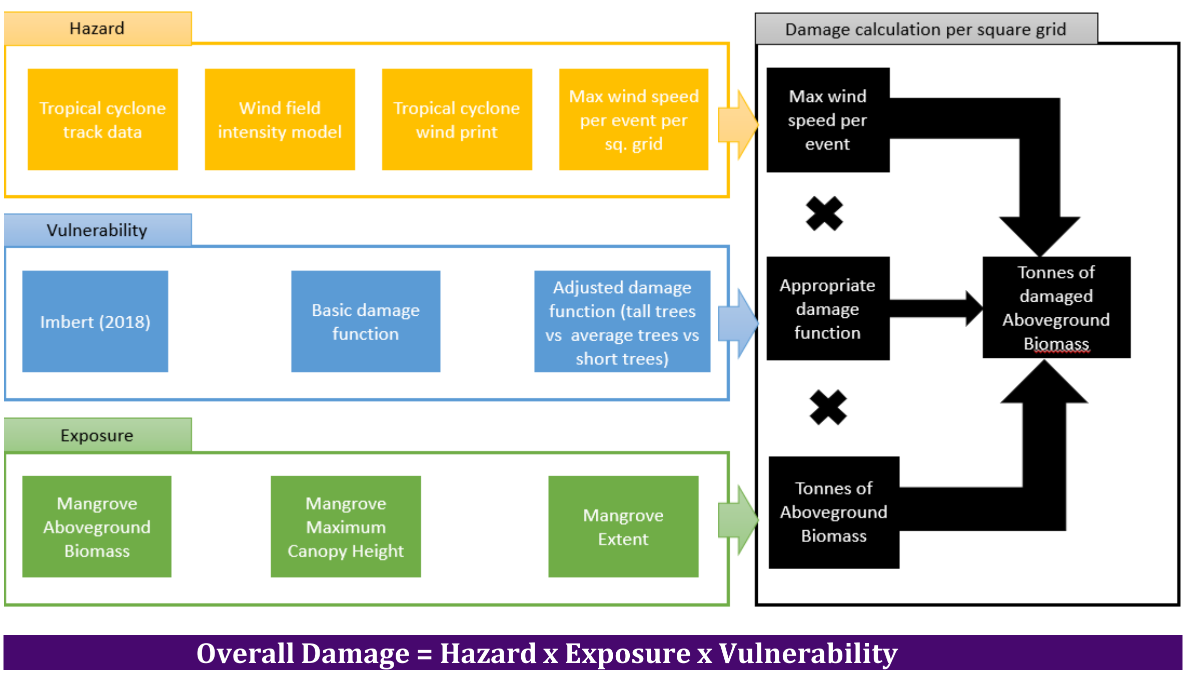
Hurricane driven storm surges primarily cause damage through sedimentation, deposition, erosion and inundation of mangroves which cause mortality through altered hydrological regimes.

Conclusion: Hurricane winds are the primary cause of damage to mangroves and based on availability of data, were selected as the hazard to model in the MDM.

The MDM has three components (Figure 4): **hazard**, **vulnerability** and **exposure**. Within each, thereare sub-components which are deemed important to determine the relationship between hurricanewinds and damage to mangroves.

Key outputs for each module:

- **Hazard**: Maximum wind speed per grid cell, per historic event
- **Vulnerability:** Appropriate Damage Function per grid cell
- **Exposure:** Tons of Aboveground Biomass (AGB) per grid cell
- **Damage:** Total loss of AGB per grid cell

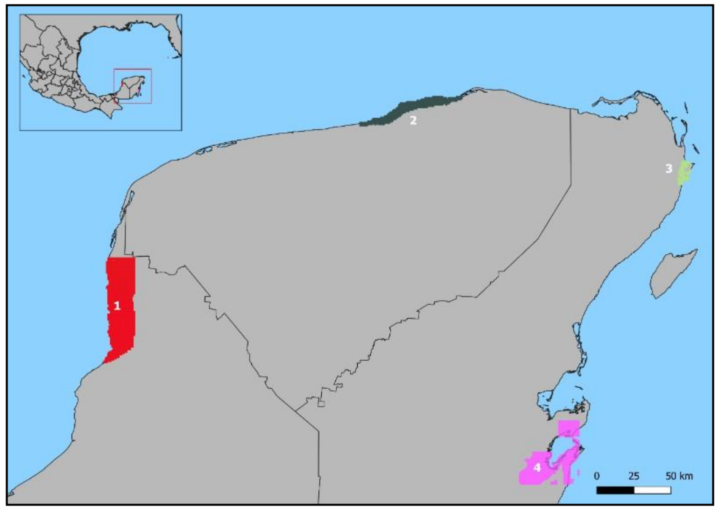


V.1.1. Figure 4. An overview of the sub-components of the hazard, vulnerability and exposure modulesin the Mangrove Damage Model, used to calculate total hectares of damaged mangrove forest across the four key sites.

Source: WTW (2024).

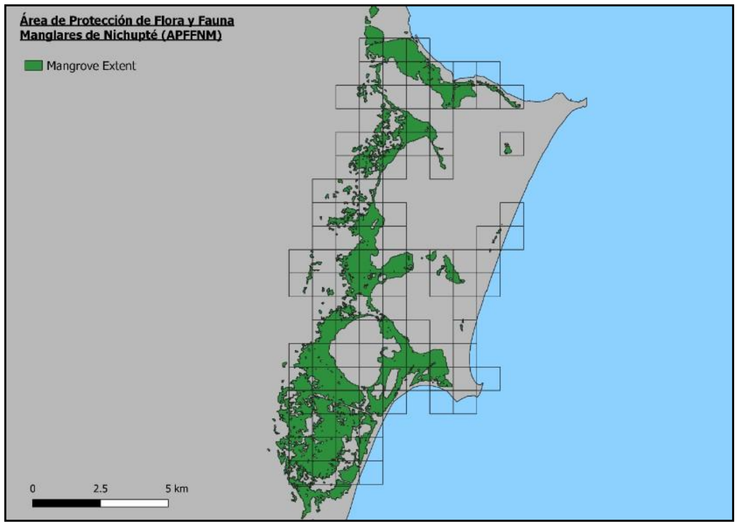
The MDM was applied to four sites, informed by consultancy assessing mangrove vulnerability under the ACCION project:

3. Reserva de la Biósfera los Petenes (RBLP), Campeche
4. Reserva Estatal Dzilam de Bravo (REDB), Yucatán
5. Área de Protección de Flora y Fauna Manglares de Nichupté (APFFNM),Quintana Roo
6. Reserva de la Biósfera Sian Ka'an (RBSK), Quintana Roo



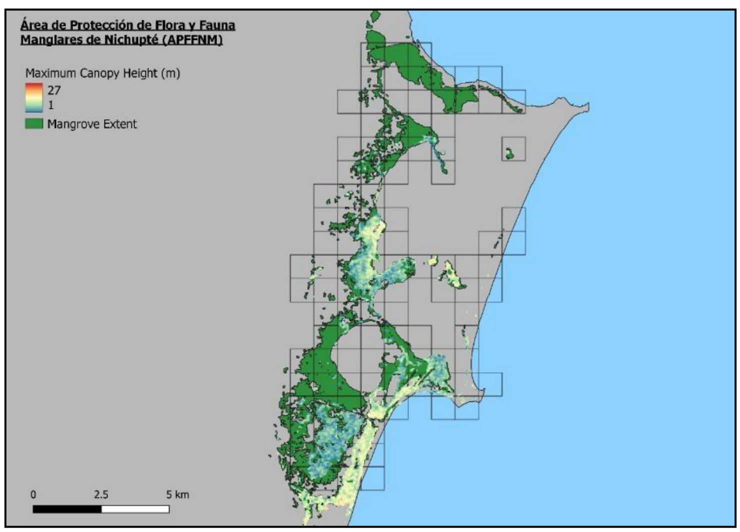
Exposure

Mangrove Exposure is characterized in terms of Aboveground Biomass (AGB), Maximum Canopy Height (Hmax) and Mangrove Extent (m2). The AGB and Hmax datasets were developed by Simard et al. (2019) at ~ 30 metres resolution, over the period 2000-2009 and the satellite outputs of the Consultancy on Mangrove vulnerability were used for mangrove extent (period 2013-2023). The AGB and Hmax datasets do not fully overlap with the Mangrove Extent dataset, implying that only a subset of areas were used when the AGB and Hmax datasets were developed (See Figure 5 to Figure 7 below for APFFNM). Inverse Distance Weighting (IDW) interpolation method was used to interpolate known data values for AGB and Hmax across each of the four sites within the defined grid.



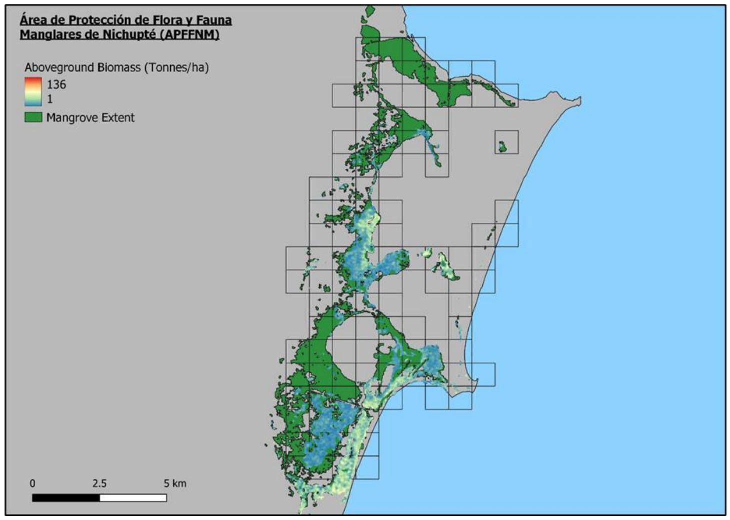
V.1.2. Figure 5. An example of Mangrove Extent in APFFNM.

Source: WTW (2024).



V.1.3. Figure 6. An example of Maximum Canopy Height in APFFNM.

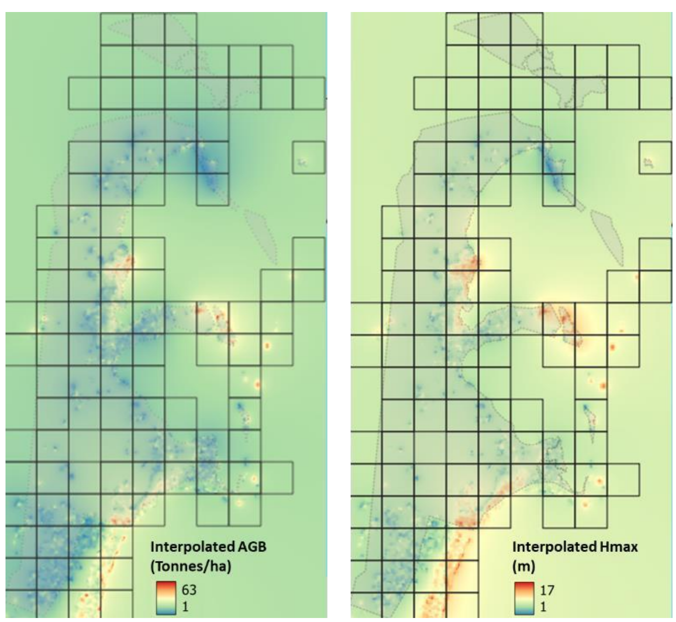
Source: WTW (2024).



V.1.4. Figure 7. An example of Aboveground Biomass in APFFNM.

Source: WTW (2024).

Figure 8 below shows the results of the IDW Interpolation for APFFNM. The values for AGB are measured in tonnes per hectare. The value of AGB in each grid cell is multiplied by a conversion factor to get the total amount of AGB in each grid cell in tonnes. The total AGB for a site is the sumof the AGB in tonnes for those cells which have mangrove cover in them (dictated by the MangroveExtent dataset). A median Hmax value for each grid cell is calculated to allow each grid cell to be tagged in the 'short', 'average' or 'tall' mangroves categories. This allows an appropriate damage function to be selected in the vulnerability component.



V.1.5. Figure 8. The results of the IDW Interpolation for (i) Aboveground Biomass and (ii) MaximumCanopy Height for APFFNM.

Source: WTW (2024).

Hazard

The MDM uses the historical hurricane track data from the International Best Track Archive for Climate Stewardship (IBTrACS) (NOAA, 2024) as the basis for generating wind fields, from which peak wind speeds can be extracted for use in the hazard component of the MDM. The IBTrACS dataset is global and contains the most complete set of historical tropical cyclone best-track data. The dataset has merged outputs from twelve different reporting agencies or historical databases tocreate an open-source, unified, best-track dataset. Figure 9 shows an example of the windspeed hazard from Hurricane Delta (2020) and the mangrove extent for the Área de Protección de Flora yFauna Manglares de Nichupté (APFFNM). The peak wind speed is extracted from the centroid of each grid cell.

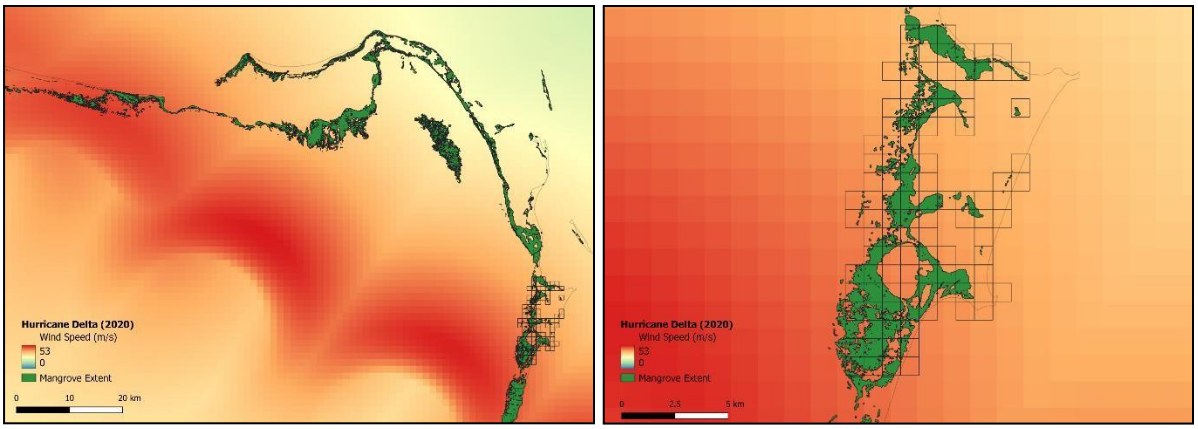


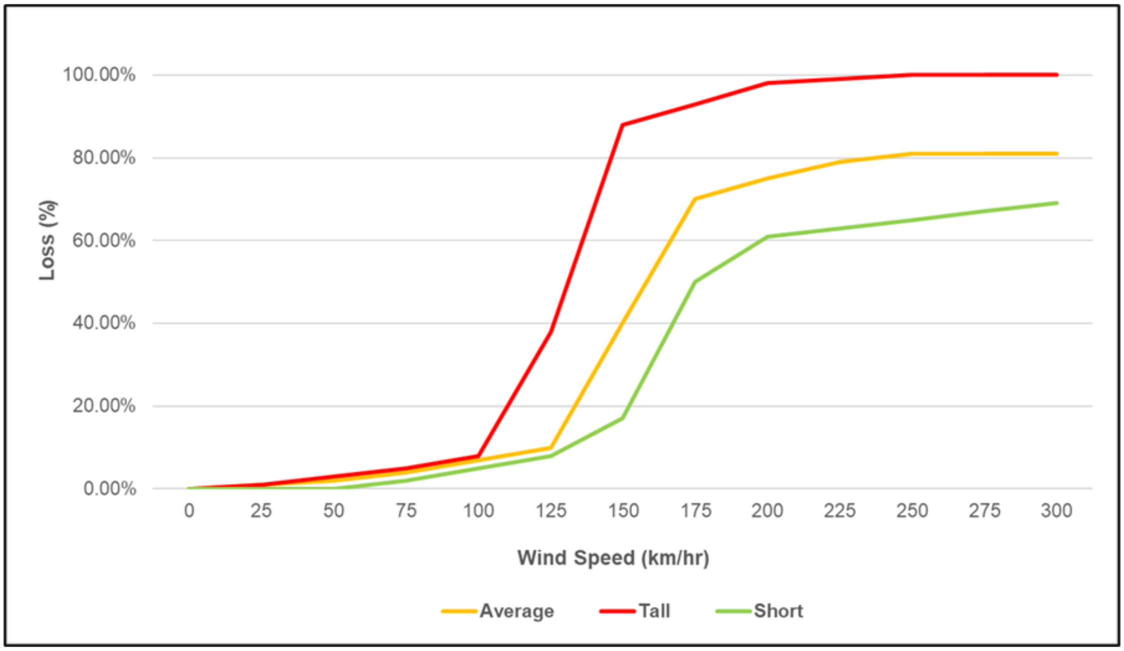
Figure 9. Left: An overview of the wind field generated for Hurricane Delta in 2020. The peak windspeed (ms-1) was extracted at each grid cell. **Right:** A zoomed in visual representation of the wind field generated for Hurricane Delta across the APFFNM grid.

Source: WTW (2024).

Vulnerability

Vulnerability relationships describe the susceptibility of the underlying exposure to damage from agiven hazard. The MDM uses the median, Maximum Canopy Height (Hmax) in a grid cell level to determine vulnerability. Canopy height was selected as a key factor that determines mangrove vulnerability to hurricane wind based on peer-reviewed literature and data availability.

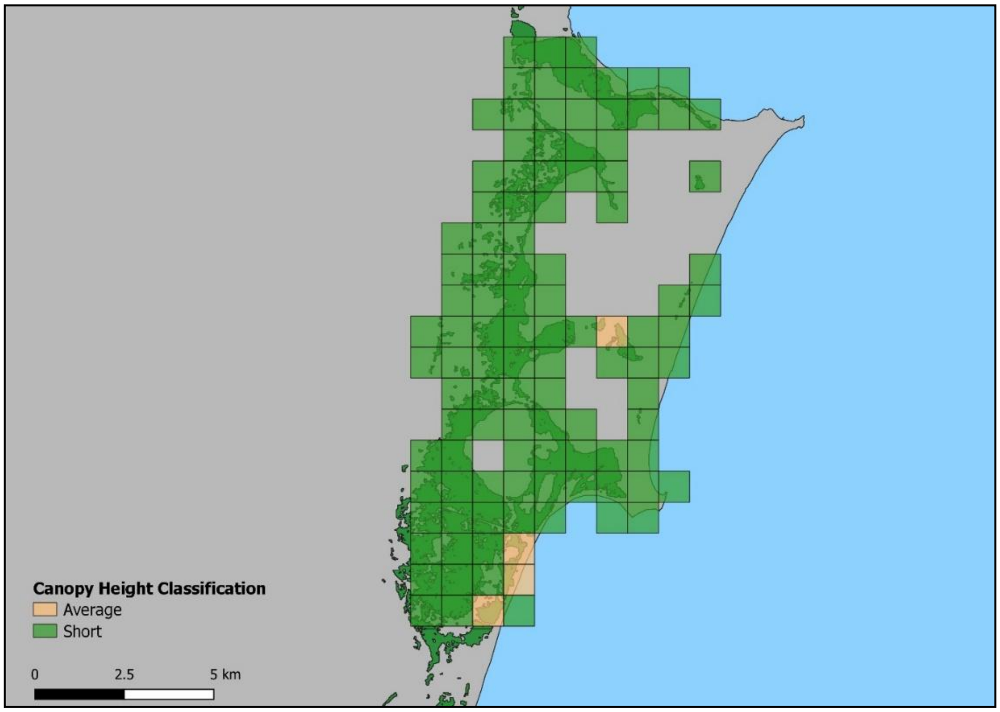
The relationship of wind damage to hurricanes, for different heights of mangroves (tall, average, short) in the Caribbean and vulnerability curves were constructed based on a previous academic study. We extracted the wind speed (km/hr) and the associated basal area loss for average-sized mangroves, tall (basin) mangroves and small (fringe) mangroves to develop the final vulnerability curve (Figure 10) as an input into the MDM.



V.1.6. Figure 10. Vulnerability curves developed for the Mangrove Damage Model.

Source: WTW (2024).

Vulnerability was assigned per 1 km grid cell as seen in Figure 11. Each grid cell was tagged as having a Median, Maximum Canopy Height of 'Short', 'Average' or 'Tall' based on the interpolation of the Carbon Monitoring System (CMS) Global Mangrove Aboveground Biomass Dataset, developed by Simard et al. (2019), to the boundaries of the mangrove extent. The proportion of cells assigned ashaving a 'short', 'average' and 'tall' median, Hmax for each site is shown in Table 3. For APFFNM, RBLP and RBSK, over 50% of the grid cells were tagged as having a 'short' Hmax. In REDB, the largestproportion of grid cells (44%) were tagged as having an 'average' Hmax. Across all sites, the numberof grid cells assigned as having a 'tall' Hmax was the smallest in comparison to the 'short' and 'average' classifications.



V.1.7. Figure 11. The classification of grid cells in APFFNM according to the results of the IDW interpolation and zonal statistics run on the Maximum Canopy Height data (QGIS).

Source: WTW (2024).

V.1.8. Table 3. An overview of the proportion of grid cells at each site tagged as have median Hmax of

'short', 'average' and 'tall'.

Site	Short (% of total)	Average (% of total)	Tall (% of total)
APFFNM	98	2	0
RBLP	50	42	8
RBSK	72	25	3
REDB	33	44	23

Damage

The MDM was run for all historical hurricanes which passed within a 500-km buffer of each of the sites and exceeded a category one hurricane in at least one of the grid cells, as per the Saffir SimpsonScale. For each event, the hazard, vulnerability, and exposure was used to calculate the tonnes (Mg)of damaged AGB per model grid square. The total amount of damaged AGB is then aggregated for each mangrove site. Historical events are ranked in terms of (i) loss of AGB and (ii) peak wind speed(where events are called 'high wind events' if at least one grid cell at the site has a PWS > 30 ms^{-1}). Damaging events and high wind events showed good correlation (Table 4) showing that wind is theprimary determinant of damage to mangrove in comparison to the underlying vulnerability.

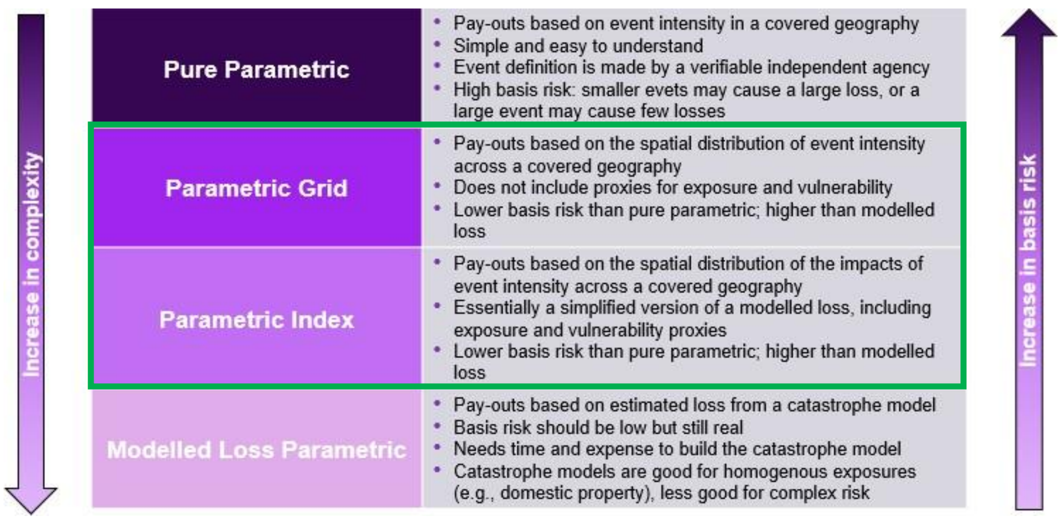
Table 4. An overview of the number of mangrove-damaging events per site and modelled loss inaboveground biomass.

Site	Total number of damaging events	Top three damaging events	Modelled loss in AGB (Mg)	Modelled loss of AGB as % of total exposed AGB
APFFNM	24	Gilbert (1988)	31,750	64.5%
		Wilma (2005)	29,751	60.4%
		Beulah (1967)	8,945	18.2%
RBLP	21	Isidore (2002)	380,128	32.4%
		Hilda (1955)	72,517	6.2%
		Roxanne (1995)	72,516	6.2%
RBSK	25	Dean (2007)	770,782	59.7%
		Carmen (1974)	450,629	34.9%
		Janet (1955)	435,009	33.7%
REDB	23	Gilbert (1988)	833,233	83.0%
		Isidore (2002)	733,735	73.1%
		Beulah (1967)	608,073	60.6%

The Development of a Mangrove Risk Financing Product Concept

The following concepts are important for a parametric product (Figure 12):

- **Insured**: an entity who exerts management rights over a mangrove area, and plans togenerate blue carbon credits
- **Event**: maximum tropical cyclone windspeed in a defined area
- **Pay-out use**: purchase of carbon credits and/or mangrove restoration actions
- **Structure**: comparison between the modelled loss in AGB, and high wind events demonstrates that a parametric product that captures high wind events over the selected mangrove areas is likely to be an effective proxy for damage to the mangroves.



V.1.9. **Figure 12. Forms of parametric insurance**

Source: WTW (2024).

Conclusion: Either a parametric index or a parametric grid approach could be suitable for underpinning an insurance product that protects blue carbon investments. Initially, a parametric grid approach should be investigated, validated by the MDM. Following refinements, the MDM could underpin a parametric index.

Conclusions

For the following reasons, we find it feasible to further explore the development and implementation of an insurance product to protect mangroves in the Yucatán Peninsula against hurricane wind:

- Wind is frequently cited as the main cause of damage to mangroves. Mangroves are important ecosystems which are critical for carbon sequestration, amongst other things.
- These hazards are neatly captured by data source, IBTrACS, which accurately reflects/proxies the parameters, is reliable, historically and publicly available and acceptedby risk markets.
- The creation of a damage model shows multiple damaging events per site, and these damaging events have good correlation with high wind events.

Next Steps

Should FMCN wish to continue exploring a **parametric insurance solution for protecting mangrovesagainst hurricanes,** suggestions for future activities could include:

- Further enhancements to the MDM, including: exploring the relationship between other vulnerability factors and wind damage, explore the inclusion of other datasets (e.g., soil organic carbon data, rainfall data).
- Validation of key damaging events with stakeholders due to the limited data published online with regards to impacts to mangroves from these events.
- Demand assessment to refine structure of the product and understand willingness to pay for the product.
- Outreach to the insurance industry on their underwriting capacity and pricing (including costs like taxes, capital provision margins, etc.) to get a better sense for likely premium.
- Securing premium finance for the pilot.

Gaps and Challenges

The gaps and challenges experienced under this Consultancy can be grouped largely into two mainareas (Table 5): lack of available data and information, and lack of input data from other consultancies in a timely manner.

V.1.10. Table 5. An overview of the gaps and challenges experienced under the Consultancy.

Gaps and Challenges	Details
Lack of available data and information	Lack of reliable, comprehensive, up to date information on existing government schemes on risk financing products.
	Lack of gender-disaggregated data on fishers.
	Lack of comprehensive data on impacts of past events on reefs, i.e., monitoring of reefs at regular time intervals (this is generally an issue in this space).
	Lack of information of the isolated impact of hurricane driven precipitation on mangroves, which meant it difficult to justify including this in the MDM.
Lack of and reliance on inputdata in a timely manner	Delay in receiving information from previous consultancies or fishers in a timely manner.
	Reliance on other consultancies for inputs into analysis.

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ANNEX C. Database on potential OLLC

Estado	Nombre del Actor	Breve descripción	Año de inicio de operaciones	Tipo de proyecto	Figura Jurídica	Área temática	Medidas AbE	**Vulnerabilidad climática**
CAMPECHE	Comunidad de Restauradores del Manglar en Isla Aguada	Comunidad enfocada en la restauración de humedales en Isla Aguada	-	Cooperativas	Sociedad Cooperativa	Manglares, dunas y pastos marinos	Restauración de ecosistemas de humedales y sabanas inundables	Aumento de la frecuencia de tormentas y huracanes
CAMPECHE	Yum Kaax	La Coordinación General de Sustentabilidad "Yum Kaax", es una estrategia general y transversal para lograr un óptimo desempeño ambiental de la Universidad Autónoma de Campeche, desde una visión crítica, propositiva y comprometida con el desarrollo sustentable.	1994	Centros de Investigación	-	Manglares, dunas y pastos marinos	Construcción sostenible	Diferencias extremas de temperatura
CAMPECHE	Campamento Tortuguero Chenkan	Lugar de esparcimiento cultural que ofrece actividades de ecoturismo, actividades recreativas, educativas y sociales que integran el conocimiento del medio ambiente y su relación con el ser humano.	1984	Iniciativa	-	Turismo sostenible	Repoblamiento y conservación in situ y ex situ de especies	Diferencias extremas de temperatura
CAMPECHE	Wotoch Aayin	Centro ecoturístico operado por una sociedad cooperativa legalmente constituida dedicada al aprovechamiento sustentable del cocodrilo Moreletii y a brindar diversos servicios ecoturísticos, educación ambiental, servicio de restaurante, hospedaje, así como la recreación a turistas nacionales y extranjeros.	-	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes
CAMPECHE	Centro Ecoturístico Carey	Iniciativa de ecoturismo que ofrece recorridos en lanchas y canoas en manglares dentro de la reserva de la biósfera Petenes y la Ría Celestún. Actualmente cuentan con cabañas frente al mar, restaurante, lancha y canoas, para ofrecer servicios de hospedaje, alimentos de gastronomía local a base de mariscos, tours de pesca y de observación de aves.	2005	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Aumento de la frecuencia de tormentas y huracanes

CAMPECHE	Isla Aguada Tours	Centro de actividades turísticas	2019	Cooperativas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Mares agitados
CAMPECHE	BlueMX Mangrove	Asociación civil sin fines de lucro que se enfoca en la conservación de ecosistemas de manglares vírgenes y la restauración/reforestación de áreas de manglares degradadas en más de 110,000 hectáreas bajo contrato. Las áreas de nuestro proyecto Blue Carbon son ecosistemas costeros de manglares, marismas.	2019	Organizaciones de la Sociedad Civil	Asociación Civil	Manglares, dunas y pastos marinos	Manejo forestal	Sequía
CAMPECHE	Centro Ecoturistico Zazil-Há	Centro ecoturístico ubicado en el sur del estado de Campeche, donde la comunidad se ha organizado para proteger la biodiversidad del Área Natural Protegida Laguna de Términos, y ofrecen experiencias turísticas. Cuentan con cabañas, paseos en lancha, y un restaurante	2010	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Aumento de la frecuencia de tormentas y huracanes
CAMPECHE	Cooperativa Isla Valor	Cooperativa de pobladores de Isla Aguada enfocada en turismo alternativo. Ofrecen recorridos guiados en la Ría de Sabancuy, la zona de islotes dentro de la Laguna de Términos, zona de manglares y lagunas de Isla Aguada.	2016	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
CAMPECHE	COBIUS	Conservación de la Biodiversidad del Usumacinta A.C. (COBIUS A.C.) es una organización civil sin fines de lucro, que contrinuye a la conservación de la biodiversidad de la cuenca del río Usumacinta y del Sureste de México	2011	Organizaciones de la Sociedad Civil	Asociación Civil	Sistemas agroforestales	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Cambio en los patrones climáticos estacionales
CAMPECHE	Miel y Cera de Campeche	Fabricante de miel en Campeche	-	Empresas	S.P.R de R.L	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
CAMPECHE	Grupo KAABMX Sureste	Productos de Miel de Abeja obtenidos bajo proceso ambiental responsable, libre de crueldad animal.	-	Empresas	-	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar	Cambio en los patrones climáticos estacionales

							los retos asociados a los cambios en el clima	
CAMPECHE	Consejo de turismo rural Campeche	Red formada en 2013, está integrada por 7 empresas sociales comunitarias que unen esfuerzos y capacidades para brindar experiencias auténticas y participativas de turismo de naturaleza y ecoturismo que ayuden al desarrollo sustentable, la conservación de los recursos naturales y su herencia cultural.	2013	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
CAMPECHE	COBI	Comunidad y Biodiversidad, A.C. (COBI) promueve la conservación marina y el manejo sostenible de los recursos pesqueros, trabajando mano a mano con quienes habitan las comunidades costeras de México. Impulsan que las generaciones actuales y futuras de pescadoras y pescadores utilicen y compartan sus conocimientos para co-diseñar e implementar soluciones que logren comunidades resilientes y océanos saludables.	1999	Organizaciones de la Sociedad Civil	-	Pesca sostenible	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Cambios en el área de distribución de especies importantes
CAMPECHE	Colectivo Indígena por el Agua Calakmul	-	-	Organizaciones de la Sociedad Civil	-	Manglares, dunas y pastos marinos	Protección y fortalecimiento de conocimientos locales	Sequía
QUINTANA ROO	Colectivo Manglares	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Incendios
QUINTANA ROO	Grupo Dakatso	Negocio que ofrece un sistema de barrera flotante de contención, además de todos los equipos y maquinaria como son las bandas de extracción y carga desde la orilla de playa, anclajes marinos, remolques de traslado, de la primera embarcación fabricada en el país diseñada para la recolección y disposición del alga desde el mar y del mas novedoso sistema de Trituración.	2015	Empresas	S.A de C.V	No maderables	Repoblamiento y conservación in situ y ex situ de especies	Cambio en los patrones climáticos estacionales
QUINTANA ROO	Humans4Reefs	Proyecto que tiene el objetivo de apoyar los esfuerzos de restauración de corales en Cozumel y Riviera Maya,	-	Organizaciones de la	Asociación Civil	Corales	Repoblamiento y conservación	Cambios en los factores físicos y químicos

		con fondos, material, ayudando a restaurar los corales y reuniendo más voluntarios. Además, comercializan el arte de artistas locales a través de la venta de ropa.		Sociedad Civil			in situ y ex situ de especies	
QUINTANA ROO	Restore Coral	Organización trabajando para la restauración de los sistemas arrecifales en Mexico, a través de la innovación social, el arte y el uso de tecnologias emergentes buscan sensibilizar al público acerca de la importancia de la protección de los arrecifes de coral.	2015	Organizaciones de la Sociedad Civil	Asociación Civil	Corales	Repoblamiento y conservación in situ y ex situ de especies	Cambios en el área de distribución de especies importantes
QUINTANA ROO	Maralive	Servicios de recolección de sargazo	2021	Empresas	-	Corales	Control de especies invasoras o exóticas	Cambio en los patrones climáticos estacionales
QUINTANA ROO	Kaxaan	Organización sin fines de lucro enfocada en la conscientización ambiental y conservación	2020	Organizaciones de la Sociedad Civil	Asociación Civil	Corales	Concertación de áreas de conservación, exclusión y aprovechamiento	Mares agitados
QUINTANA ROO	Cooperativa Isla Mujeres	Cooperativa de servicios turísticos en Quintana Roo	1977	Cooperativas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Servicios Digitales para la Pesca Sostenible	Aplicación móvil, diseñada por y para las personas dedicadas a la pesca en pequeña escala que permite llevar el registro y almacenamiento de las capturas diarias, así como los gastos que implican las jornadas de pesca en México, América Latina y Caribe.	2023	Empresas	S.A.P.I de C.V	Pesca sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes
QUINTANA ROO	SECORE	Organización dedicada a la conservación y restauración de los arrecifes de coral.	2015	Organizaciones de la Sociedad Civil	Asociación Civil	Corales	Repoblamiento y conservación in situ y ex situ de especies	Acidificación de los océanos
QUINTANA ROO	Sargablock	Sargablock es un material de construcción fabricado a partir del alga sargazo.	2015	Empresas	S.A de C.V	No maderables	Construcción sostenible	Cambio en los patrones climáticos estacionales
QUINTANA ROO	Amigos de Sian'Kan	Organización dedicada la conservación de los recursos naturales y al desarrollo sustentable	1986	Organizaciones de la Sociedad Civil	Asociación Civil	Corales	Repoblamiento y conservación in situ y ex situ de especies	Diferencias extremas de temperatura
QUINTANA ROO	Rutopía	Experienicas turísticas bajo el mar con el objetivo de crear conciencia sobre nuestro entorno natural y social para	2017	Empresas	S.A.P.I de C.V	Turismo sostenible	Concertación de áreas de conservación, exclusión y	Cambio en los patrones climáticos estacionales

		ayudar a formar una sociedad y empresas sostenibles.					aprovechamiento	
QUINTANA ROO	Cozumel Coral Reef Restoration Program	El CCRRP cuenta con un jardín de coral, compuesto por plataformas artificiales submarinas donde los corales que se han desprendido del arrecife (normalmente por buceadores o embarcaciones descuidadas) pueden ser rescatados, fijados con seguridad y volver a crecer en un entorno seguro.	2013	Organizaciones de la Sociedad Civil	Organización sin fines de lucro	Corales	Repoblamiento y conservación in situ y ex situ de especies	Acidificación de los océanos
QUINTANA ROO	Alquimar	Pequeña empresa basada en la búsqueda de nuevas formas para la utilización y el aprovechamiento de residuos de biomasa vegetal, especialmente en el sargazo	2017	Empresas	-	No maderables	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Cambio en los patrones climáticos estacionales
QUINTANA ROO	Manta Caribbean Project	Organización dedicada a la Conservación, Investigación y Educación con Manta rayas en el Caribe Mexicano	2013	Organizaciones de la Sociedad Civil	Organización sin fines de lucro	Corales	Repoblamiento y conservación in situ y ex situ de especies	Aumento de temperaturas atmosféricas y acuáticas
QUINTANA ROO	“U BELILEK KAXTIK KUXTAL”	-	-	Cooperativas	-	Turismo sostenible	Protección y fortalecimiento de conocimientos locales	Incendios
QUINTANA ROO	Mar Sustentable	Organizacón que tiene el objetivo de crear productos científicos y de educación ambiental sólidos que sean útiles a los responsables políticos para las estrategias de toma de decisiones centradas en preservar el capital natural y el patrimonio sociocultural de las sociedades costeras humanas.	2018	Organizaciones de la Sociedad Civil	-	Manglares, dunas y pastos marinos	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Erosión de riberas y costas
QUINTANA ROO	Centro Eco turístico Beej Ka´AX h	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Xyaat Ecoturismo Comunitario Maya	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	CENTRO ecoturistico Síijil Noh Há	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura

QUINTANA ROO	Kiich Pam Kàax	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura	
QUINTANA ROO	Community Tours Sian kaan	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura	
QUINTANA ROO	AllTourNative	Líderes en ecoturismo en la Riviera Maya, ofreciendo tours y Native Parks certificados como experiencias sostenibles.	1988	Empresas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura	
QUINTANA ROO	Akumal Dive Center	Centro de buceo en Akumal.	1975	Empresas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales	
QUINTANA ROO	Flora, Fauna y Cultura	Trabajan en la recuperación y reforestación de manglares en Quintana Roo, en colaboración con organismos gubernamentales, instituciones académicas, consultorías, grupos comunitarios y empresas interesadas en la conservación de estos ecosistemas clave.	2008	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Sequía	
QUINTANA ROO	Alianza Kanan Kay	La Alianza Kanan Kay es un organismo multisectorial líder que promueve las pesquerías en pequeña escala saludables, contribuye a la seguridad alimentaria y beneficia a las comunidades costeras de la Península de Yucatán.	2011	Organizaciones de la Sociedad Civil	-	Pesca sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes	
QUINTANA ROO	Resiliencia Azul	Resiliencia Azul es una Asociación Civil sin fines de lucro que promueve y asesora el diseño, financiamiento, coordinación y ejecución de acciones técnicas, legales, financieras y de gobernanza que contribuyan a la mitigación y adaptación al cambio climático global.	-	Organizaciones de la Sociedad Civil	Asociación Civil	Carbono azul	Restauración de ecosistemas de humedales y sabanas inundables	Aumento de la frecuencia de tormentas y huracanes	
QUINTANA ROO	Project QRRestore	Consorcio internacional de biólogos marinos, profesionales del medio ambiente y submarinistas que trabajan	-	Organizaciones de la Sociedad Civil	Organización sin fines de lucro	Carbono azul	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Aumento de la frecuencia de tormentas y huracanes	

		en el novedoso espacio de la restauración del carbono azul.						
QUINTANA ROO	Orquídeas de Sian Ka'an	Operadora de Tours de naturaleza en la reserva de Sian Ka'an	-	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
QUINTANA ROO	SmartFish	Venta de productos de pesca sostenible bajo buenas prácticas. Capacitación de pescadores.	2011	Empresas	S.A de C.V	Pesca sostenible	Establecimiento de sistemas agrícolas y pecuarios diversos y sostenibles	Cambios en el área de distribución de especies importantes
QUINTANA ROO	Estrategia Integral de Turismo Regenerativo para la Restauración Coralina	-	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Acidificación de los océanos
QUINTANA ROO	Restauración Comunitaria del Arrecife	-	-	Iniciativa	-	Corales	Restauración de nacederos y restauración en sitios de rondas hídricas	Acidificación de los océanos
QUINTANA ROO	Restauración Arrecifal, Manejo Integral del Sargazo y Aprovechamiento de Energías Renovables	-	-	Iniciativa	-	Corales	Restauración de nacederos y restauración en sitios de rondas hídricas	Acidificación de los océanos
QUINTANA ROO	Las Mujeres del Mar y el Ecoturismo en Sian Ka Án	Cooperativa de mujeres dedicada a brindar servicios de ecoturismo	2019	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Incendios
QUINTANA ROO	Circuito Xiimbal Maya, una experiencia vivencial en comunidades mayas	Centro de aprendizaje para la conservación del medio ambiente.	-	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
QUINTANA ROO	King Crab Mariculture: a Delicious Solution against	Iniciativa impulsada por Healthy Reefs for Healthy People que busca cultivar King Crabs como solución a algas invasivas en el Arrecife Mesoamericano	-	Iniciativa	-	Acuicultura/maricultura	Control de especies invasoras o exóticas	Acidificación de los océanos

	Macroalgae Proliferation							
QUINTANA ROO	Casa Wayuú AC	Centro de aprendizaje para la conservación del medio ambiente.	-	Organizaciones de la Sociedad Civil	Asociación Civil	Manglares, dunas y pastos marinos	Educación ambiental, capacitación e intercambio de saberes para la formulación, la implementación y el monitoreo de acciones AbE	Cambios en los factores físicos y químicos
QUINTANA ROO	Cooperativa Tulum Sostenible	Grupo de pobladores del municipio de Tulum, de diferente formación, experiencia buscando de hacer de Tulum un lugar con vida social armónica y sostenible.	-	Cooperativas	Sociedad Cooperativa	Manglares, dunas y pastos marinos	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Diferencias extremas de temperatura
QUINTANA ROO	Ciudadanos por Bacalar	-	-	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	AMCAH	Iniciativa inmediata de realizar acciones de conservación de biodiversidad, tomando como eje principal las aves de México y sus hábitats.	-	Organizaciones de la Sociedad Civil	Asociación Civil	Sistemas agroforestales	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Cambio en los patrones climáticos estacionales
QUINTANA ROO	EcoCaribe	Ecocaribe es un grupo de voluntariado enfocado en realizar actividades en pro del medio ambiente, pláticas y limpiezas de ecosistemas.	-	Organizaciones de la Sociedad Civil	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Muluk	Organización socioambiental dedicdaa al fortalecimiento de capacidades en el desarrollo sostenible de las comunidades.	2021	Organizaciones de la Sociedad Civil	Organización sin fines de lucro	Corales	Protección y fortalecimiento de conocimientos locales	Incendios
QUINTANA ROO	Cooperativa Yaalcab-Há	Empresa comunitaria de turismo alternativo y vigilancia ambiental en el Santuario del Manatí	2021	Cooperativas	Cooperativa turística	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Hurakaan Ecotactica	Organización de la sociedad civil sin fines de lucro que trabaja en implementar proyectos de desarrollo sustentable desde la conservación,	2017	Organizaciones de la Sociedad Civil	Asociación Civil	Manglares, dunas y pastos marinos	Concertación de áreas de conservación, exclusión y	Incendios

		restauración y preservación de ecosistemas.					aprovechamiento	
QUINTANA ROO	Centro Biomar	Organización enfocada en servicios de investigación	-	Centros de Investigación	Asociación Civil	Acuicultura/maricultura	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Acidificación de los océanos
QUINTANA ROO	Expedition Akumal	La Expedición Akumal se dedica a proteger y restaurar el ecosistema del arrecife costero mesoamericano.	2014	Empresas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Acidificación de los océanos
QUINTANA ROO	The Regenerative Development Alliance	Ayudan a sus clientes a triunfar creando identidades de marca, experiencias digitales y materiales impresos.	-	Iniciativa	-	Manglares, dunas y pastos marinos	Concertación de áreas de conservación, exclusión y aprovechamiento	
QUINTANA ROO	CENTRO UKANA I AKUMAL, A.C.	El Centro Ecológico Akumal es una organización sin fines de lucro que se enfoca en temas relacionados con la sostenibilidad y mejora de la gestión de los ecosistemas de Akumal y sus alrededores.	1993	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Centinelas del Agua	Centinelas del Agua se enfoca en preservar y proteger el acuífero de la Península de Yucatán a través del fomento participativo hacia una Nueva Cultura del Agua impulsada con base en nuestras dos áreas.	2011	Organizaciones de la Sociedad Civil	Asociación Civil	Acuicultura/maricultura	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Intrusión de agua salada y salinización del agua
QUINTANA ROO	Oceanus	Organización mexicana (no lucrativa) basada en Quintana Roo, México que desarrolla proyectos para la conservación de arrecifes de coral.	2006	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Acidificación de los océanos
QUINTANA ROO	Red de Turismo Comunitario de la ZM de Quintana Roo	La RTC de la Zona Maya de Quintana Roo se formó en 2014 por 8 empresas sociales, cuya creación está vinculada con la marca Maya Ka'an.	2014	Iniciativa	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
QUINTANA ROO	Vanguardia e Innovación Apicola de Tzucacab	-	-	Iniciativa	-	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales

QUINTANA ROO	Maya Environmental Education and Research Center Mexico	El Centro de Investiación y Educación Ambiental de la Zona Maya se encuentra ubicado en la zona limítrofe de Quintana Roo y Yucatán desde donde se conecta con las comunidades Mayas del norte de la Península, llevando a cabo acciones de desarrollo comunitario y responsabilidad social corporativa.	2006	Organizaciones de la Sociedad Civil	-	Sistemas agroforestales	Educación ambiental, capacitación e intercambio de saberes para la formulación, la implementación y el monitoreo de acciones AbE	Incendios
QUINTANA ROO	Playa Miel	Familia de apicultores en playa del carmen que vende la miel que produce directo de la colmena		Empresas	-	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
QUINTANA ROO	Sal a Pajarear	Iniciativa de la Fundación Transformación, Arte y Educación, A.C. y desde febrero de 2018 la FPMC forma parte de esta red peninsular que fomenta la observación de avifauna para niños de 8 a 12 años, quienes aprenden a proteger y conservar las especies de aves que existen en sus comunidades.	2018	Iniciativa	-	Manglares, dunas y pastos marinos	Educación ambiental, capacitación e intercambio de saberes para la formulación, la implementación y el monitoreo de acciones AbE	Incendios
YUCATÁN	Mayatil	Empresa yucateca productora de tilapia de primera calidad, estamos ubicados en el oriente del estado de Yucatán e iniciamos operaciones en el año 2018, actualmente producimos y comercializamos mas de 350 toneladas de tilapia al año	2018	Empresas	S.A de C.V	Acuicultura/maricultura	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Aumento de la frecuencia de tormentas y huracanes
YUCATÁN	Salgax	Empresa dedicada a desarrollar y comercializar productos biotecnológicos como fertilizantes de algas marinas (sargazo) para cultivos y plantas ornamentales	2015	Empresas	S. de R.L de C.V	Acuicultura/maricultura	Establecimiento de sistemas agrícolas y pecuarios diversos y sostenibles	Cambios en los factores físicos y químicos
YUCATÁN	Axisima	Consultora internacional con sede en Mérida, México. Especializado en proporcionar soluciones críticas, integradas e innovadoras de apoyo a la ingeniería costera y portuaria, la gestión ambiental y la sostenibilidad de los proyectos energéticos.	2004	Empresas	S.A de C.V	Sistemas agroforestales	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los	Cambio en los patrones climáticos estacionales

							cambios en el clima	
YUCATÁN	iPescado	Es una plataforma electrónica que surge de la necesidad de acercar a los productores, comercializadores y distribuidores de pescados y mariscos MEXICANOS, tanto de de pesca como de acuacultura con los chefs, restaurantes, tiendas de autoservicio y público en general. La necesidad de acercamiento surge para apoyar al sector en un esfuerzo conjunto por fortalecerse y apoyarse.	2021	Empresas	-	Pesca sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes
YUCATÁN	Vivero Chabihau (Las Flores de Mangle)	-		Organizaciones de la Sociedad Civil	-	Acuicultura/maricultura	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Sequía
YUCATÁN	Vivero Dzilam (Coccoloba)	-	-	Organizaciones de la Sociedad Civil	-	Acuicultura/maricultura	Concertación de áreas de conservación, exclusión y aprovechamiento	Aumento de la frecuencia de tormentas y huracanes
YUCATÁN	Comunidad pesquera (cangrejo)	-	-	Organizaciones de la Sociedad Civil	-	Pesca sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Aumento de la frecuencia de tormentas y huracanes
YUCATÁN	Promotora Turística Las Coloradas	Tour operadora turística en las Coloradas, Yucatán	-	Empresas	S.A de C.V	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
YUCATÁN	Cinvestav Mérida	Centro de Investigación con tres Departamentos que se enfocan en proyectos de investigación relacionados con biología marina, química y ciencias del medio ambiente. Además, cuenta con una Estación Marina en Telchac Puerto, Yucatán, sede del Observatorio de los Mares y las Costas Jacques-Yves Cousteau.	1961	Organizaciones de la Sociedad Civil		Manglares, dunas y pastos marinos	Educación ambiental, capacitación e intercambio de saberes para la formulación, la implementación y el monitoreo de acciones AbE	Cambio en los patrones climáticos estacionales
YUCATÁN	Guardianes de los manglares de Dzinintún	Ofrecen recorridos ecoturísticos con guía certificado y locales.		Organizaciones de la		Manglares, dunas y pastos marinos	Concertación de áreas de conservación,	Aumento de temperaturas

				Sociedad Civil			exclusión y aprovechamiento	atmosféricas y acuáticas
YUCATÁN	Hotel Xixim	Servicio Hotelero	2023	Empresas	S.A de C.V	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
YUCATÁN	Ducks Unlimited	-	1974	Organizaciones de la Sociedad Civil	Asociación Civil	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
YUCATÁN	Parque Ecoturistico Jaltun	Parque ecoturistico en el cual se realizan recorridos terrestres y acuaticos con educacion ambiental	2016	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Incendios
YUCATÁN	La Ría de Progreso	Parador Turístico que ofrece Servicios Turísticos que permiten la Convivencia y Disfrute con la Naturaleza.	-	Cooperativas		Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
YUCATÁN	Sayachaltún	26 cooperativistas que originalmente tenían el oficio de pescadores en la costa yucateca, principalmente en la zona de Telchac Puerto.Hoy manejan la Reserva Ecológica Sayachaltún en donde los visitantes aprenden sobre el manglar, las aves y la protección del medio ambiente.	-	Cooperativas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
YUCATÁN	Ejido San Crisanto	San Crisanto ofrece actividades turísticas para navegar los canales del manglar de día y de noche, explorar pantanos de sal con un guía local. El Ejido San Crisanto ofrece hospedaje en cabañas rústicas y un área de camping.	-	Cooperativas	-	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Sequía
YUCATÁN	Ban.Co2 de Carbono Mestizo	El Ban.CO2 de Carbono Mestizo es una Plataforma de Promoción de Proyectos con rendimiento.Este instrumento integra a compradores de inversión y ONGs para coinvertir con los Dueños Forestales mediante un mecanismo que da transparencia, certeza jurídica y financiera a las Partes en el cumplimiento de Acuerdos.	-	Organizaciones de la Sociedad Civil	-	Carbono azul	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Aumento de la frecuencia de tormentas y huracanes

YUCATÁN	Pronatura Península de Yucatán A.C.	Pronatura es una organización que trabaja con un enfoque regional, que a su vez se integra en una visión nacional a través de 6 oficinas de representación (Regiones: Noroeste, Noreste, Centro de México, Sur, Veracruz y Península de Yucatán).	-	Organizaciones de la Sociedad Civil	Asociación Civil	Sistemas agroforestales	Gestión integrada del paisaje	Cambio en los patrones climáticos estacionales
YUCATÁN	Manglares San Crisanto	El Proyecto “Manglares San Crisanto” / “San Crisanto Mangroves” fue registrado con el Protocolo Forestal para México de la Climate Action Reserve v1.5. Este proyecto es el primero en su clase en México. Incluye tres periodos de reporte y emitió 10,368 CRTs. Un estimado de 47,908 toneladas de CO2 han sido removidas por este proyecto.	2022	Iniciativa	-	Carbono azul	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Cambios en los factores físicos y químicos
YUCATÁN	Río Lagartos Xplore	Empresa social (cooperativa) ubicada en la Reserva de la Biosfera de Ria Lagartos que promueve un turismo responsable y solidario en la segmentación de turismo alternativo a través de experiencias, contacto con la naturaleza y educación ambiental vivencial	-	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Precipitación irregular
YUCATÁN	Cooperativa San Felipe y Naturaleza	Cooperativa con más de 10 años de experiencia en turismo de aventura y naturaleza. A lo largo de los años, ha establecido alianzas con prestadores de servicios locales para ofrecer a los turistas opciones de hospedaje y servicios de alimentos en el poblado.	2008	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Diferencias extremas de temperatura
YUCATÁN	Igualdad de Género en el Mar	Es un programa desarrollado por Comunidad y Biodiversidad, A.C. (COBI) para lograr la participación igualitaria de mujeres y hombres, en los procesos de toma de decisión con el fin de lograr resultados duraderos de conservación marina y pesca sustentable.	-	Iniciativa	-	Acuicultura/maricultura	Protección y fortalecimiento de conocimientos locales	Erosión de riberas y costas
YUCATÁN	Scolel'te	-	-	Organizaciones de la Sociedad Civil	-	Carbono azul	Manejo forestal	Diferencias extremas de temperatura
YUCATÁN	La Fragata	Cooperativa que se dedica a la prestacion de servicios turisticos en la Laguna de Terminos, ya sean por lancha o kayak.	2011	Cooperativas	Sociedad Cooperativa	Turismo sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales

YUCATÁN	Blue Core	Organización enfocada en crear proyectos y programas de desarrollo sustentable, que permitan la regeneración de los ecosistemas y la recuperación de la Identidad Cultura en la Península de Yucatán	-	Organizaciones de la Sociedad Civil	Asociación Civil	Sistemas agroforestales	Manejo forestal	Sequía
YUCATÁN	Ecologistas Subacuáticos de Yucatán	Apasionados y comprometidos con la conservación, difusión y cuidado de los recursos naturales.	-	Iniciativa	-	Manglares, dunas y pastos marinos	Educación ambiental, capacitación e intercambio de saberes para la formulación, la implementación y el monitoreo de acciones AbE	Cambios en los factores físicos y químicos
YUCATÁN	CeDePesca	Organización sin fines don el objetivo específico de ayudar a las pesquerías de América Latina a alcanzar la sostenibilidad	1997	Organizaciones de la Sociedad Civil	-	Pesca sostenible	Mantenimiento y mejoramiento de cuerpos y cursos de agua	Cambios en el área de distribución de especies importantes
YUCATÁN	Eco.caland	Servicios profesionales relacionados con la conservación, aprovechamiento y cultura ambiental de flora, fauna, ecosistemas y medio ambiente	2022	Organizaciones de la Sociedad Civil	-	Sistemas agroforestales	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes
YUCATÁN	Reciclando Dunas	“Reciclando Dunas” es un proyecto de restauración de la vegetación de duna costera que busca restablecer los beneficios de la duna en un área de 5,550m². Asimismo, se plantea reutilizar envases de PET, para construir instrumentos útiles en los procesos de protección, germinación y plantación de la vegetación natural de duna.	2019	Iniciativa	-	Manglares, dunas y pastos marinos	Restauración, reforestación, rehabilitación, enriquecimiento y regeneración asistida	Erosión de riberas y costas
YUCATÁN	Colectivo Playa	Comunidad creada para tener un impacto profundo en la comunidad de Sisal,	-	Iniciativa	-	Pesca sostenible	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambios en el área de distribución de especies importantes
YUCATÁN	Earth Connection Center	Earth Connection reúne los aspectos de educación, investigación y acción. La educación está enfocada en la educación ecológica, ambiental, regenerativa, de negocios y liderazgo, la investigación se basa en estudio de biodiversidad, la permacultura y la	2015	Organizaciones de la Sociedad Civil	Asociación Civil	Carbono azul	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los	Aumento de la frecuencia de tormentas y huracanes

		innovación tecnológica y en la acción se enfocan a la restauración ecológica, el aumento de la biodiversidad y el secuestro de carbono.					cambios en el clima	
YUCATÁN	KALANBIO A.C.	Organización sin fines de lucro que tiene el objetivo contribuir a la preservación, mitigación y/o restauración de los servicios ecosistémicos de los mares y costas.	2017	Organizaciones de la Sociedad Civil	Asociación Civil	Corales	Concertación de áreas de conservación, exclusión y aprovechamiento	Acidificación de los océanos
YUCATÁN	Apiturismo Sinanché	Servicios de experiencias de apicultura	-	Cooperativas	-	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Mieles de Mayab	Mieles del Mayab es una empresa productora y comercializadora de Miel de Abejas 100% Natural de Excelente calidad, con más de diez años en el mercado.	2010	Empresas	S.A de C.V	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Mimiel	Somos una empresa mexicana, creada con el objetivo de ofrecer a nuestros clientes y amigos productos derivados de la colmena, procesados con la más alta calidad, inocuidad e higiene, así como insumos apícolas apropiados y material genético mejorado, consolidándonos como uno de los principales productores y comercializadores en el mercado regional y nacional.	2000	Empresas	S.A de C.V	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Maya Honey	Miel de abejas orgánicas y demás productos de origen apícola.	1997	Empresas	S.A de C.V	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Oaxaca Miel	Somos una empresa mexicana, dedicada a la compra y venta de miel	2000	Empresas	S.A de C.V	Apicultura	Biodiversidad y servicios	Cambio en los patrones

		100% natural pura de abeja, con más de 30 años de experiencia. Contamos con centros de acopio en los principales estados productores de miel de abeja dentro de la República Mexicana.					ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	climáticos estacionales
YUCATÁN	Zazil Kaab	Meliponario y venta de miel.	-	Iniciativa	-	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Abeja Reyna	Ofrecen al mercado productos elaborados de miel de abeja natural, lo cual es elaborada por más de 120 apicultores a nivel nacional.	-	Empresas	S.A de C.V	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Mielnativa	Somos una empresa yucateca productora y comercializadora de miel de abeja natural multiflora, buscando satisfacer las necesidades del cliente y mejorar constantemente como equipo para poder brindarles un mejor producto, atención y servicio con los más altos estándares de calidad en el mercado.	2019	Empresas	S.A.P.I de C.V	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	Educe	EDUCE es una cooperativa con cerca de 900 apicultores asociados, poco más de 40 grupos de base, que se dedica a la producción y comercialización de miel de nuestros apicultores asociados, brindándoles asesoría técnica y capacitación, promoviendo la producción orgánica y los valores del comercio justo.	2000	Cooperativas	S.C de R.L	Apicultura	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los cambios en el clima	Cambio en los patrones climáticos estacionales
YUCATÁN	EcoGuerreros	una empresa social cooperativa comenzó a operar en julio de 2016, y cuyo objetivo es contribuir a conservar el medio ambiente y la cultura local mediante ofrecer actividades en contacto con la naturaleza, en alianza	2017	Cooperativas	S.C de R.L	Turismo sostenible	Biodiversidad y servicios ecosistémicos como solución para enfrentar los retos asociados a los	Cambio en los patrones climáticos estacionales

		con cooperativas, ejidos y organizaciones rurales.					cambios en el clima	
YUCATÁN	Acuicola Maya	La unidad acuícola representada por Jorge Luis Gamboa Álvarez, dedicada a la producción de tilapia y recientemente incursionó en la producción de camarón, bajo el esquema de las buenas prácticas de producción acuícola,	2017	Empresas	Empresario Individual	Acuicultura/maricultura	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales
YUCATÁN	Ocho Venado Garra Jaguar	Ubicado en el centro de la Península de Yucatán, 8 Venado Garra Jaguar es un Rancho agroecológico sustentable. Este surge como un proyecto familiar con dos beneficiarios directos y cuatro indirectos, donde incorporan una granja integral de cultivo de tilapia para consumo humano y una producción agrícola orgánica, como son hortalizas menores, cítricos y miel. La unidad lleva a cabo la transformación y comercialización de todos los productos en el estado de Quintana Roo, y también en la zona Sur del estado de Yucatán.	2017	Empresas	Empresario Individual	Acuicultura/maricultura	Concertación de áreas de conservación, exclusión y aprovechamiento	Cambio en los patrones climáticos estacionales