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## Capstone Projects

### Title

Beneath the Surface: Uncovering Climate Change in Tobasco

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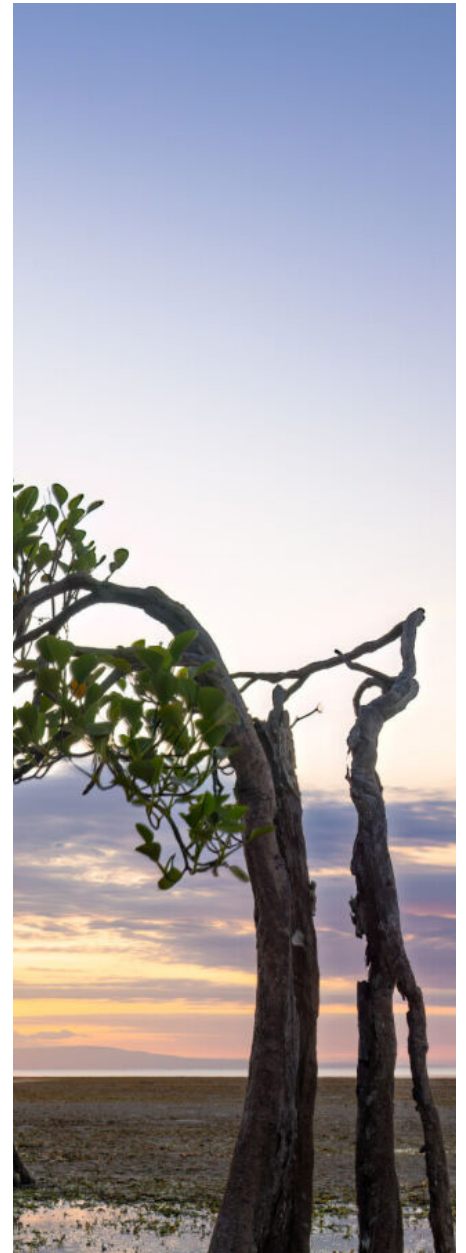
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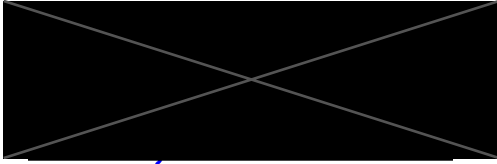
Sofia I. Alli

# BENEATH THE SURFACE

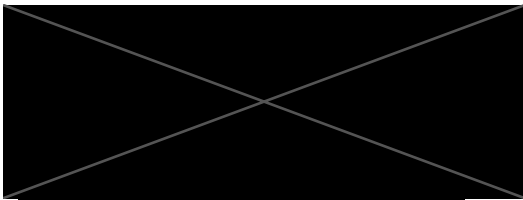
UNCOVERING CLIMATE CHANGE IN TABASCO

Submitted in partial fulfillment of the requirements for the degree of Master of Advance Studies  
in Marine Biodiversity and Conservation

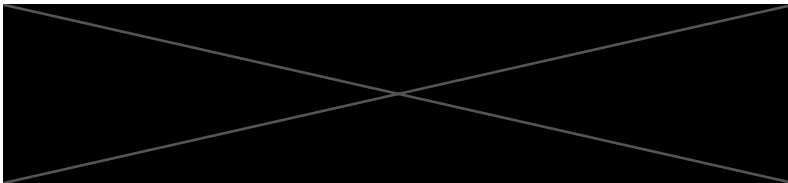
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# Contents

1. Abstract	4
2. Background	5
3. CAP Project Design	8
3.1 Components	8
3.2 Global Environmental Objectives (GEOs)	9
4. CAP Development Methodology	10
4.1 Step 1: Assess Vulnerabilities and Risks	11
4.2 Step 2: Plan for Adaptation	13
4.3 Step 3: Implement Adaptation Measures	16
4.4 Step 4: Monitor and Evaluate Adaptation	20
5. Case Studies	22
5.1 El Bosque	22
5.2 Pemex Refinery	23
6. Policy Recommendations	25
6.1 Extensive Evaluation of CAP Region Conditions	25
6.2 National Displacement Plans	26
6.3 Data Collection System	27
6.4 Environmental Offset System	28
References	30
Appendix 1	34
Appendix 2	35
Appendix 3	37

# 1. Abstract

Climate adaptation plans are an effective way to manage a marine ecosystem and support climate change research. However, in developing nations that have to deal with the impacts of climate change, there is little follow-up and no measures on whether these climate adaptation plans are implemented effectively and yield the desired results. This report contains a detailed analysis of a climate adaptation plan implemented in Tabasco, Mexico, that sought to decrease vulnerability to the impacts of climate change. This report consists of a background on the climate adaptation plan in Tabasco and a comprehensive, step-by-step comparison of this plan to the the UNFCCC framework for adaptation. Lastly, this report is complete with two case studies in Tabasco and policy recommendations for improved climate adaptation plans and government involvement in climate policy. The purpose of this report is to determine that despite the completion status of the climate adaptation plan, the goals outlined in this plan were not achieved satisfactorily and did not reduce vulnerability to the impacts of climate change. Mexico has faced challenges in effectively implementing conservation tools, ranging from weak enforcement to poor coordination between national, state, and local authorities. Ultimately, this report outlines the importance of a comprehensive and stakeholder-inclusive approach to climate change policy and planning, especially in the global south.

## 2. Background

The *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project* was the first attempt by the World Bank and the Global Environment Facility in 2010 to support climate change adaptation measures in Mexico (World Bank, 2016). Because Mexico's approach to climate change was at a very early stage when the project was prepared, the project design concentrated on developing a set of pilot activities in the states of Tabasco, Quintana Roo, and Veracruz, which are along the country's vulnerable Gulf Coast. The primary goals of this plan, as per the World Bank, was to promote adaptation to the consequences of climate change by implementing pilot activities, assessing the impacts of climate change, identifying potential response options, and informing future adaptation (Global Environment Facility, 2009). The purpose of this report is to indicate that these goals were not achieved, despite the World Bank claiming they were.

The *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project*, or CAP as it will now be referred to, is a type of climate adaptation plan. Climate adaptation plans are developed by a governing body that prioritize actions integrating climate adaptation into government planning, multi-level programming, operations, and management (U.S. Department of Agriculture, 2022). There are many different frameworks climate adaptation plans can follow, some popular ones being the UNFCCC Framework for Adaptation and NOAAs Steps to Resilience. A frequent criticism of climate adaptation plans, as they pertain to "developing nations," is that they do not contain measures to improve the baseline conditions of the targeted region and are overly focused on monitoring whether climate adaptation plan processes were followed rather than their effectiveness. This can be to the detriment of the communities impacted by climate change, primarily when climate adaptation plan processes and goals do not consist of meeting local targets for environmental conservation, sustainability, and overall living standards.

This criticism consists of applying a climate adaptation plan developed by international organizations and consultants without engaging with local partners in a region that requires more nuance and community collaboration. An accompanying criticism is that the emphasis on financing the climate adaptation plans overpowers the focus on the goals. Climate adaptation plans contain intricate plans on how the funds allocated for the climate adaptation plan will be spent (creating infrastructure, funding research, etc.), but these same intricate plans do not contain as detailed information on how the climate adaptation plan will promote resilience and continue to be monitored in the future.

Many large organizations such as the World Bank and International Monetary Fund (IMF) overly prioritize the idea that money is what will aid developing nations be better prepared for the impacts of climate change. The World Bank states that many countries are not "ready to face the consequences of climate change" and blames this on a lack of funding rather than available internal infrastructure (equipment availability, capacity for building) and government coordination (World Bank, 2014). The World Bank cites itself as the "world's largest financier of climate action in developing countries" and provides detailed Country Climate and Development Reports (CCDRs) that outline the many uses of their funds (World Bank, 2024). Overall, there is a high availability of information on financing these types of projects, and many completion metrics are based on whether the funds were spent appropriately.



Figure 1: Map of Tabasco, Mexico and its regions

The *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project's* framework was modeled after Colombia's Integrated National Adaptation Program and the Regional Adaptation to Rapid Glacier Retreat in the Tropical Andes (World Bank, 2012). Colombia, similar to Mexico, is highly vulnerable to climate change. However, the CAP done in Colombia pertains to an entirely different ecosystem that requires different adaptation strategies. The basic framework of Colombia's CAP prioritizes knowledge, infrastructure, monitoring systems, stakeholder involvement, adaptation implementation, and design - all of which the Mexico CAP also contains. The *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project* consisted of selecting three pilot states in Mexico (Tabasco, Veracruz, and Quintana Roo) and creating a climate adaptation plan that would apply to these three states. Each state had its own specific set of indicators and goals within the strategy that made it more customized to the needs of the individual state. For this report, the overall CAP will be analyzed as well as the specific pilot state of Tabasco, Mexico.

Tabasco (Figure 1), one of the three pilot states in the 2010 plan, has been chosen for this assessment due to its unique placement in the Gulf of Mexico, abundant wetland ecosystem, and relationship with offshore oil and gas. The study's significance extends beyond Tabasco's borders, as this Gulf shares waters with the U.S. This implies that the findings and implications of the CAP's implementation and sustainability in Tabasco could have far-reaching effects, making the study globally relevant.

This report will analyze how the *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project* has been implemented and whether the proposed measures and actions have been sustained. Essential elements of this report include an analysis of the framework used for the *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project* against the United Nations Framework Convention on Climate Change (UNFCCC) climate adaptation framework, an overview of the Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project's success indicators, Tabasco-specific success indicators, case studies on current events in Tabasco, Mexico, and policy recommendations to improve climate adaptation plans.



## 3. CAP Project Design

### 3.1 Components

The *Adaptation to Climate Change Impacts on the Coastal Wetlands in the Gulf of Mexico Project* consists of four main components (World Bank, 2008):

#### 1. Detailed design of key selected adaptation measures

- Identifies elements of the CAP, such as identifying potential environmental and social impacts, their characterization, and the definition of specific actions to improve, prevent, and control adverse outcomes. These elements come from the need for proper management practices in the selected pilot regions in Mexico. Component 1 monitoring was proposed to consist of monthly and semiannual progress reports on design plans and public outreach.

#### 2. Implementation of pilot adaptation measures in four selected wetlands highly vulnerable to the effects of climate change

- Sub-component as it pertains to Tabasco: wetlands of Carmen-Pajonal-Machona (CPM) will support reforestation with native species to create biological corridors to enhance biodiversity conservation while supporting state and local reforestation efforts, strengthening sandbars that separate the coastal lagoons from the sea. The Tabasco State Climate Change Committee will coordinate implementation.
- Monitoring for Component 2 was proposed to consist of semiannual progress reports, voluntary agreements, reforestation plans, and a detailed supervision report.

#### 3. Internalization of climate change considerations on water resources planning at a national level

- To assess current and feasible policy options and measures that could be adopted at a national level to incorporate the anticipated impacts of climate change on water resource planning (global overlay). The component will update the diagnosis of current impacts and produce an analysis of recommended policy measures
- This component outlined the importance of selecting pilot states (Tabasco, Veracruz, Quintana Roo), obtaining some sort of hydrological model for the selected pilot states, analyzing the policy options so that climate change can have a prioritized role in decision-making, developing tools for climate management, and lastly conducting an institutional analysis for the implementation of adaptive management.

#### 4. Monitoring and evaluation systems for implementing the goals set out in the CAP.

- The project will support the design and implementation of the corresponding monitoring and evaluation systems to analyze the effectiveness of the adaptation measures adopted under the project framework.

### CAP Timeline

The CAP went into action in 2010 until 2017. During this time, the planned mid-term review took place in 2013, with a restructuring following in 2015. The project's official close date was in October 2016, with only a year left to implement the changes made in the restructuring properly. The restructuring, however, analyzed what progress had been made by the mid-term review point and altered the specifications of the CAP to suit what had already been completed more adequately.

## 3.2 Global Environmental Objectives (GEOs)

Global Environmental Objectives (GEOs) were developed for the CAP based on the goals in the components above (World Bank, 2016). The GEOs for the CAP were:

- To promote adaptation to the consequences of climate impacts in the coastal wetlands of the Gulf of Mexico by implementing pilot measures that will provide information about the costs and benefits of alternative approaches to reduce the vulnerability of said coasts to climate change.
- To assess the overall impacts of climate change on the Recipient's (Mexico's) national water resource planning, including identifying potential response options, focusing on coastal wetlands and associated watersheds.

The achievement of these goals was measured by the World Bank based on indicators set in place as a part of the CAP. The indicators for the CAP were restructured in 2015 (Box 2) to adjust the key performance indicators (KPIs) to more adequately reflect the conditions of the three pilot states (See Appendix 1 for the restructured CAP GEO indicators, Appendix 2 for the CAP Intermediate Outcome Indicators and Appendix 3 for the Tabasco Intermediate Outcome Indicators). The rationale for the restructuring include the World Bank stating that some elements of the CAP were put in place without seeing what existing legislature existed. Another reason for the restructure was that 2015 was the halfway point for the CAP and if some of the indicators were not mostly achieved by then, they needed to be adjusted. The GEOs above were not restructured, however, new ones were added:

- Two management plans for UMA in mangrove ecosystems were developed
- Infrastructure and equipment to reduce vulnerability to climate change applied in pilot sites
- Strengthening capacities for adaptation to CC in at least three municipalities

### Reasons for Restructuring

The project underwent restructuring due to several key factors. Firstly, there are no Natural Protected Areas (ANPs) in the wetlands of Tabasco, necessitating a shift in the project's focus. Secondly, a GEO Indicator outlining a 15k ha target had to be scrapped because there are no ANPs, and it required the definition of conservation areas by land use plans (LUPs) to happen first. This restructuring was seen by the World Bank as a testament to the project's adaptability and commitment to addressing goals set in place by the World Bank, despite these goals not addressing reduced climate vulnerability. It can be argued that the restructuring of this CAP may not have been necessary had the region been properly researched and the local community involved in the development of the CAP.

## 4. CAP Development Methodology

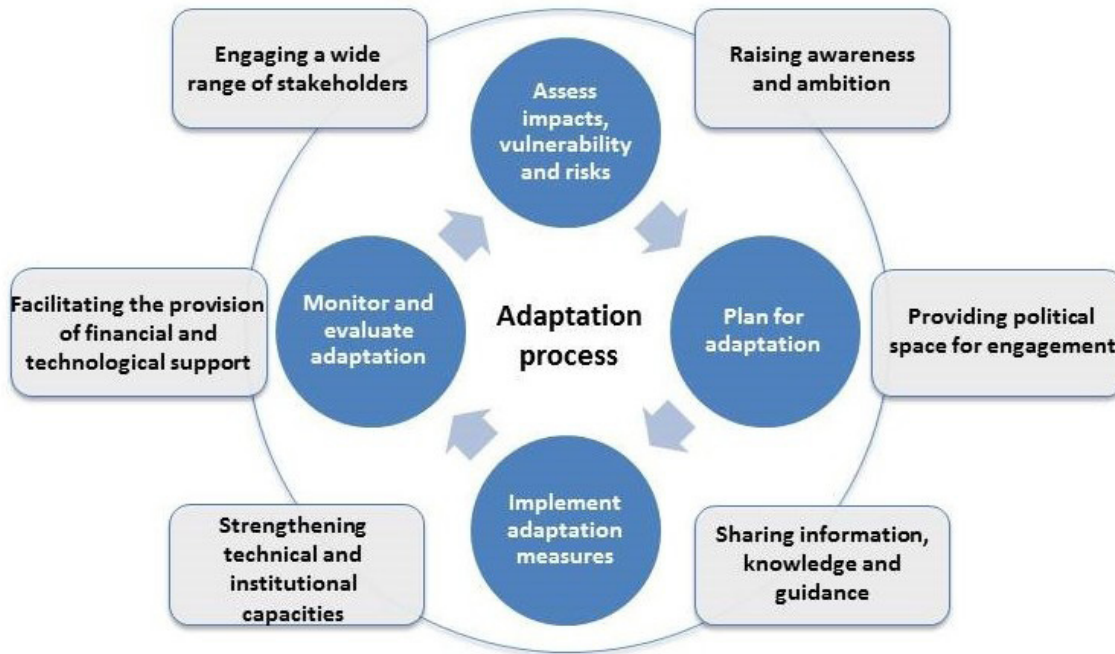


Figure 2: UNFCCC Climate Adaptation Framework | UNFCCC. (n.d.). Retrieved May 13, 2024, from <https://unfccc.int/topics/adaptation-and-resilience/the-big-picture/introduction>

The methodology used to create the CAP contained the basics of standard climate adaptation plans; assessment of vulnerabilities, stakeholder engagements, goal setting/planning, and implementation. Having an understanding of these methods is essential when creating a successful climate adaptation plan and over the last few years, the metrics for a successful climate adaptation plan have changed. This report will compare the standard climate adaptation plan methodology used in the CAP with the UNFCCC Climate Adaptation Framework.

The UNFCCC Climate Adaptation Framework (Figure 2) was selected as a basis of comparison due to its intended purpose of achieving the Global Goal on Adaptation and its connection with the UN Climate Change regime. The Global Goal on Adaptation was established in the 2015 Paris Agreement with the purpose of enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change (UNFCCC, n.d.). The UN Climate Change regime is a global framework that aims to mitigate global climate change by regulating human activity with the global climate system. This consists of the UNFCCC, Conference of Parties (COP) Intergovernmental Panel on Climate Change (IPCC), and the World Meteorological Organization (WMO), all collectively working together to create policy frameworks and scientific bases to understand climate change. Essentially, the framework is four global institutions creating what they have deemed as the best practice for global climate change adaptation.

The framework consists of an inner ring; vulnerability and risks, plan for adaptation, implementation, and monitoring and evaluation, and an outer ring; raising awareness, political engagement, sharing knowledge/guidance, strengthening technical and institutional capacities, financial and technological support, and stakeholder engagement. What makes this framework unique and different from the one used in the CAP is its cyclical nature, implying that adaptation is an ongoing process and does not end when the project is over. The CAP will be compared to the UNFCCC Climate Adaptation Framework to determine where there were gaps in the CAP, what was done well, and what improvements can be made.

#### **4.1 Step 1: Assess Vulnerability and Risks**

Assessing impacts, vulnerability, and risks consists of determining the conditions of the selected region and whether they are susceptible to climate change, thus requiring a climate adaptation plan.

At the start of the CAP, Mexico had been identified as a globally particularly vulnerable region to the impacts of global climate change. Tabasco was assessed by the World Bank and selected partially since its coastal wetlands are home to 45 of the 111 endemic species of aquatic plants registered for Mexico, making it a vital region for conservation (World Bank, 2006). Mexico's wetlands are considered the most productive ecosystem in the country, with their productivity closely linked to the water cycle. This region was also selected because of its connection to the Gulf of Mexico. The Gulf of Mexico was identified as a region vulnerable to increasing ocean temperature, sea level rise, high-intensity hurricanes, and changes in precipitation patterns. This region also experiences heavier rainfall than most Mexican states. In October 2007, heavy rains caused widespread floods in Tabasco's coastal regions. At the time, it was considered to be the most detrimental flood in 50 years, with approximately 80% of the state flooded. The average rainfall for the month of October in 2007 was around 317.5 mm (Rivera et al., 2010). During a 3-4 day span of heavy rains, the maximum recorded rainfall daily was between 200 mm and 300 mm (Rivera et al., 2010). Prior to this 3-4 day span, the average rainfall recorded was between 0 mm and 1.7mm. The high levels of rainfall carried on into the month of November. During this period, the CAP was in its developmental phase, with proposed flood mitigations being integrated into its framework.

The only flood-responsive aspect of the CAP is the restoration and reforestation of mangroves and riparian areas, which can hold water during heavy precipitation events. However, according to the CAP, flood response was not an explicit consideration when deciding to restore and reforest mangroves. Moreover, wetlands, specifically mangroves, are important to the survival and flourishing of Mexico's communities and coasts due to their environmental benefits. They provide the coasts with natural protection from storm surges and erosion and house many marine species that locals fish (Spalding et al., 2014). Mangroves also serve as water filtration systems, filtering phosphates, nitrates, and other pollutants (Kim et al., 2016). As an added benefit, if mangroves can be protected and erosion prevented, they can capture and hold carbon. This means that mangroves can help mitigate climate change and reduce climate-related hazards, protecting the community and the region. Therefore, coastal communities in Tabasco that are near the mangroves have more of a buffer between themselves and many climate change impacts.

At the start of the CAP, data on CPM wetlands noted a decline in mangrove and riparian vegetation and no future plans for reforestation. There was no management plan for mangroves, no management plan for wildlife conservation or management, and no sustainable utilization units (UMA) in man-grove ecosystems. Before the CAP, the CPM Wetlands (Figure 3) were not Natural Protected Areas (ANPs) and had no set land use plan or land use planning program. Information about climate change was also limited at this time. Reasons for the deforestation of mangroves in this region include the placement of oil pipelines, logging, animal breeding, and agriculture, to name a few. Following the CAP, the CPM still is not an ANP.

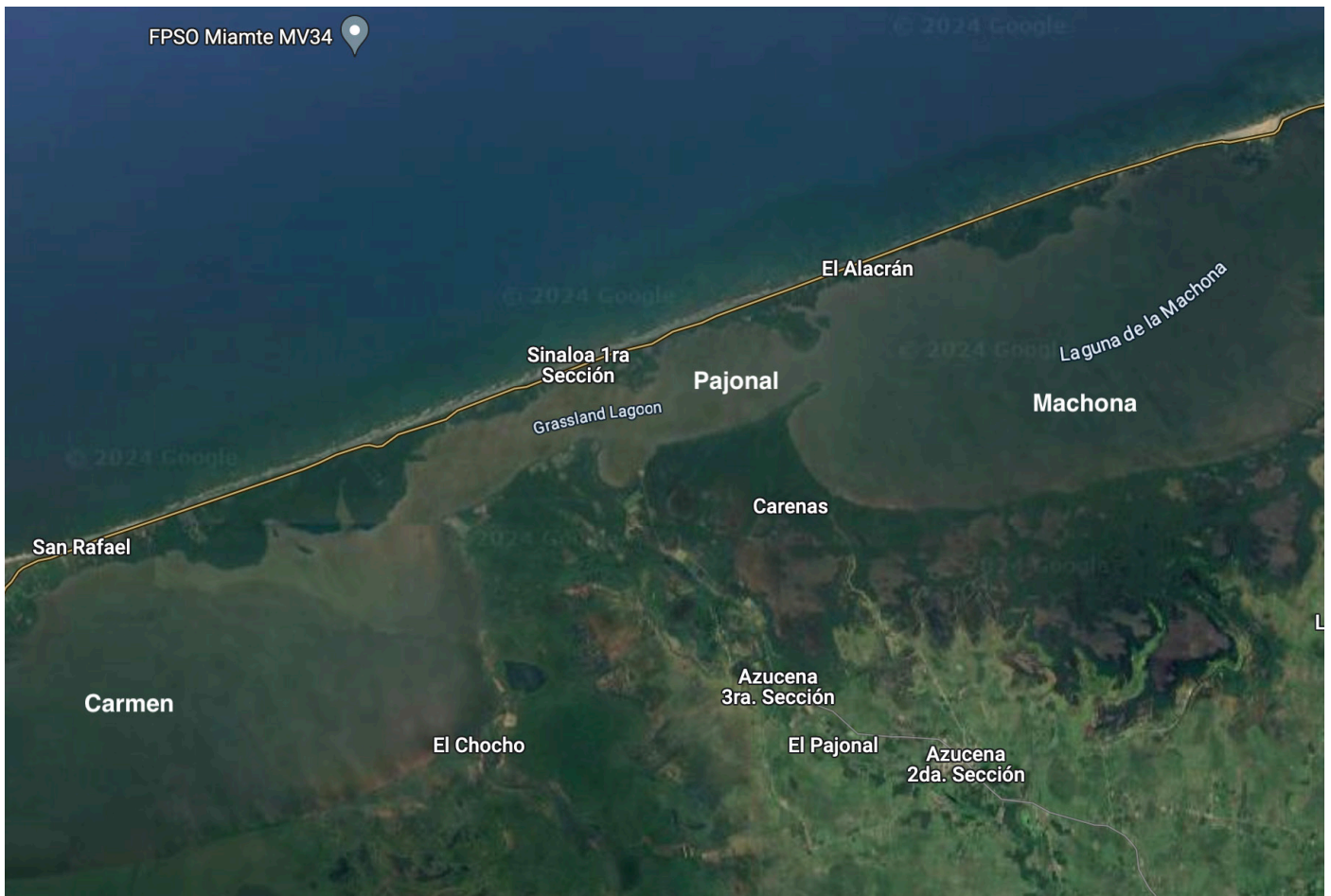


Figure 3: The Carmen-Pajonal-Machona Lagoon system. Source: Google Maps



## Stakeholder Engagement

The local community, regional government, and federal/national government were defined as the stakeholder groups for this CAP. A crucial element that was overlooked was whether each group had the capacity and ability to coordinate. Historically, the lack of capacity within and coordination between these three stakeholder groups is the reason for stunted climate adaptation development in this region.

The CAP took many approaches to engage stakeholders. In Tabasco, the CAP stated that stakeholder participation was key in assuring the CAP's success. It is important to note that stakeholder participation in Tabasco was documented to mainly consist of the local community with some elements of regional/municipal government and little to no federal/national government involvement. Stakeholder engagement and participation took the shape of design documents and protected area management being presented and discussed with key stakeholders (GEO Indicator B), workshops being done with the local community (Indicator 6), land use plans discussed with stakeholders (Indicator 12), and contract processing (Indicator 23). The World Bank documents are the only source of information regarding the work shops. The documents that the World Bank have published all state that these workshops occurred and were deemed "successful," but no Tabasco-specific sources cite these workshops happening.

Stakeholder participation was deemed essential when designing climate change adaptation measures for the CPM Lagoon system. Local stakeholders were needed for this due to their local knowledge and connection to local institutions and academics. The idea of community-based adaptation (CBA) was needed considering it takes context, culture, knowledge, and agency into consideration when designing plans (Kirkby et al., 2017). Under this, the workshops (indicator 6) were the primary area of stakeholder participation, although information regarding the details of these workshops was limited. The first workshop reported focused mainly on vulnerability evaluation and assessment of climate change impacts. The second workshop reported was used to identify highly vulnerable and/or valuable sites where adaptation measures should be implemented. The local community was also crucial for conducting much of the wetlands fieldwork. There was no availability on the specific dates and years of these workshops. However, they were stated to have been conducted during the CAPs 2010-2017 lifespan, with no indication if they still exist today.

## 4.2 Step 2: Plan for Adaptation

This step consists of creating a plan for adaptation in the selected region. It also consists of determining what plans existed before the proposed one and what is feasible for the region.

Risk assessments were noted to have been conducted at the start of the CAP (2010) as a part of the Environmental Management Framework of the CAP under the corresponding components of the CAP project design (step 3). The components created as a part of this CAP serve as a framework for all indicators (GEO, Tabasco, etc.) to follow. All indicators fall under the category of one of the four components. All the risk assessments listed contain a clause that states that the design has considered environmental issues and impacts outlining potential risks the environment and community may face. The risk assessments include the severity of the effects proposed, with most being determined to have no significant impact. Those with slight impacts have intervention measures to reduce the vulnerability of the impacted region.

As stated, the CAP components create a guideline for the four GEO Indicators (Appendix 1) to follow. For Indicator A, the design documents allow for future adaptation by creating a framework to ensure ample sustainability strategies and guidance for prompt implementation and management provisions. Indicator B created two land use planning programs (LUPPs), and the one in Tabasco was then approved by local authorities in 2016, paving the way for future implementation. Indicator C consisted of a plan to reforest mangrove and riparian ecosystems but did not indicate if forested areas would be increased. Indicator C does not mention that the CMP wetlands are not an ANP, which is important to note because this prevents certain proposed adaptation measures from occurring. Lastly, Indicator D focuses on creating climate change impact scenarios for the creation of a national water response, which Mexico had not yet created. While the GEO Indicators focus on the bigger picture, the intermediate outcome indicators allow for more specific and relevant updates to the project, and were, in fact, updated and restructured throughout the seven-year CAP period (Appendix 2). The project underwent restructuring due to several key factors. Firstly, there are no ANPs in the wetlands of Tabasco, necessitating a restructuring. Secondly, a GEO Indicator outlining a 15k ha target was scrapped because there are no ANPs, and it required the definition of conservation areas by land use plans (LUPs) to happen first. Although these lofty goals were created within the indicators, many aspects of the indicators required further research and evaluation.

The World Bank deemed the restructuring a testament to the project's adaptability and commitment to addressing goals set in place by the World Bank, despite these goals not addressing reduced climate vulnerability. It can be argued that the restructuring of this CAP may not have been necessary had the region been properly researched and the local community involved in the development of the CAP. It can also be argued that the new goals set by the restructuring degrade the value of the plans due to its newly lowered expectations.

### Pre-CAP Legislation

In 2005, the National Committee on High Priority Wetlands was created by the National Commission of Protected Areas (CONANP) to develop guidelines and recommendations for wetland management (World Bank, 2012). A National Wetlands Inventory was promoted by CONANP, CONABIO, and SEMARNAT, among others, to assist the decision-making process. Despite the creation of this committee and the promotion from these institutions, very little was done from this. As stated, the committee only created guidelines and recommendations, and these guidelines and recommendations were not enforced. Additionally, the promotion from CONANP, CONABIO, and SEMARNAT were examples of institutions advocating for an inventory, but no information on whether the inventory was created is known.

The 2007-2012 National Water Program was divided by region and outlines goals set for 2030 (Comisión Nacional del Agua, 2008). The National Water Program cites rainfall as a key factor in water management and the goals consist of improving water productivity, access, management, and sustainability. Climate change is specifically mentioned as one of the goals being “To assess the effects of climate change on the hydrological cycle.” Within this goal are objectives that center on developing climate change scenarios, formal educational programs, and developing climate change adaptation indicators. Climate adaptation plans are not specifically mentioned, but many of the objectives within the goal seem to overlap with the goals of a climate adaptation plan. Although this National Water Program seems very encompassing and robust on the surface, evidence of the climate change-specific goal being implemented is difficult to find. Wetlands are mentioned as needing priority in conservation and preservation, but no clear plan is outlined. In this National Water Plan, Tabasco was identified as a highly impacted region due to high rainfall and flooding potential and is specifically cited in this plan as needing infrastructure to regulate flow rates and rivers and reduce flooding. In this National Water Plan, towns in Tabasco take up the #1, #2, #12, and #16 spots on the list of rainfed districts. Clearly, ample research in this region has been conducted by the government, but no plan on how to move forward is explicitly stated.

In 2007, Mexico amended the General Wildlife Law (GWL), which, as it pertains to wetlands, covers the protection of the integrity of coastal wetlands, including the restoration of hydrology, contiguity, water supply, and coastal stabilization (Cámara de Diputados del H. Congreso de la Unión, 2000). The GWL is mainly concerned with protecting wildlife/organisms in Mexico, not necessarily the conservation of their wildlife’s environments. For this reason, the inclusion of wetlands was monumental but as it was not the primary focus, any plan regarding wetlands was not as extensive as a CAP. Before 2007, many wetlands in Mexico had been designated Protected Natural Areas (PNAs

or ANPs), however, the CPM in Tabasco had not been declared one. It is important to note that this is not the case with all wetlands in Tabasco; the Pantanos de Centla wetlands have been protected since 2006 and were declared an Ecoregion by the World Wildlife Fund (WWF, 2001). It is unclear as to why the CPM had not been included in prior wetland preservation legislation, but it is also important to note that this region is popular for industrial development, specifically in Mexico's oil and gas industry. This is an industry that Mexico has expressed interest in expanding over the past decade.

It is evident that before the CAP, some discussion of wetland conservation and climate change had been discussed in legislation, but not to the extent of actual implementation. The existing legislation and policies surrounding climate change and wetland conservation heavily focused on creating guidelines and a baseline acknowledgment of any issues surrounding these two topics. Ultimately, the existing foundations for the CAP were challenging to work with, meaning that the CAP needed to fill in any remaining gaps, specifically those involving actual implementation measures.

### **Political Engagement**

The CAP cites Mexico's 2013-2018 National Development Plan as an example of an overlap between the CAP's objectives and its reliance on national policy in Mexico. This was also an example of how this CAP supports that legislation, specifically in strategies for disaster prevention and how to engage local stakeholders (Diario Oficial de la Federación, 2013). This CAP also cites Mexico's National Climate Change Strategy's Vision 10-20-40 and the 2014-2018 Special Climate Change Program (PECC) as examples of how the CAP supports its sustainable development and conservation goals, specifically regarding ecosystem management and climate change adaptation and mitigation.

### 4.3 Step 3: Implement Adaptation Measures

This step consists of the implementations in Tabasco that were targeted towards increasing local resilience and decreasing vulnerability.

The World Bank had several implementations they wanted to apply to Tabasco for this CAP. First, the World Bank considered a comprehensive land use plan, including zoning regulations, land management strategies, and community engagement, essential for understanding and addressing the deforestation occurring in the region. At the end of the CAP, this land use plan was created and submitted for approval to local authorities, but there was never an update on whether it was approved.

Second, the CAP outlined the importance of the reforestation of mangrove ecosystems and riparian zones. At the end of the CAP, 25 ha of mangroves were reported reforested, and 5 ha of riparian zones were reported restored.

Third, the World Bank sought to install equipment and infrastructure for climate change adaptation monitoring established through the CAP. Throughout the life of this CAP, a rainwater capture system and a water plant were installed. Mareographic and meteorological stations and radio and communication equipment were also installed. The radio and communication equipment functioned as early warning systems for the communities in Tabasco.

Wildlife conservation, management, and sustainable units (UMA) were also seen as necessary in Tabasco, and a UMA plan was created through the CAP. Creating a UMA was the extent of this implementation, as there was never an update if the UMA was approved by local authorities.

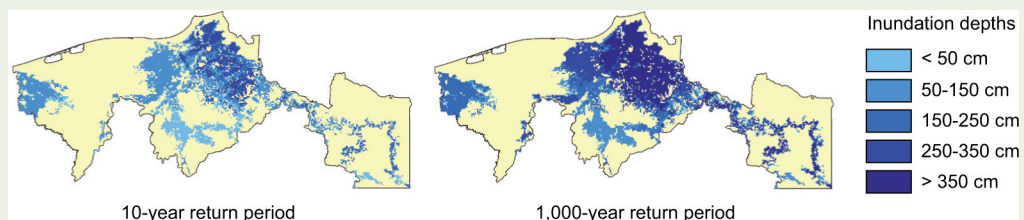
Lastly, workshops within Tabasco communities were seen as incredibly important in strengthening the region's capacity for climate change adaptation. There were at least four workshops throughout the CAP, and high levels of community participation were reported. These workshops focused on proposing designs for adaptation measures, presenting a diagnostic of climate change conditions in the area, and brainstorming methods to strengthen regional capacities for climate change adaptation.



### Information, Knowledge, & Guidance

Local communities in Tabasco were tasked with providing and facilitating geographical and regional knowledge. The workshops outlined in Indicator 6, designed for stakeholder engagement, prioritized leaving the local community with enough knowledge and guidance to maintain the proposed implementations. It is unclear what exactly the local communities contributed to these workshops or if they were as involved as the World Bank claimed that they were.

This CAP required creating a cost-benefit analysis (CBA) of adaptation measures in the coastal wetlands document, which was meant to be disseminated to existing institutions in Tabasco (Haer et al., 2017). For Tabasco, this looked like an analysis of flood risk and the desirability of flood protection. The cost-benefit analysis results estimated that flood damage to infrastructure would be up to \$4.12 billion USD by 2080 if no adaptation measures were taken during the CAP. The cost-benefit analysis proposes a multi-disciplinary approach to assist policymakers in flood risk management decisions and suggests that more research is needed on environmental conditions. This report was published in 2017 and covered the years under the CAP implementation. During this time, tropical storms, heavy rainfall, and storm surges were all reported causing destruction to the region. The cost-benefit analysis estimated that the current SLR is around 3.4mm/year and is projected to increase to 8.0mm/year. The CBA project created projected inundation maps for 10-year to 1,000-year return periods to illustrate what Tabasco could look like without climate adaptation measures addressing SLR (Figure 4). It is important to note that since this cost-benefit analysis was produced at the end of the CAP period, the recommendations that would have been useful for the CAP were not able to be implemented/used. Although, the recommendations could be useful for future climate adaptation plans in this region.



*Figure 4: Inundation maps for 10- and 1000-yr return period coastal floods under current climate conditions (Haer et al., 2017)*

The distribution of information surrounding the CAP and its results was relatively internal to the Tabasco community, meaning the national government and other external stakeholders were not the recipients of the results from this CAP.

### **Strengthening technical and institutional capacities**

The CAP mentions strengthening technical and institutional capacities in the indicators found in Appendix 2. A wildlife conservation, management, and sustainable utilization units (UMA) plan was crucial for the CAP. In Tabasco, a UMA is perceived to develop actions that will contribute to mangrove conservation and provide equipment, infrastructure, and local training to reduce the population's vulnerability to climate change. As of now, UMA certification is still pending in Tabasco, and it is unclear when or if the certification will be approved or cleared.

Regarding more technical capacities, Indicator 5 called for building and implementing infrastructure and equipment to reduce Tabasco's vulnerability to climate change. This included mareographs, rainwater caption systems, radio communication equipment, and early flood warning systems. Although this indicator was considered fully achieved, there are still instances of climate change impacting the region today, such as extreme flooding.

Workshops conducted in the local community during this CAP implementation also claimed to have strengthened capacities for climate change adaptation, but there was no report of whether these workshops were active or if there were lasting improvements - or any improvements.

As noted in the CAP, this CAP was the first consolidated and integrated effort to address climate change adaptation in Mexico. There is no availability of information within the CAP as to if this outcome was achieved however, the National Institution for Ecology and Climate Change (INECC), one of the Mexican institutions involved in the CAP created a position, Directorate for Vulnerability and Ecological Adaptation, tasked with leading these efforts in the future. A cited outcome of this position was strengthening the local community to become leaders and champions of adaptation (World Bank, 2017).

There are a few measures the federal government has implemented to strengthen technical and institutional capacities. Mexico's *National Development Plan for 2013-2018* focused on generating community development schemes and strategies for disaster prevention, with one of its four pillars being sustainability (Diario Oficial de la Federación, 2013). However, climate change adaptation was not an explicit goal. There

was also the *National Climate Change Strategy: 10-20-40 Vision* which contains an adaptation pillar, that prioritizes conservation and ecosystem management (Ministry of the Environment and Natural Resources, 2013). The Government of Mexico created the *2014-2018 Special Climate Change Program (PECC)*, a program dedicated to reducing the vulnerability to climate change, and preserving and protecting ecosystems and environmental services. The PECC had an objective that outlines conserving and sustainability managing ecosystems, specifically mentioning protecting and conserving marine ecosystems and their biodiversity (Ministry of the Environment and Natural Resources, 2014).

#### 4.4 Step 4: Monitor and Evaluate Adaptation

Monitoring and evaluating an adaptation plan is a critical step in supporting successful climate adaptation. This step is included in the UNFCCC Framework for Adaptation because it consists of tracking the progress made in implementing climate adaptation plans as well as measuring effectiveness of these plans (UNFCCC, 2023).

According to the results published in the CAP, monitoring and evaluation consisted of three elements: design, implementation, and utilization.

For the design aspect, the CAP cites detailed monitoring and evaluation system guidelines written into the project's operational manual. However, this document was not accessible, so it is unclear if these guidelines were followed to completion. The CAP also cites a "project implementation team" (PIT) that was responsible for monitoring and evaluation. This is the first mention of any project implementation team within the CAP.

For implementation, the CAP cites frequent meetings between the "project implementation team" and stakeholders to monitor implementation progress, identify bottlenecks, and define mitigation measures. It is unclear which stakeholders they are referring to. The CAP cites that during these meetings, the PIT reviewed progress toward fulfilling the key project indicators, but the CAP does not outline how.

Lastly, for utilization, the CAP states that the PIT frequently visited the pilot states to obtain "firsthand knowledge" of the status of the development in Tabasco. This is also the first mention of any visit to the region. The CAP also claims that these visits helped determine which indicators needed restructuring.

Monitoring and evaluation ensure that the implementation is successful in terms of actions taken and the effectiveness of these actions within the CAP. This CAP identifies success as stating that there are tools in place and the capacity for the community and region to continue the CAP's work. This CAP approach is linear, meaning that once the end goal is achieved, there is no plan to continue the CAP's goals after the end date. This approach can be detrimental to the longevity of the CAP since there is no plan to reinforce the infrastructure or policy guidelines as they adapt and require maintenance over the coming years.

Additionally, the monitoring and evaluation information available within the CAPs final published report was limited since the results were stated to be in the operational manual, which was inaccessible.

### **Active Local Organizations**

Despite little follow-through from the agencies tasked with CAP monitoring and evaluation, some on-ground groups in Tabasco have taken it upon themselves to continue the CAP's work.

"Women in Action" is a group based in El Palmar funded by the UNDP through the Small Grants Program of the GEF. Women in Action plans to restore 205 ha of mangroves in collaboration with communities that rely on fishing and tourism (PPDMéxico, 2023). This project is part of the Restoration and Conservation of Coastal Wetlands and Community Development, funded by the World Resources Institute Mexico (WRI).

"RE3CO" is another initiative led by the World Resources Institute Mexico and the Small Grants Program that is dedicated to mangrove restoration. This initiative focuses on ecosystems in the Yucatan Peninsula, Oaxaca, and Tabasco (WRI, 2024). Their goals include restoring and conserving over 4,000 ha of mangroves across 10 sites and enhancing resilience to climate change for coastal communities and ecosystems. This is a new initiative.

## 5. Case Studies

The following case studies are examples of current events that have occurred in Tabasco. These case studies portray instances where the aforementioned CAP did not yield the desired outcomes. By dissecting the instances in which the CAP did not effectively address climate concerns in Tabasco, it is possible to understand what future actions should be taken.

### 5.1 El Bosque

El Bosque sits along Tabasco's coast, near the wetlands and on a peninsula jutting out into the sea. Since the 1980s, this town has been a fishing hub, developing into a small community with churches, three schools, and residential areas. Over the past few decades, the town faced the impacts of coastal erosion, sea level rise, and hurricanes. Today, this town has ceased to exist (Williams, 2023). Once home to a population of over 700, as of December 2023, El Bosque is completely underwater. Sea level rise has ravaged this once lively town and sunken the livelihoods of all of its residents, many of whom are still displaced or living in the ruins.

Tabasco is a region that has high risks of rising sea levels, especially in the areas in proximity to the wetlands (Figure 5). El Bosque was no stranger to floods and coastal erosion, with its coastline being cited to have moved 500 m inwards since the early 2000s. Since 2019, severe weather events attributed to climate change have been eroding the shoreline; now, in 2024, nothing is left of the town. This is the first recorded instance of a village overtaken by sea level rise in Mexico. El Bosque does not lie near the wetlands that the CAP aimed to protect. Instead, its geographical location is on a peninsula, causing it to be more exposed to the sea (Nygren & Lounela, 2023). El Bosque may be the first in Mexico, but many coastal communities in Mexico are also at risk of rising sea levels.

The case of El Bosque begs the question of how far climate adaptation plans should extend, especially when a town repeatedly suffers from flooding and coastal erosion. When determining the parameters for the CAP, climate adaptation strategies that concerned sea level rise and flooding consisted of early warning systems and mareographs in El Golpe, Las Coloradas, and El Mingo, but none in El Bosque, a town famous for its flooding.

An element in climate adaptation that the CAP lacks, as shown with El Bosque, is climate displacement strategies. The residents of El Bosque claim to have been waiting for displacement aid, housing, and overall government assistance since the first severe flooding in 2019 that displaced over 400 residents.

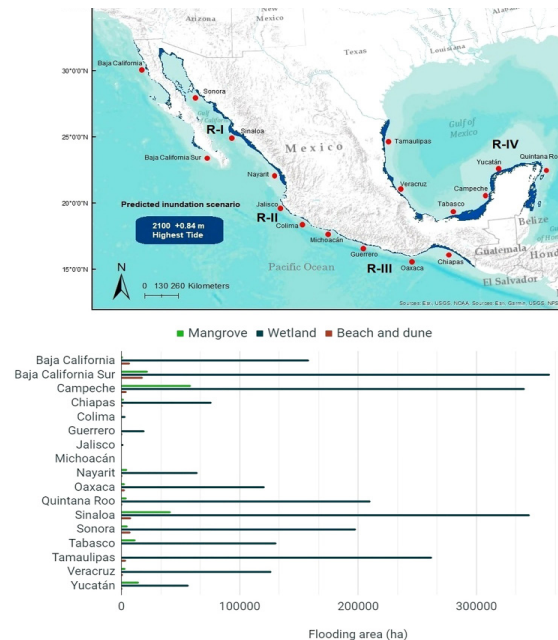


Figure 5: Predicted coastal flooding areas resulting from sea level rise in Mexico (Fernández-Díaz et. al, 2022).



The municipal government's hands-off approach was attributed to the belief that this was now the national government's concern. However, then Mexican president, Andres Manuel Lopez Obrador, opted to use the national climate adaptation funds to finance a train project that will destroy sectors of the Yucatan Jungle Shailer, 2023). Moreover, the lack of climate displacement strategies shows a deficit in the CAP. This CAP prioritizes preventative measures, rather than explicitly addressing issues already plaguing the region.

It can be argued that there are existing funds in place that specifically address these types of climate concerns. However, areas like El Bosque do not have the means or capacity to apply for these funds actively because of their government structures. The municipal and regional governments deem these climate issues as a national concern and not something the state of Tabasco can handle.

## 5.2 Pemex Refinery

Understanding the implications and importance of the Dos Bocas Refinery on climate adaptation requires background on the role of PEMEX and energy security in Mexico. Mexico prioritizes state-owned enterprises like PEMEX due to its promise of energy security. By having a robust national oil company, Mexico is in a position to take part in energy negotiations. It does not need to rely on global superpowers like the U.S. to provide its nation with energy. The concept of energy security within Mexico comes with many caveats. The Dos Bocas refinery presents many opportunities that could benefit the nation and the economy. The creation of this refinery provided over 15,000 jobs in Mexico, with 36% of those employed being from Tabasco (Techint, 2024). According to the Mexican president, this refinery is set to produce nearly 300,000 barrels of gasoline per day. It is also important to note that Tabasco is Andres Manuel Lopez Obrador's home state. Some believe that this was instrumental in choosing Tabasco as the site of this refinery. However, it can also be argued that the geographical location is a driver of this, too, being so close to the coast and oil sites.

Alleged documents from 2006 and 2007 published by the Secretaría de Medio Ambiente y Recursos Naturales (SEMARNAT) indicate that there was a protected mangrove area in a region in Tabasco that is now where the Dos Bocas refinery is located (de Haldevag, 2021). According to these documents, Petroleos Mexicanos, or PEMEX, a Mexican state-owned petroleum company, was the organization that committed to protecting this region. They conducted an environmental impact assessment of the region. They deemed it a "high-priority area," stating that this would now be a "restricted use zone" due to its biodiversity and environmental benefits, such as flood protection. In 2019, a third party illegally removed the mangroves on the Dos Bocas site and was fined by the Security, Energy, and Environmental Agency (ASEA). Despite this, satellite data published by Quartz shows that these mangroves continued to get torn down during the construction of the Dos Bocas Refinery (Quartz, 2020).

The idea behind clearing the mangrove ecosystem is set to imply that the financial benefits received from the refinery overpower the financial benefits received by the wetlands. While this may be true, it does not discount that this region was specifically protected by PEMEX due to its importance in the ecosystem. It also does not discount the fact that the financial benefits generated by the refinery have no evidence of directly impacting the local communities' relationship to the environment. It sets a precedent that protected areas do not mean much in the eyes of the government when there are financial incentives involved.

## 6. Policy Recommendations

It is evident that this CAP has not achieved its targeted goals. The following are proposed policy recommendations for changes in climate adaptation plans and the Mexican government.

### 6.1 Extensive Evaluation of CAP Region Conditions: Creating a Meaningful CAP for the Region

Many climate change adaptation plans default to a “one-size-fits-all” approach, applying generalizations that may not apply (Hansen & Bi, 2017). For example, the UNFCCC Climate Adaptation Framework needs to be interpreted to meet local needs. Each nation is incredibly nuanced with what risks they face, how their government operates, and what their capacity for climate adaptation is. The Framework needs to be applied with that knowledge.

There is no one-size-fits-all solution for these nuances, but there are ways for these questions to be answered in climate adaptation plans. The CAP for Tabasco underwent an intensive restructuring in 2015 that decreased the ambition of the original goals. Not only did this process reduce the ambition, but it also took time and resources that could have been used to have a more comprehensive evaluation process of the region’s environmental conditions and capacity to support a CAP. The CAP cites Indicator 13 as one of these instances that required more research on Tabasco conditions and existing legislation in this region. If individual nations and entities such as the World Bank and the UN want to create comprehensive, achievable, and impactful CAPs, it is crucial that there is a capacity for a CAP in the selected region, meaning a thorough assessment of the region to determine its strengths and weaknesses.

It can be argued that risk assessments outlined in Step 1 can be reworked to include an extensive evaluation of CAP region conditions, and although that may be true, risk assessments mainly serve to see how likely a region is to be affected by climate change. There needs to be a specific assessment that takes into account what measures the area already has in place, what its funds look like, meaning what funding is already available and what is needed, and more importantly, what is the state of the region as it stands. The region’s state can be defined as what is the level of infrastructure, what is the local community capable of contributing, whether the region has already been heavily impacted by climate change, and whether there are institutions in place to promote the longevity of the CAP. Additionally, the design of the CAP needs the input of the local community and stakeholders and needs to be co-developed by them as well. Along with this, it is essential that a CAP coordinates with already established institutions in the region.

For example, Mexico has a history of having very dominant state-owned enterprises (SOEs) such as PEMEX be involved in Mexican and global environmental initiatives, such as PEMEX’s promise to reach net-zero emissions by 2050 (Climate Action 100+, 2024). This can be seen as problematic since PEMEX is a large contributor to the environmental destruction of Mexico (Squires & Vazquez, 2024). PEMEX’s high involvement in environmental policy and implementation is also seen as a means for them to offset their destruction. It would be beneficial to the productivity of future CAPs

It would be beneficial to the productivity of future CAPs if these SOEs are included in the development of the CAPs, considering that they are a primary collaborator with the Mexican government and they are essentially institutions that Mexico cannot function without. To not include SOEs in the CAP conversation would be a misstep due to their connectedness with the government.

## 6.2 National Displacement Plans

As seen in the scenario with El Bosque, many coastal towns worldwide are at risk from rising sea levels. Even more “developed” nations with seemingly better climate change policies are at risk of befalling the same fate as El Bosque. For instance, the town of Shishmaref in Alaska lies within the Bering Land National Preserve, a protected region considered a tribal region. This town can be seen as another dire example of the impacts of sea level rise (Andres Henao, 2022). Residents of Shishmaref have been well aware of the risk their town faces for over two decades now, even having voted twice to relocate. Reasons for their unsuccessful attempts at relocation include their lack of funding. In 2021, the United States released the US EPA Climate Adaptation Plan, with a specified addendum for tribal affairs (EPA, 2021). This 32-page addition acknowledges the consequence of displacement only once and cites that funding is a solution, and focuses heavily on increasing resilience rather than responding to the impacts. For this reason, a National Displacement Plan is an essential element of a climate adaptation plan.

Plans that tackle damage, loss, and displacement caused by climate change are beginning to emerge from global entities such as the United Nations. The UNFCCC agreed to establish a Loss and Damages Fund during the Conference of Parties (COP) 27; however, it was not implemented until COP28 the following year (UNFCCC, 2024). This fund is specifically to assist “developing” nations that are vulnerable to the impacts of climate change. The Loss and Damages Fund follows the traditional definition of loss and damage, which is economic loss damage (infrastructure damage, reduced crop yield) and non-economic loss and damage (culture, displacement). Despite this fund being in its infancy, it is already commendable how it prioritizes non-financial incentives for responding to climate change. It is difficult to determine how quickly this fund can be implemented effectively and what its true impacts will be, but it is a step in the right direction.

The UN Loss and Damages Fund is a strong start, but it can be argued that it is simply not enough. A loss and damage fund, specifically one with a clear and robust climate displacement fund or plan, needs to be implemented at a national level. Additionally, funds similar to the UN Loss and Damages Fund are meant to address damage caused by climate change, but they still remain separate from climate adaptation plans. It would be more practical if loss and damage funds fell under the umbrella of climate adaptation plans. Going forward, when governments such as Mexico agree to take on a climate change adaptation plan from groups like the World Bank, the UN, or the IMF, it is imperative that these plans integrate some sort of timely response or funds set aside to assist the communities already suffering from climate change, along with communities that will suffer from

climate change. It is not an effective adaptation strategy if there is no solution for those who have already suffered from climate change. Additionally, when governments like Mexico begin to plan their climate change adaptation strategies, it is imperative that displacement programs are considered.

Similarly, based on the findings of the CAP, displacement plans need to integrate local and municipal governments. This could look like state-specific funds for climate change impacts set aside for communities and natural systems management. It can be argued that early warning systems, similar to the ones the CAP helped implement, are not enough to aid communities with climate change impacts, considering that they do not specifically address the needs of communities that have already been impacted. It is local and municipal governments that are key in assuring the communities they govern have the resources they need to thrive in new climatic conditions. It is impossible to reverse climate change, but it is possible to provide opportunities and resources to those who have been victims and those who will be victims. All this being said, this would be impossible to implement effectively without the support and backing of the government. As previously noted, the lack of coordination between the local and national governments is a large part of why this CAP may not have been as successful and effective as reported.

### **6.3 Data Collection System**

There was a lack of information regarding the long-term results of the implementation of the CAP that was examined. Successful implementation results in this CAP are based on whether the indicators were achieved within the CAP's time span. This CAP cites creating infrastructure in Tabasco communities to support ongoing climate change adaptation. Still, it does not cite whether this goal, in particular, was successful and if the local communities kept up with the implementations after the CAP period. In short, monitoring is lacking. A monitoring system or database that frequently updates information on CAPs would be extremely useful for CAP creation in the future.

There are no clear institutions in place to ensure continuous monitoring after the CAP ends, and there is no measure of accountability after the fact to ensure that the CAP is still doing what was promised. A database published by the World Bank, IMF, or any other agency tasked with climate adaptation plans should be included in the monitoring and evaluation step of CAPs. Along with the infrastructure built and the restoration work, CAPs should allow for seamless data reporting so that these databases can be reliable and timely. It would also be necessary for organizations like the World Bank and the IMF to change their reporting indicators, as nothing in the existing indicators points to ensuring the long-term effectiveness of CAPs.

This could also be proposed as a national database for countries like Mexico to track climate change adaptation actions across their states. This would be extremely useful for Mexico to move forward in environmental policy by allowing entities that do conservation and policy work the ability to see what progress has been made in Mexico. This would require heavy cooperation and



enforcement from the Mexican government to ensure that the states participating in climate change adaptation provide and enter data. This could be something that could begin at the university level, considering that currently, the universities in Tabasco are at the forefront of mangrove conservation and environmental research. Additionally, as Mexico continues to advance its climate strategy, it could expand to state-owned enterprises that operate in Mexico. This will only be successful if the seeds of successful monitoring and evaluation are planted during the preliminary stages of a CAP. This recommendation cannot exist without Policy Recommendation 1: Extensive Evaluation of CAP Region. The region will need to be assessed for existing climate-related policies. If no regional policies are already in place to assist with this data collection and database, then institutions will need to be created.

Additionally, a database is only successfully created if the CAP has long-term goals and outcomes. Many CAPs in developing nations fall short of the data needed to create a database because after bodies like the World Bank or U.N. leave and declare the CAP a success, nobody ensures that the CAP stays a success (Feder, 1983).

### 6.4 Environmental Offset System

As mentioned in the PEMEX section of this report, the economic incentives that the Dos Bocas Refinery has provided for Tabasco and Mexico are considered high enough to compensate for clearing a mangrove ecosystem.

The refinery was meant to be completed with a budget of \$8 billion USD; however, as of March 2024, it has cost Mexico \$18.9 billion USD (Mexico Business, 2024). The financial returns on the oil produced at this refinery are still in their infancy, with the exact value still not known. However, what is known is that Tabasco was estimated to have over \$200,000,000 USD in economic losses per year due to the disappearance of wetlands (Figure 6) (Fernandez-Diaz et al., 2022).

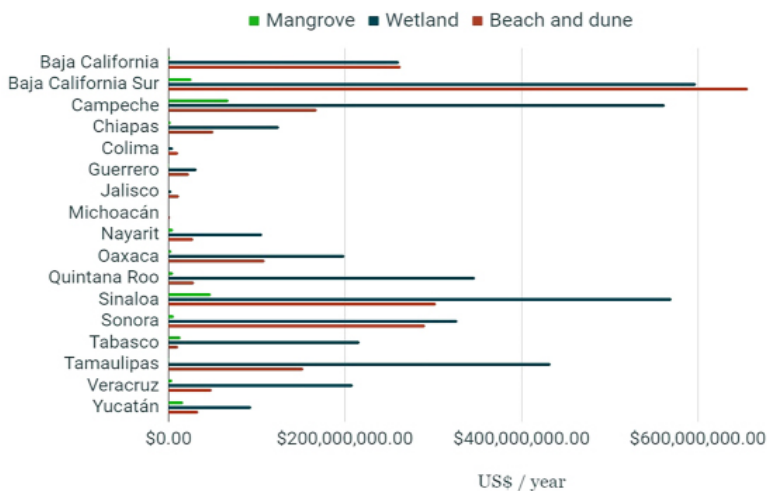


Figure 6.: Annual economic losses by state due to the disappearance of ecosystem services in Mexico (Fernández-Díaz, et. al. 2022).

Whatever value the Dos Bocas refinery may provide to the economy, additional income from wetlands or any other ecosystem service is not harmful. For that reason, an Environmental Mitigation System, similar to the framework of carbon credits, would be extremely beneficial to the Mexican economy. The mangroves cleared to create the Dos Bocas refinery are not easily replaceable, considering that mangrove ecosystem restoration can take over 20 years (Burns et al., 1993). If there were an existing Environmental Mitigation System in Mexico, it would be possible for PEMEX to purchase some sort of credit that allows them to fund organizations with projects dedicated to environmental restoration or protection of another at-risk region. Naturally, this will not restore all the losses created by the mangrove deficit, but while projects like the Dos Bocas refinery cannot be undone, these credits can provide benefits elsewhere. An argument is that this system will only incentivize environmental destruction because companies like PEMEX can purchase credits as a solution. While this is valid, ideally, companies like PEMEX would be funding groups that work towards creating more protected areas.

Integrated into this system would be harsher penalties for companies that cause environmental destruction without a permit or illegally in protected areas. The Dos Bocas refinery was only built because a third party illegally tore down a protected area, and the penalty for this third party was a fine. A stronger penalty would be a higher fine or holding a company criminally liable. This would be effective only if the government strictly enforces this and does not succumb to corruption.

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## Appendix 1

Table 1. Restructured GEO indicators for Tabasco and their outcome

CAP GEO Indicators		
Indicator	Description	Implementation/Results
<b>A</b>	Create three design documents for the pilot areas. These documents contain pilot adaptation measures (initially with six measures, restructured to four) and a fully operating monitoring system generating continuous data.	According to the World Bank, this indicator was considered completed. However, the design documents cannot be found in the World Bank's databases, and when requested, no documents were provided.
<b>B</b>	Two land use plans and a revised protected area management program incorporating climate change adaptation activities	Two land use planning programs (LUPPs) were completed, including one for Tabasco, which was approved by local authorities. Currently, there are protected wetlands in Tabasco, but it is unclear if the LUPP from this CAP was utilized.
<b>C</b>	Reforestation of more than 50 ha of mangrove ecosystems and riparian zones and restoring more than 70 ha of rehabilitated water fluxes in Tabasco. The revision lowered 50 ha to 25 ha of mangrove, and 5 ha of riparian zones reforested in Tabasco.	The World Bank considered this indicator 100% achieved, with 50 ha of mangrove ecosystem and 10 ha of riparian zones reforested in Tabasco.
<b>D</b>	Develop climate change impact scenarios for selected basins and coastal wetlands supporting the knowledge base required to mainstream climate change into water resources and wetland management planning.	There was no revision, and the World Bank considered the goal, including developing a hydrological flow model in Tabasco, achieved. Currently, there is an existing hydrological flow model, but it is unclear if it is a result of the CAP.

## Appendix 2

Table 2. Intermediate Outcome Indicators: Overall for the CAP

Intermediate Outcome Indicators: Overall for the CAP		
Indicator*	Description	Implementation/Results
1	Consists of creating three pilot adaptation measures that could be implemented in the three pilot areas. The original goal stated that the need was six, but the number was reduced to three at the restructuring point. Concerning Tabasco, five adaptation measures were completed, including a reforestation design, rehabilitation of water fluxes, design of rainwater caption system and potabilization plant construction, and the establishment of palafites (stilt houses).	Following the restructuring, the World Bank considered the goal 100% achieved. These pilot adaptation measures are still in place, but it is unclear whether they have been maintained or updated.
2	Consists of creating a monitoring plan using long-term remote sensing, data analysis, and access to information. The IMTA established a Land Observation Satellite, a GIS manual, and temporal and spatial data in the pilot watersheds. This indicator can visualize the long-term impacts of climate change.	This indicator was not restructured, and the result was considered a 100% achievement by the World Bank. Many regional universities currently use these Land Observation Satellites, but it is unclear if their use is directly related to this CAP.
3	Focuses on ensuring that pilot adaptation measures include sustainability strategies, environmental action plans and strategies for implementing adaptation measures in the pilot states.	The World Bank considered this 100% achieved in the design of adaptation measures in Tabasco. However, these action plans are not available in the World Bank database for the project, and it is unclear what entity owns access to these documents.
4	<p>Outlines the need for Wildlife Conservation and Management and Sustainable Utilization Units (UMAs)* in mangrove ecosystems. Following the restructuring, this was changed to require at least two UMAs established in mangrove ecosystems instead of one and no Wildlife and Conservation Management.</p> <p>*UMAs are a voluntary conservation and development strategy utilized by Mexico to match the conservation of wildlife and its habitats with activities of productive diversification in the rural sector.</p>	The World Bank considered this project only 50% achieved due to the pending registration of the UMAs in Tabasco. There is no current update on whether this UMA has cleared the pending process in the Tabasco government or was approved by the state of Tabasco.

Table 2. Intermediate Outcome Indicators: Overall for the CAP (cont.)

Intermediate Outcome Indicators: Overall for the CAP		
Indicator*	Description	Implementation/Results
5	Focuses on installing equipment and infrastructure to reduce vulnerability to climate change in applied pilot states. This includes mareographs, rainwater capture systems, radio communication equipment, and early warning systems.	The World Bank considered this 100% achieved, but there is no information on where the collected data is held or whether the equipment and infrastructure are frequently updated and maintained.
6	Outlines the importance of strengthening community capacities for climate change adaptation at a local level. The restructuring focused on this occurring and being followed up in at least one location.	The World Bank considered this 100% achieved because workshops were conducted in all three pilot states. Still, it states that the local dynamic has positively changed in some communities, and working groups have been established between federal, state, and local levels in order to strengthen the decision-making processes and carry out follow-up actions on adaptation measures. There was no mention of working groups occurring in Tabasco, and there is no mention of whether these working groups are still active in other states. There were workshops in Tabasco, but there is no mention of whether they are still active. Details on the Tabasco specific workshops can be found in Indicator 16.
22	Identifies the need for a climate change impact scenario for national water resources and coastal wetlands. At the time of the CAP, national policies did not yet incorporate climate change impacts on water availability. There was no restructuring.	The World Bank considered this indicator 100% achieved. Currently, Mexico has a National Water Plan.  The indicator resulted in one national water response plan with climate change impact scenarios.
23	Calls for articulation and coordination among the agencies implementing the CAP in the chosen pilot regions. This indicator's focus was to measure the progress made by the agencies involved in the CAP implementation. The goal was to increase management and action capacity.	The World Bank considered this 100% achieved and measured it by reduced contracting time, a high level of disbursements, and a higher availability of resources for project implementation. It also measured increased communication between stakeholders by an increased number of implemented activities and increased levels of financial disbursements.

\*Indicators 12-16 are in the following section. Indicators 7-11 and 16-21 are not included because they pertain to the other pilot sites: Quintana Roo and Veracruz.

## Appendix 3

Table 3. Tabasco Intermediate Outcome Indicators

Tabasco Intermediate Outcome Indicators		
Indicator	Description	Implementation/Results
12	Indicator 12's target was creating a land use plan incorporating climate change impacts, adaptation, and conservation measures. This indicator was decided on based on the deforestation occurring in the region and the lack of climate change and/or adaptation considerations in existing land use planning. The restructuring allowed the indicator to focus more on the Carmen Pajonal Machona (CPM) wetlands in Tabasco, and the land use planning program (LUPP) was submitted for approval. The LUPP included flooding risk areas, evacuation routes, reforestation schemes, proposals for protection against anthropogenic pressures, and sustainable approaches to mangrove management of the CPM area.	The World Bank considered the indicator 100% achieved. A LUPP incorporating climate change impacts, adaptation, and conservation measures for the CPM was completed, discussed with stakeholders (local community, financiers, etc.), and submitted for approval. It is unclear if the LUPP was ever approved.
13	Indicator 13 focuses on the reforestation of mangrove ecosystems and riparian zones in Tabasco, with the original goal aiming for at least 20 ha. This was in response to the decline of mangrove and riparian vegetation in Tabasco and the lack of a reforestation plan. The goal was restructured since the original goal was to create at least 50% of a buffer zone under "recommended practices." This was removed from the goal because a buffer zone would require creating a national protected area (ANP), which was not in the original CAP and would not be accomplished in time. The restructured plan asked for at least 20 ha of mangrove reforestation.	The World Bank considered this indicator 100% achieved. Twenty-five ha of mangrove were reported reforested, and 5 ha of riparian zones were reported restored.

Table 3. Tabasco Intermediate Outcome Indicators (cont.)

Tabasco Intermediate Outcome Indicators		
Indicator	Description	Implementation/Results
14	Indicator 14 focuses on equipment used for monitoring the CAP's climate change adaptations. This indicator prioritized the infrastructure and equipment needed for cleaning, desilting, and rehabilitating at least 3 km of water fluxes, one tide gauge, meteorological instruments, and at least two stilt houses. Before the CAP, Tabasco had very little infrastructure and equipment to carry through these activities. This indicator contributes to the CAP's climate change adaptation element since the infrastructure and equipment minimize the impacts of potential floods, provide clean water, and provide decision-makers with data on climatic events.	This indicator was not restructured and was considered 100% achieved by the World Bank. A rainwater capture system, water plant, cleaning, desilting, and rehabilitation of 3km of water fluxes were completed. Along with this, mareographic and meteorological stations were installed and operated. Radio and communication equipment were installed and functioned as early warning systems for communities in Tabasco. These equipment were installed in three towns in Tabasco, but it is unclear if they are still functioning and maintained.
15	Indicator 15 outlined the need for one management plan for wildlife conservation, management, and sustainable utilization units (UMA) in mangrove ecosystems. Before this, there was no record of sustainable use of mangroves. The UMA plan was completed at the close of the CAP; however, its registry was still pending. causing the indicator to be considered.	The World Bank considered this only 50% completed. The UMA was anticipated to contribute to the adaptation of local communities to floods, water needs, food security, and mangrove conservation. At present, there is no update if this UMA has been approved.
16	Indicator 16 heavily focuses on strengthening the CPM's capacity for climate change adaptation. At the start of the CAP, this region had limited information about climate change. The chosen approach was to create workshops in the local communities to engage community members and educate them on climate change impacts.	The World Bank's achievement in implementing the capacity-building workshops was significant. These workshops were documented in at least four instances, which focused on presenting a diagnostic of climate change conditions in the area, proposing designs for adaptation measures, and strengthening capacities for climate change adaptations. These workshops took place in the communities within the Las Coloradas lagoon system of the CPM. The high levels of participation, as reported by surveys, and the establishment of working groups underscore the success of these workshops. However, there is no record of whether these groups are still active.