CASE STUDY

Community Fisheries' Climate Change Vulnerability Assessment

CAMBODIA

2025

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ADIC
ANALYZING DEVELOPMENT ISSUES CENTRE

Landesa

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Landesa's coastal work in Cambodia is done through its local partners:

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Executive Summary

Cambodia is **highly vulnerable** to the adverse effects of extreme natural events and climate change. This is especially evident in the country's coastal areas, which face frequent flooding, unpredictable rainfall, droughts, tropical storms, and rising sea levels. These challenges are compounded by Cambodia's heavy reliance on climate-sensitive sectors such as fishery and agriculture. These sectors form the economic backbone of coastal communities, making them particularly vulnerable to climate variability. Projections suggest that the threats to coastal ecosystems and livelihoods will continue to intensify in the coming years. As a result, numerous assessments have concluded that coastal communities are **highly vulnerable** to climate change.

Using data provided by Koh Kresna Lok Community Fishery (CFi), Bantey Prey CFi, Samrong CFi, Champou Khmao CFi, and Beoung Rang CFi, alongside secondary sources, Landesa and its local partner, the Analyzing Development Issues Centre, assessed the climate change vulnerability of these CFis, with a focus on resource-based livelihoods. This assessment evaluates their exposure, sensitivity, and adaptive capacity to climate change, factoring in historical climate variability and future projections to improve community members' understanding of climate change impacts, while also serving as a valuable reference for climate change adaptation efforts in Cambodia's coastal areas.

In terms of exposure, the five CFis have experienced a mean annual temperature increase of 0.45°C and a decrease in average annual precipitation from 2000 to 2024. Projections estimate that by the 2090s, the mean annual temperature will rise by 1.4°C to 4.3°C, with a decrease in annual rainfall in Cambodia's coastal regions. Additionally, the CFis face both historical and projected "high" risk of sea-level rise, further exacerbating their exposure.

In terms of sensitivity, on average, 42% of the five CFis' members (50% of men and 34% of women) rely on fishing, farming, animal husbandry, and/or fish processing as their main occupation—sectors that are exposed and highly sensitive to climate change. Climate variability disrupts fish distribution, migration patterns, and production, with projections indicating a catastrophic potential decline up to 98% by the end of the century. Agricultural land, much of which is located in low-lying, flood-prone areas, is equally at risk. Climate change impacts in Cambodia's coastal areas have already contributed to higher rates of vector-borne diseases and animal fatalities due to extreme weather events.

Regarding CFis' adaptive capacity, while some community members from the five CFis have begun adopting alternative economic activities to diversify their income sources, these efforts face significant challenges. Differing opinions among CFi committee members and low levels of community participation hinder decision-making and the implementation of adaptive strategies. Moreover, there is a pressing need to enhance knowledge and technical capacity, improve fundraising, and address environmental issues such as deforestation and waste discharge to ensure the viability of alternative activities.

The combination of climate change exposure, key sectoral sensitivities, and limitations in the adoption of new initiatives as part of their adaptive capacity underscores the **high vulnerability** of these coastal communities. These findings are consistent with broader assessments of climate change impacts in Cambodia's coastal areas. Enhancing community awareness of their vulnerability to climate change is a crucial step toward strengthening adaptive strategies and ensuring long-term resilience.

Introduction

According to the World Risk Index of 2024, Cambodia is highly[1] vulnerable[2] to damage from extreme natural events and the negative impacts of climate change. The index ranks Cambodia as the 65th most at-risk country among 193 countries worldwide (RUB, 2024). Specifically, in Cambodia's coastal areas, the Global Environment Facility (2020) has highlighted the region's exposure to frequent flooding, unpredictable rainfall, drought and dry spells, tropical storms, and sea-level rise. These challenges are exacerbated by the country's heavy reliance on climate-sensitive sectors such as agriculture, fisheries, aquaculture, and forestry, which form the economic backbone for most livelihoods in coastal communities (GEF, 2020).

Reports indicate that coastal communities have a limited capacity to adapt to the changing climate, primarily due to a lack of technical knowledge, policy and institutional support, and persistent poverty (UNEP, 2010) (GEF, 2020). Climate variability predictions for the coming years suggest an increasing threat to coastal ecosystems and livelihoods. Consequently, multiple assessments, including those by The WorldFish Center (2008), UNEP (2010) and GEF (2020), have concluded that coastal communities are highly vulnerable to climate change.

[1] On a scale of very low, low, medium, high, and very high.
[2] As a sphere of economic, political, social, and environmental factors, vulnerability depicts the capacities and dispositions of people, households, and societies and indicates how easily and to what extent they can be destabilized, damaged, or even destroyed by extreme events (RUB, 2024).

To strengthen the resilience of coastal communities in Cambodia, a series of recommendations builds upon these vulnerability assessments. Supporting actions include establishing clear boundaries to facilitate effective management plans; identifying fishing, spawning, and breeding zones to protect critical resources; conducting mangrove forest inventories to prevent land encroachment; and enforcing legal measures to safeguard coastal natural resources. However, at the forefront is raising awareness among local communities and stakeholders about the growing risks posed by climate change and its impacts on livelihoods—a critical step in fostering long-term resilience (IUCN, 2019) (GEF, 2020).

Landesa's Coastal Livelihoods and Mangroves Project

Landesa, through its **Coastal Livelihoods and Mangroves Project**, is strengthening coastal land tenure rights in the Bay of Bengal and Southeast Asia to sustain livelihoods, protect mangrove forests, mitigate climate change, and enhance climate resilience. In Cambodia, Landesa collaborates with local partners to strengthen land and resource tenure security while enhancing community governance and sustainable livelihood initiatives.

As part of this work, the Analyzing Development Issues Centre (ADIC), Landesa's local partner, conducted Participatory Action Research (PAR) in 2024 to enhance livelihoods and entrepreneurship development, improve land and natural resource governance in the context of climate change, and deepen the understanding of current social issues and challenges.

ADIC's PAR efforts have been pivotal in providing key information to understand the vulnerability to climate change of five Community Fisheries (CFi) along Cambodia's coast: Koh Kresna Lok, located along the coast of Kampot Province, and Bantey Prey, Samrong, Champou Khmao, and Beoung Rang, situated along the coast of Preah Sihanouk Province within the Prek Kampong Smach Marine Fishery Management Area. Leveraging the PAR's results, this assessment aims to improve community members' understanding of their exposure, sensitivity, and adaptive capacity to climate change, while also serving as a valuable reference for climate change adaptation efforts in Cambodia's coastal areas.

Assessment Objective

The primary objective of this report is to assess the climate change exposure, sensitivity, and adaptive capacity of **resource-based livelihoods**[3] essential to the economy of five Community Fisheries managing coastal resources. By assessing the vulnerability of these five Community Fisheries in coastal areas, the report seeks to provide key insights to enhance community members' understanding of their susceptibility to climate change and highlight the importance of enacting plans to strengthen their resilience. Furthermore, the report aims to serve as a reference to influence other Community Fisheries along the Cambodian coast by fostering a deeper understanding of the key factors contributing to climate change vulnerability.

[3] Extractive livelihoods (i.e., fishing, hunting, gathering, forestry, logging) and productive livelihoods (i.e., farming, ranching and livestock herding).

Methodology

This vulnerability assessment adopts the Global Green Growth Institute's conceptual framework for the Climate-Resilient Green Growth (CRGG) Assessment Methodology, which is based on the Green Growth Potential Assessment. The CRGG Assessment Methodology facilitates the evaluation of challenges posed by the adverse impacts of climate change and helps identify opportunities to enhance resilience. Additionally, the CRGG Assessment enables the evaluation of the vulnerability of extractive, productive, and processing activities of key commodities affected by climate change by analyzing three key components of vulnerability:

1. **Exposure:** Identifies the climate change threats and the potential damage resulting from their effects.
2. **Sensitivity:** Examines the dependency of local communities, in this case, on extractive, productive, and related processing economic activities and their exposure to climate change.
3. **Adaptive Capacity:** Assesses the ability of local communities to mitigate and adapt to the impacts of climate change.

Figure 1. Conceptual scheme of the CRGG Assessment Methodology.

Source: (GGGI, 2019).

Data

This report draws from primary and secondary data. The latter is used to outline the exposure and sensitivity to climate change faced by Community Fisheries, drawing on existing literature about Cambodia and utilizing information from the Global Mangrove Watch and Earth Map.

Primary data is analyzed to understand aspects of CFi livelihoods' sensitivity and adaptive capacity.

- A quantitative baseline survey was conducted over November-December 2023 in five CFis: Koh Kresna Lok, Bantey Prey, Samrong, Champou Khmao, and Beoung Rang, using a stratified sampling method and ensuring equal gender representation. Specifically, the report analyzes survey datasets on CFi members' occupations and resource-based livelihoods. See Table 1.
- ADIC conducted Participatory Action Research (monthly in-person one-day sessions) from September to November 2024, engaging a total of 103 participants across the five CFis, with women comprising one-third of the participants.

Table 1. Primary data collection by gender and Community Fishery.

CFi	Men	Women	Total
Koh Kresna Lok	19	26	45
Champou Khmao	32	24	56
Beoung Rang	18	29	47
Samrong	18	12	30
Bantey Prey	27	27	54
Total	114	118	232

Source: (Landesa, 2023).

Limitations

To carry out a robust analysis of adaptive capacity, additional information on the specific factors affecting the adaptive capacity of each livelihood of interest (i.e., fishing, agriculture, animal husbandry, other key resource-based livelihoods) would have been needed. In its absence, the report section on adaptive capacity focuses on potential for resource-based livelihood diversification, considering it an important adaptation strategy. This assessment is able to draw upon ADIC's Participatory Action Research for alternative livelihood development to assess challenges and opportunities for livelihood diversification.

Exposure

Cambodia experiences a tropical monsoon climate influenced by several factors, including its location within the Inter-Tropical Convergence Zone and the monsoon system (IUCN, 2019). Inter-annual climate variations are primarily driven by the El Niño Southern Oscillation (ENSO). During El Niño episodes, monsoon patterns are disrupted, generally bringing warmer and drier-than-average winter conditions across Southeast Asia. Conversely, La Niña episodes result in cooler-than-average summers. The pronounced seasonality in rainfall leads to variability in water availability, often causing flooding during the wet season and water shortages during the dry season (GEF, 2020). The dry season, typically from November to March, is characterized by the northeast monsoon, which brings drier and cooler air. In contrast, the wet season, from June to September, is largely influenced by the southwest monsoon, which draws moist air inland from the Indian Ocean (IUCN, 2019).

Koh Kresna Lok CFi, located along the coast of Kampot Province (See Figure 2), has a tropical climate with a mean annual temperature of 27.9°C and mean annual precipitation of 1,975 mm (FAO, 2024). Similarly, Bantey Prey CFi, Samrong CFi, Champou Khmao CFi, and Beoung Rang CFi, situated along the coast of Preah Sihanouk Province within the Prek Kampong Smach Marine Fishery Management Area (See Figure 2), experience a tropical climate but with slightly different conditions—a mean annual temperature of 25.9°C and mean annual precipitation of 2,538 mm (FAO, 2024).

Despite these climatic observations, there is limited data and analysis on how climate change has evolved and historically affected Cambodia's coastal ecosystems and socioeconomic development. Key areas of concern include variations in temperature, chemical and ecosystem composition, ecosystem health, and hydrological cycles (GEF, 2020). However, existing reports indicate that Cambodia's coastal zones are already threatened by several natural hazards. These hazards, such as storm surges, beach erosion, and saline intrusion are highly likely to be exacerbated and amplified by the impacts of climate change (UNEP, 2010) (GEF, 2020).

Figure 2. Prek Kampong Smach Marine Fishery Management Area (Left) and Koh Kresna Lok CFi (Right).

Source: Fisheries Administration and Ministry of Agriculture, Forestry and Fisheries.

Temperature

According to Earth Map ERA5-Land dataset[4] (FAO, 2024), mean annual temperature in Koh Kresna Lok CFi was 26.5°C in 2000, compared to 27.9°C in 2024. A linear (fitted) trend during this period shows an increase from 26.7°C to 27.2°C (see Figure 3). In Bantey Prey CFi, Samrong CFi, Champou Khmao CFi, and Beoung Rang CFi, mean annual temperature was 24.8°C in 2000, compared to 25.9°C in 2024. A similar linear trend shows an increase from 24.9°C to 25.3°C during the same period (See Figure 4).

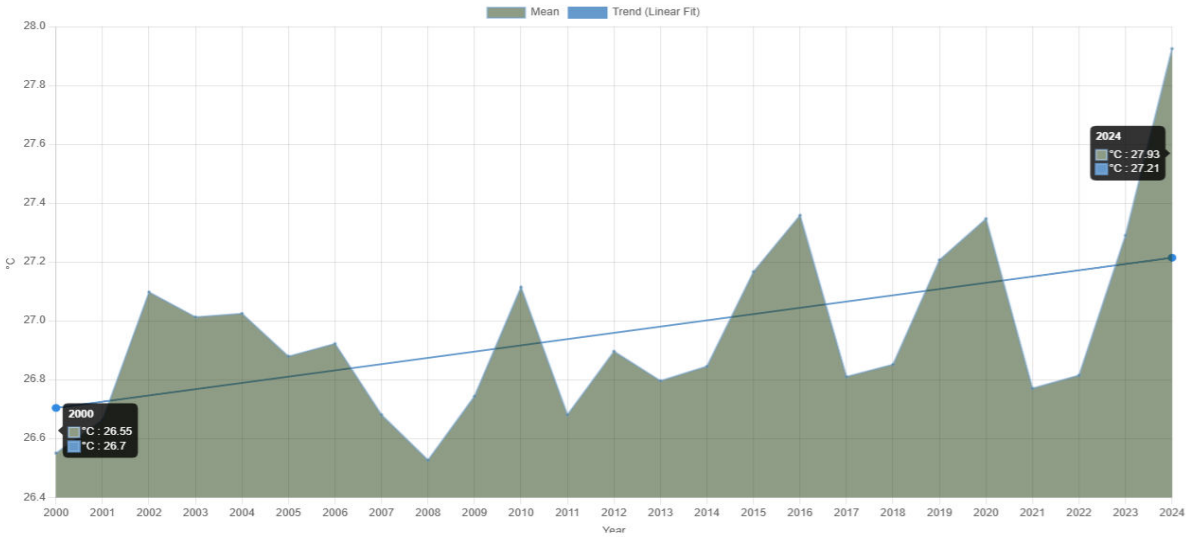
In terms of exposure to climate change due to temperature variations, the open sea is the most exposed to rising temperatures. Increases in water temperature can negatively impact the productivity of nursery grounds if the temperature exceeds the thermal tolerance of organisms.

[4] Reanalysis dataset providing a consistent view of the evolution of land variables over several decades at an enhanced resolution. Reanalysis produces data that goes several decades back in time, providing an accurate description of the climate of the past.

This may result in a reduction in the availability of fish and other species, though the extent of the impact can vary depending on the specific plant and animal species affected (IUCN, 2019).

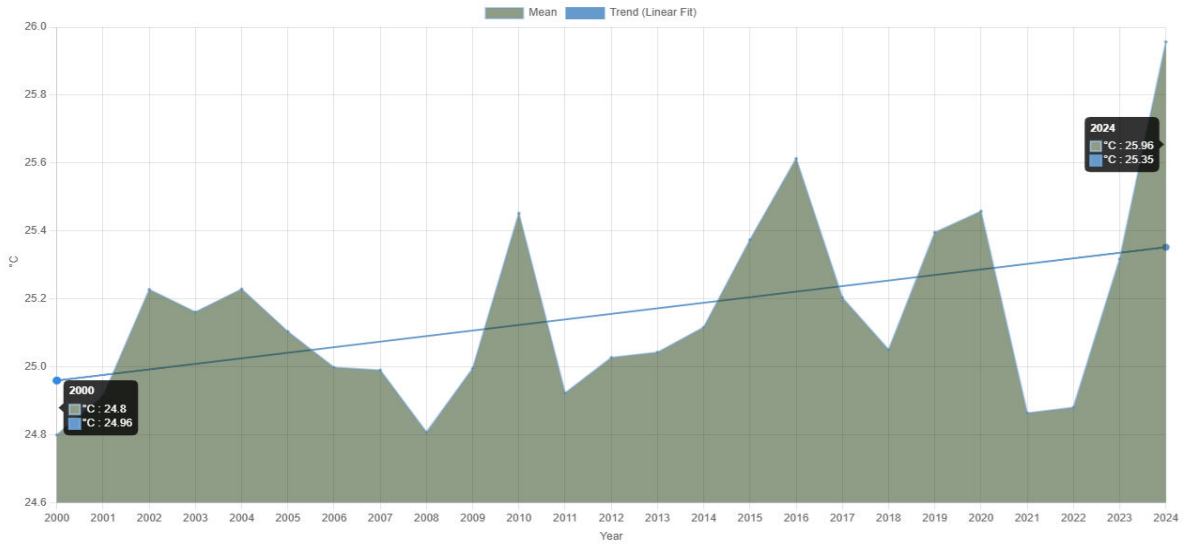
In terms of projections, UNEP (2010) reported that mean annual temperatures in Cambodia's coastal areas are expected to increase by 0.7 to 2.7°C by the 2060s and by 1.4 to 4.3°C by the 2090s. This rise will likely be accompanied by a significant increase in the number of "hot" days and nights. Additionally, IUCN (2019) predicts that annual temperatures, as well as maximum and minimum temperatures, will continue to rise.

Figure 3. Temperature - Mean (Aggr. 2000/2024) in Koh Kresna Lok CFi.



Source: ECMWF ERA5 Land Monthly (FAO, 2024).

Figure 4. Temperature - Mean (Aggr. 2000/2024) in Bantey Prey CFi, Smarong CFi, Chumpou Khmao CFi, and Beng Roeung CFi.



Source: ECMWF ERA5 Land Monthly (FAO, 2024).

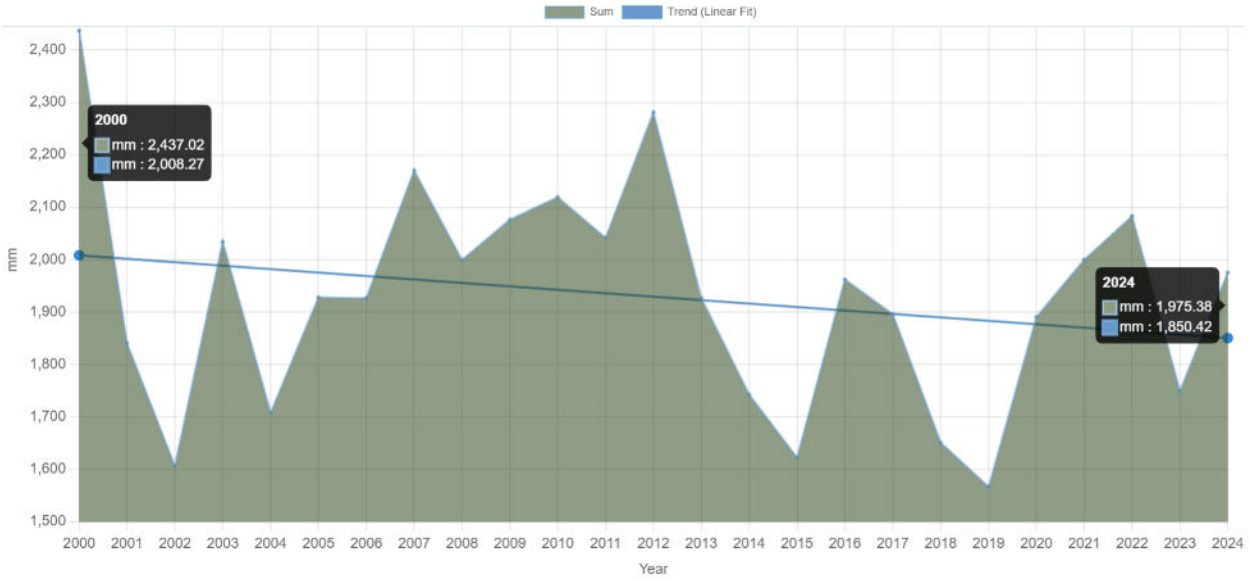
Rainfall

According to Earth Map satellite datasets (FAO, 2024), annual precipitation in Koh Kresna Lok CFi was 2,437 mm in 2000, compared to 1,975 mm in 2024. A linear (fitted) trend during this period shows a decrease from 2,008 mm to 1,850 mm (see Figure 5). In Bantey Prey CFi, Samrong CFi, Champou Khmao CFi, and Beoung Rang CFi, annual precipitation was 2,369 mm in 2000, compared to 2,538 in 2024. A linear (fitted) trend indicates a decrease from 2,821 mm to 2,764 mm over the same period (see Figure 6).

Rainfall is closely linked to flooding events along the Cambodian coastline. Flooding typically occurs twice a year—once due to heavy rainfall during the rainy season and again due to tidal action, often worsened by tropical cyclones, which usually occur during the dry season. Agricultural land is particularly exposed to tidal and flooding activity along the coast, as these areas are concentrated in low-lying coastal zones, which are fertile and ideal for agriculture (UNEP, 2010).

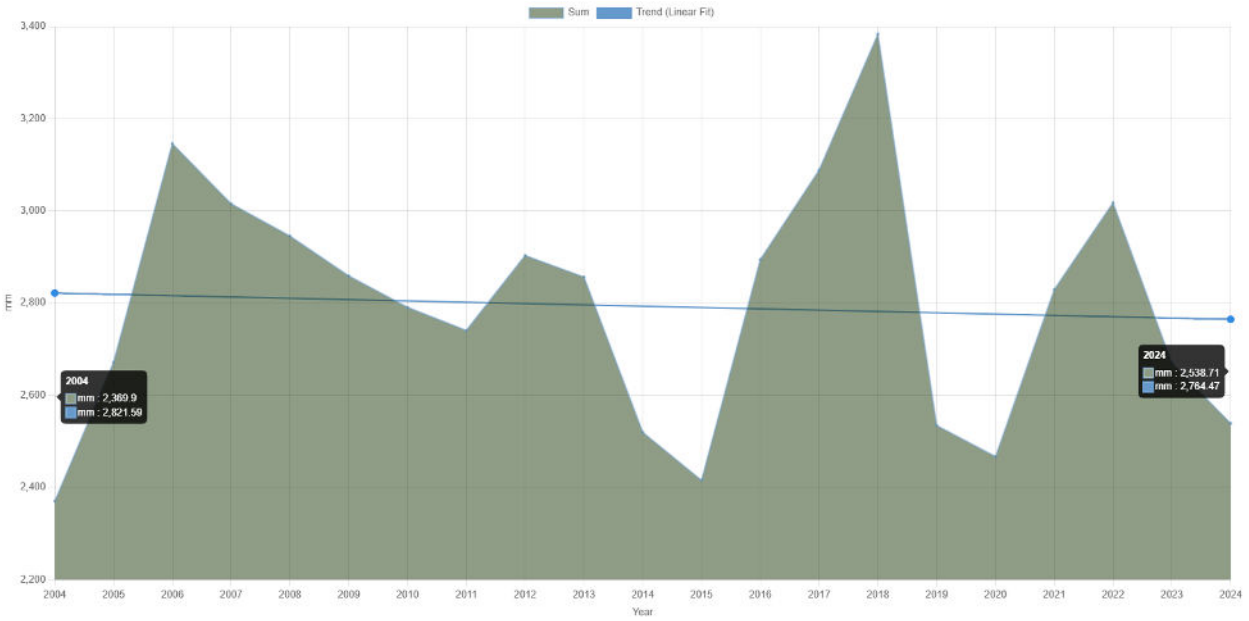
Projections for Cambodia's coastal zones indicate a slight decrease in annual rainfall, with a reduction in rainfall during the wet season and an increase during other parts of the year. Predictions also forecast an increase in maximum one-day extreme rainfall, while maximum five-day totals are expected to decrease (IUCN, 2019). Due to more frequent episodes of heavy rainfall, an increase in the frequency and intensity of flooding events is projected (UNEP, 2010).

Figure 5. Precipitation - (2000/2024) in Koh Kresna Lok.



Source: (FAO, 2024).

Figure 6. Precipitation - (2000/2024) in Bantey Prey CFi, Smarong CFi, Chumpou Khmao CFi, and Beng Roeung CFi.



Source: (FAO, 2024).

Sea Level Rise

According to the Global Mangrove Watch, Koh Kresna Lok CFi has faced a “high” risk of antecedent sea level rise[5], with a future sea level rise[6] risk also categorized as “high”. Similarly, for Bantey Prey CFi, Smarong CFi, Chumpou Khmao CFi, and Beng Roeung CFi, both the risk of antecedent sea level rise and the risk of future sea level rise are reported as "high" (GMW, 2024).

Freshwater bodies and various coastal habitats are exposed to sea level rise, with negative impacts expected from higher tides and saltwater intrusion. Since the water in many coastal habitats is brackish for part of the year, several species of plants and animals living in these areas are somewhat tolerant and resilient to these changes. However, extreme fluctuations in water levels, combined with higher water temperatures and increased saltwater intrusion, may push multiple coastal habitats past a tipping point, resulting in severe negative impacts on the species that inhabit them (IUCN, 2019).

[5] Antecedent sea level rise (ASLR) data is based on altimeter measurements from multiple satellite missions and represents regional sea level trends between January 1993 and December 2015. Risk from ASLR was calculated as a function of tidal amplitude, where higher values represent a greater risk. ASLR is categorized as ‘none’, ‘low’ or ‘high’.
[6] Future sea level rise predictions are derived from 21 Coupled Model Intercomparison Project phase 5 Atmosphere-Ocean General Circulation Models. Risk from sea level rise was calculated as a function of tidal amplitude and categorized as ‘high’ or ‘low’.

According to IUCN (2019), projections estimate a possible increase in local sea level of approximately 60 cm above the 1986-2005 baseline by the end of the century. Similarly, UNEP (2010) projects a sea level rise of 0.18 to 0.56 meters by the 2090s.

Extreme Events

Unfortunately, long-term climate observations for Cambodia are scarce, largely due to years of conflict. This data gap has led to a limited understanding of key relationships, such as the connection between El Niño and monsoon variability, as well as the occurrence of extreme weather events and their impacts (UNEP, 2010).

Despite the lack of detailed information on projected occurrence of extreme events, it has been reported that mangrove forests are highly exposed to the impacts of storms (IUCN, 2019) (Landesa, 2023). These forests are frequently subjected to intense storms from June to October each year. The severity of these storms can severely affect mangroves located along the seaward edge, resulting in a decline in the ecosystem services they provide. Beach erosion, which is likely to be worsened by storms, poses a significant concern as it can have long-term effects on fishery resources and mangrove stands. While new beaches and swamps may gradually return, they are unlikely to form in the same locations. Seagrass beds are also particularly exposed to storm damage. Seagrass is sensitive to storm impacts, and any damage is likely to have significant consequences for the biodiversity it supports. (IUCN, 2019).

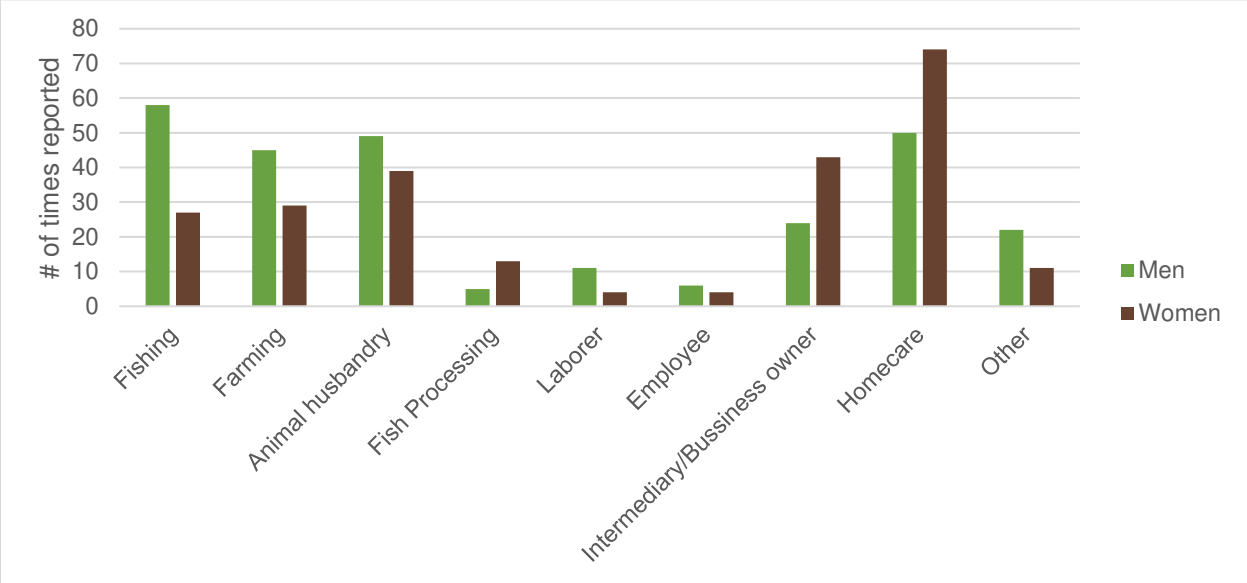
Sensitivity

This assessment focuses on resource-based livelihoods; however, understanding the broader portfolio of activities they are part of provides valuable context. On average, Community Fishery members engage in two to three occupations[7] at the same time. Men report being engaged in up to four, while women report involvement in as many as six. As shown in Figure 7, men are more involved than women in fishing, animal husbandry, farming (primarily rice), working as laborers[8], and other activities, such as transportation and CFi employment. Conversely, women are more involved than men in managing household responsibilities, working as intermediaries/small-business owners, and in crab/shrimp processing.

Among these, Figure 8 highlights the main occupations reported by CFi members. Fishing, farming, and animal husbandry, account for 50% of men's main occupation and 30% of women's main occupation. Furthermore, for those CFi members who have engaged in fishing in the last twelve months, on average the activity contributes 58% of their individual incomes. Table 2 shows the average contribution of fishing to the income of CFi members who engage in this activity.

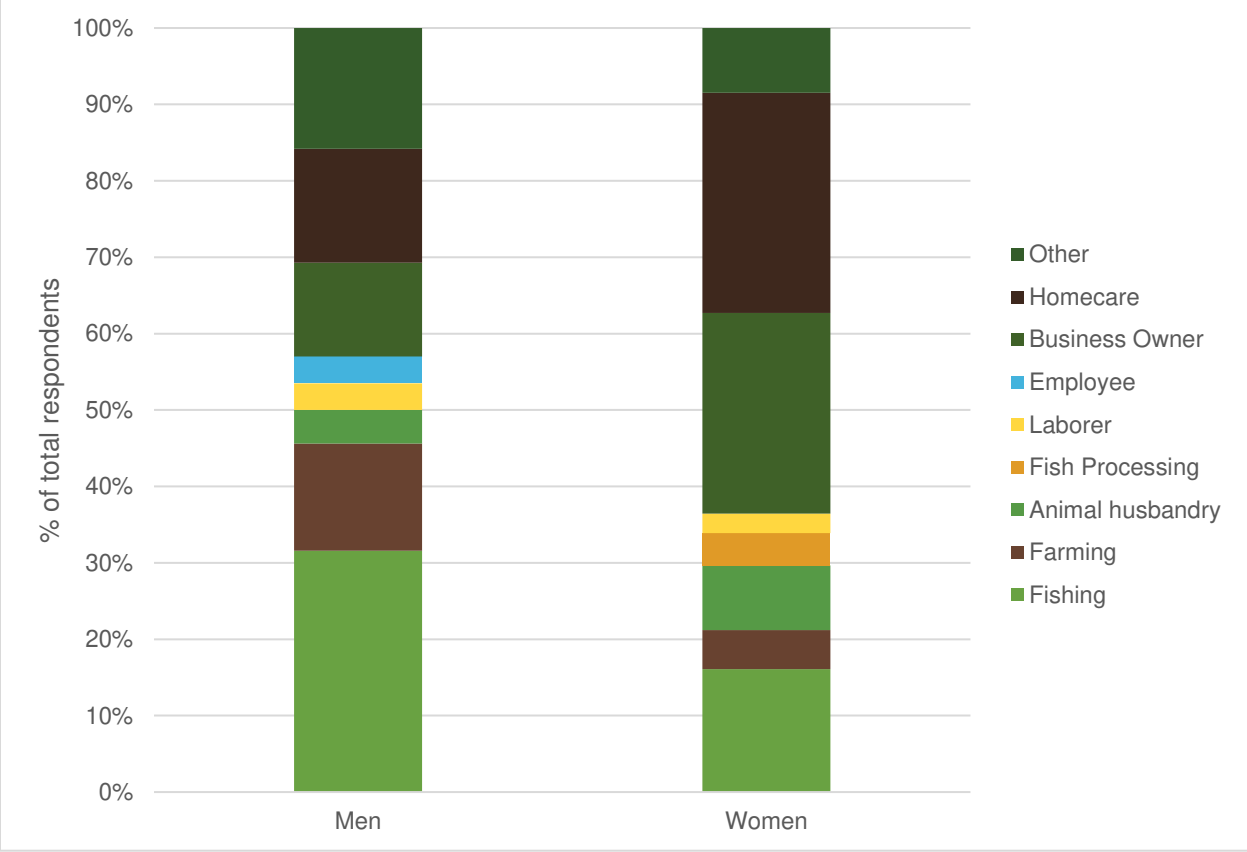
[7] Occupation defined as a regular activity.
[8] Factory worker and/or construction worker.

Figure 7. Occupations of CFi members. Men (n=114) and women (n=118).



Source: (Landesa, 2023).

Figure 8. CFi men's (n=114) and women's (n=118) main occupation.



Source: (Landesa, 2023).

Table 2. Average proportion of CFi members' income from fishing.

CFi	Men	Women	Total
Koh Kresna Lok (n=5;3)	78%	70%	76%
Champou Khmao (n=21;13)	56%	60%	58%
Beoung Rang (n=9;7)	36%	50%	42%
Samrong (n=5;0)	50%	0%	50%
Bantey Prey (n=7;2)	70%	75%	72%
Total (n=47;25)	57%	60%	58%

Source: (Landesa, 2023).

Fishing

Climate variability can significantly affect fish distributions, migration patterns, and production of sensitive species due to increased sea surface temperature and ocean acidification. Additionally, it can cause indirect effects through ecosystem-level changes that disrupt trophic webs, potentially leading to shifts in species composition. In Cambodia, the overall catch potential of the entire fishery within the Economic Exclusive Zone[9] (EEZ) waters is projected to decline by 10% to 26% by 2050. By the end of the century, this decline is expected to range from 12% to as much as 98%, indicating a potential total collapse of the fishery in EEZ waters. (GEF, 2020). A 2023 Landesa assessment for pilot site selection in Kampot Province revealed that CFi members have observed increased storm frequency and severity, as well as changes in sea levels and tidal cycles over the past 5 to 10 years. Community members reported that these changes have negatively affected fishing activities, including altered fishing seasonality, fluctuations in peak fishing periods, and a rise in storm-related accidents (Landesa, 2023). Given the primary occupations of CFi members, **fishing and fish processing are highly sensitive to climate change, posing a potential risk to approximately 32% of men's and 20% of women's main occupations** (Figure 8). On average, **climate-related impacts could negatively affect 57% of fishermen's and 60% of fisherwomen's individual incomes** (Table 2).

Agriculture

Since most agricultural land is located in low-lying and flood-prone coastal areas, climate variability poses significant threats to food security and the resilience of coastal livelihoods. Cambodia is already experiencing salinization of land surfaces and groundwater, which negatively impacts freshwater ecosystems and the fertility of agricultural lands. Climate change will exacerbate these issues, along with coastal erosion (GEF, 2020). Additionally, climate change is expected to have severe adverse effects on crop production by increasing evapotranspiration rates, thereby reducing income streams and worsening existing food security challenges.

[9] Cambodia has claimed its Exclusive Economic Zone of 200 nautical miles from the coastline to cover approximately 62,515 km2 of the Gulf of Thailand (UNEP, 2010).

Variations in rice production are closely linked to climate variability, particularly flood and drought activity. As climate change intensifies these events, the frequency of rice crop failures is expected to rise significantly (UNEP, 2010). Flooding and drought will not only threaten Cambodia's coastal agricultural activities but will also be compounded by sea-level rise, which compromises agriculture. Managing salinity caused by rising sea levels is both highly challenging and costly (ADB, 2018). **CFi members' agricultural activities are sensitive to climate change, potentially jeopardizing approximately 14% of CFi men's primary occupations and 5% of CFi women's primary occupations** (Figure 8).

Animal Husbandry

According to Sum, D., and Thav, S. (2023)[10], coastal communities involved in animal husbandry reported negative impacts from pest outbreaks caused by climate change. Small-scale livestock production was also found to be severely affected by exacerbated climate-related disasters, particularly flooding. UNEP (2010) warns that vector-borne diseases are likely to become increasingly widespread under changing climatic conditions. **CFi members' animal husbandry activities are sensitive to climate change, potentially jeopardizing approximately 4% of CFi men's primary occupations and 8% of CFi women's primary occupations** (Figure 8).

Forestry

CFi respondents did not report being heavily engaged in gathering forest products and non-timber forest products (NTFPs) from mangrove forests within the CFi with the primary goal of earning money. Those who engaged in this activity primarily collected forest products and NTFPs for personal or household consumption. However, it is important to note that climate variability can adversely impact mangrove composition and productivity, negatively affecting the community's livelihood. Mangroves are particularly sensitive to the duration of tidal flooding; prolonged flooding caused by sea-level rise can result in the loss of mangroves, especially along the seaward margins. Additionally, higher temperatures can increase evaporation rates, leading to greater salinity levels, which can further impact species diversity, size, and productivity within mangrove forests (GEF, 2020).

[10] Information was collected from villagers living in target areas for longer than ten years, using a random sampling technique with a 400-sample size. The sites selected for the study were eight districts in the four provinces of Kep, Kampot, Preah Sihanouk and Koh Kong.

Adaptive Capacity

According to the '*Fourth Study on Understanding Public Perceptions of Climate Change in Cambodia'* (2024), Cambodian families have adopted various strategies to adapt to climate change. The most prevalent adaptation is a shift in occupation, reflecting significant changes in labor dynamics and the growing need for versatile skills. Many families have also sought alternative sources of income, demonstrating resilience and resourcefulness in securing financial stability. In the agricultural sector, families have adapted by cultivating alternative crops and modifying animal husbandry practices, such as transitioning to different types of fish or livestock. Additionally, migration—both temporary and permanent—has emerged as a notable strategy, underscoring the profound impact of environmental changes on community structures and individual livelihoods (NCSD/MoE, 2024).

Regarding community-level responses to climate change, the report highlights a growing emphasis on sustainable strategies supported by secure tenure regimes, such as CFis. These tenurial arrangements facilitate greater community engagement with government institutions beyond typical coastal community interactions. Sustainable strategies include infrastructural improvements in water management, shifts in energy consumption, changes in agricultural practices, and an increasing reliance on scientific guidance over traditional methods. Insights from qualitative interviews reveal that Cambodian communities recognize environmental and climate-related challenges, prompting active engagement in adaptation efforts. However, despite this awareness, discussions about these issues remain infrequent, and only a small subset of

individuals takes proactive steps to address them. As a result, the report underscores the importance of enhancing knowledge and fostering greater community engagement. Encouraging more frequent and inclusive conversations on climate change and environmental challenges is crucial to building resilience and promoting long-term sustainability at the local level (NCSD/MoE, 2024).

Given the limitations of this report, this section highlights community members' efforts to diversify their livelihoods as part of their adaptive capacity. To gain a deeper understanding of this, the Analyzing Development Issues Centre (ADIC), Landesa's local partner in implementing the Coastal Livelihoods and Mangroves Project in Cambodia, conducted Participatory Action Research (PAR) in 2024 across the five Community Fisheries. The PAR facilitated discussions and development of actionable plans to address challenges and opportunities within these communities. It also provided valuable insights into their needs, aspirations, and strategies for sustainable community initiatives. As a result of the PAR, the following initiatives and challenges were identified as part of the communities' current and future plans.

Koh Kresna Lok CFi

Community members have been exploring the establishment of a volunteer group to engage in dry-shrimp processing as a potential income-generating activity. They are also assessing the feasibility of fish and mud crab farming as a means to diversify livelihoods and enhance food security. However, a significant concern repeatedly raised is the lack of technical knowledge and practical experience required for fish and mud crab farming.

Additionally, community members are keen on exploring ecotourism services. To support this initiative, they are in discussions with local authorities about constructing a boat port, enabling guests and visitors to explore the community's mangrove forest and its rich biodiversity.

Banteay Prey CFi

CFi members reported attempting fish farming in creeks as an alternative livelihood within the CFi. However, waste discharge from a nearby factory severely degraded water quality, resulting in high fish mortality rates. In response, community members explored the possibility of household-level aquaculture, such as raising catfish and shrimp in plastic tents. Additionally, they considered raising mud crabs in designated, community-managed areas. Recognizing the need to protect these areas from external contamination, they are now discussing ways to identify and secure suitable locations and resources to implement this initiative.

Samrong CFi

Five families from the CFi successfully engaged in aquaculture and generated income from it. However, in 2022, they were forced to cease this activity due to waste discharge from a nearby tile factory, which contaminated the creek and caused high fish mortality rates. In response, some

families shifted to home gardening, growing vegetables to sell in nearby local markets. Currently, CFi members are assessing their capacity to support catfish farming as a collective initiative.

Chumpou Khmav CFi

Community members are currently working to revitalize previous fundraising initiatives to secure financial support for community livelihood alternatives. Simultaneously, they are establishing committees to manage shrimp, mud crab, and fish farming. Recognizing the potential of eco-tourism, the community has also outlined plans to form a management committee to oversee eco-tourism services, including offering boat trips to explore mangrove forests and setting up kiosks and resting areas for guest recreation.

Boeng Raing CFi

The community has agreed to raise mud crabs in a CFi-managed area connected to the creek as an initiative to enhance livelihoods by leveraging available natural resources. As part of this agreement, a guardhouse is currently under construction within the 1-hectare rearing area to ensure security and support the community's aquaculture efforts.

Overall, efforts to diversify the livelihoods of CFi members face several challenges, including differing opinions among CFi committee members and low levels of community participation and engagement, which contribute to slow decision-making processes. Furthermore, there is a recognized need to enhance knowledge and technical capacity, strengthen fundraising efforts, and address environmental issues such as mangrove forest encroachment and waste discharge.

Other research carried out by local partners highlights challenges to gender-responsive management and governance of the CFis due to social norms and local beliefs constraining women’s meaningful representation and participation in the CFis (Chrin, 2023a, 2023b). CFi resource management and planning that fails to respond to women’s needs can limit the communities’ adaptive capacity.

Vulnerability

As a result of exposure to climate change, key sectoral sensitivities, and challenges to promoting alternative livelihood options, the communities' livelihoods are **highly** vulnerable to climate change, aligned with findings for Cambodia and Cambodian coastal areas. Survey findings from the five CFis show that 50% of men and 34% of women engage in fishing, fish processing, agriculture, or animal husbandry as their main occupation; these are activities exposed to and sensitive to climate change (See Figure 8).

Fishing, for instance, accounts for approximately 24% of the community members' main occupations (See Figure 8), contributing an average of 58% of the income of individuals involved in this activity (See Table 2). Fishing is highly sensitive to climate variability, with alarming projections even indicating a potential collapse of this sector in Cambodian EEZ waters by the end of the century. Considering that the open sea is the most exposed to rising temperatures, and historical data reflects an increase in temperature of about 0.45°C in the CFis assessed from 2020 to 2024, the vulnerability of coastal CFis to climate change becomes a serious concern.

This vulnerability extends to other key resource-based activities, including agriculture, animal husbandry, and fish processing, which are also directly and indirectly affected by climate variability and its long-term intensification.

Beyond the heavy reliance of CFi members on natural resources, the nascent stage of implementation of alternative livelihoods—hindered by limited community participation,

engagement, and organization, as well as a lack of technical knowledge, financial resources, and environmental challenges—further exacerbates the vulnerability of these communities.

To make matters worse, Cambodia lacks adequate monitoring systems in coastal areas to track climate change-related impacts, making it difficult to access information and understand these effects in order to develop successful long-term strategies to reduce the vulnerability of coastal CFis.

Enhancing CFis' Climate Change Resilience

As a reference for coastal CFis and those working with them to enhance climate change resilience, recommendations based on coastal vulnerability assessments suggest that communities should strive to reduce strain on local environments by diversifying livelihoods. This can be achieved through training in seafood processing, aquaculture (fish and crab farming), and other income-generating activities such as ecotourism. However, these initiatives should be implemented alongside improvements in basic services and enabling infrastructure (IUCN, 2019).

In terms of implementing initiatives to enhance climate change resilience, it has been recommended that CFis should be guided by an adaptive management and capacity-building process. This approach requires a willingness to experiment, the capacity to accept and learn from mistakes, and the flexibility to foster social and institutional learning. By adopting an adaptive management process (see Figure 9), CFis can plan and enhance their resilience by improving productivity and diversifying income sources (Almack, 2012). Based on Landesa's experience, tenure security under arrangements such as CFi, along with close coordination with local authorities (i.e., the Fisheries Administration), facilitates adaptive community management. Under these conditions, communities can update CFi zoning and the CFi Management Plan to respond to a dynamic environment. For example, if an area becomes unsuitable for a particular activity after an extreme weather event, community members can closely collaborate with the Fisheries Administration to identify and utilize a new area or restore the affected one.

The report '*Community-Based Climate Change Adaptation through Agriculture: Experiences from Cambodia'* offers valuable insights for implementing adaptive initiatives at the community level. According to the report, community-based climate change interventions do not need to be overly complex. The most successful initiatives rely on well-coordinated actions rooted in traditional practices rather than technologically sophisticated solutions. Key factors for success include community understanding and support, active involvement of trusted local leaders and government, and initiatives developed collaboratively with input from the community (ADB, 2018).

Without these "soft" interventions—such as fostering understanding, building trust, and strengthening relationships—"hard" physical investments, such as infrastructure and equipment, are unlikely to succeed. Increasing communities' awareness of climate change and its impacts on their economic activities, while also reinforcing institutional capacity and relationships, creates the essential foundation for effective adaptation investments (ADB, 2018).

Figure 9. Adaptive Management Cycle.

Source: *CSIRO Marine and Atmospheric Research Adaptive Management Cycle cited in* (Almack, 2012).

Regarding strategies for raising climate change awareness, the '*Fourth Study on Understanding Public Perceptions of Climate Change in Cambodia'* emphasizes the importance of distinct, deliberate messaging tailored to different themes. Whether addressing personal health, the environment, the economy, or migration, messages should be designed to resonate at the individual, community, national, or global level. The report also highlights the need for high-quality, reliable content in communication products, such as awareness-raising campaign materials, articles, graphics, and videos. Effective communication should integrate the following key principles (NCSD/MoE, 2024):

- Use credible scientific data and dependable messaging.
- Explain the issue and potential solutions through storytelling, making the topic relatable on a personal or community level.
- Avoid reinforcing stereotypes. For example, women are often portrayed as victims of climate change rather than as active agents of change.
- Inspire action through visual and written communication, emphasizing the positive aspects of a sustainable future to engage and excite audiences. Messages should be timely, relevant, and framed around themes of safety, stability, and the preservation of environmental resources.

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