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A fishery at risk and the limits to adaptation

– a study of Cambodian Community Fishery organisations' role in reducing livelihood vulnerability to climate change in their communities

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Abstract

Cambodia’s small-scale fisheries support the livelihoods of a major part of the country's rural population and play a crucial role in food security. Climate change-related impacts alongside geopolitical changes harm the aquatic ecosystems the fishery depends on, and thus contain a great threat to both food security and rural fishery-based livelihoods in the country. During the last two decades, the government of Cambodia has implemented major political reforms aiming towards decentralising the management of natural resources. Following that, local organisations called Community Fisheries have been established as the main local level institution to organise the management of fishery resources. Being the main local institution responsible for fishery-based livelihoods and natural resource management, Community Fisheries are now essential when dealing with climate-related impacts on fishery in their local communities.

Through field visits and semi-structured interviews with Community Fishery committees and members from five Cambodian Community Fisheries in four different provinces, this thesis seeks to understand how the work of Community Fishery organisations can contribute to reduce livelihood vulnerability and strengthen the local communities’ capacity to adapt to climate-related impacts. Furthermore, the thesis discusses Community Fisheries socio-political role on climate change adaptation. Community Fisheries conduct various measures and livelihood strategies to meet local challenges in their villages, that can improve both generic and specific capacities to adapt and reduce livelihood vulnerability in their local communities. However, the impacts from the various changes the communities are dealing with seem to exceed the limit of adaptation on a local level in a long-term perspective.

Keywords: livelihood vulnerability, climate change adaptation, community fisheries

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Contents

Abbreviations

ADB	Asian Development Bank
CBO	Community Based Organisation
CF	Community Forestry
CFi	Community Fishery
CPA	Community Protected Area
CBNRM	Community Based Natural Resource Management
FACT	Fisheries Action Coalition Team
FiA	Fisheries Administration
FAO	Food and Agriculture Organization of the United Nations
IPCC	Intergovernmental Panel on Climate Change
MAFF	Ministry of Agriculture, Forestry and Fisheries
NGO	Non-Governmental Organisation
MoE	Ministry of Environment
RGC	Royal Government of Cambodia
SCW	Save Cambodia's Wildlife

1 Introduction

Cambodia's small-scale fisheries support the livelihood for a vast part of the country's rural population. Fish is, together with rice, the most important food in the country and the source of up to 80 percent of the Cambodians' intake of animal protein (FAO, 2017; RGC, 2010). The fishery sector hence plays an important role for food security, as well as being central for both culture, traditions and the national economy. During the past two decades however, the ongoing climate change has, alongside unsustainable management of natural resources and geopolitical changes, drastically altered the conditions for the country's small-scale fisheries.

Cambodia belongs to the group of countries worst affected by climate change. While the entire Southeast Asian region is estimated to be highly affected by climate change related impacts, Cambodia is considered particularly vulnerable to climate risk (Almack, 2012; Germanwatch, 2016). Climate-related impacts entail changes in both season extremes and variability, with longer and hotter droughts in the dry seasons and heavier rainfalls during the rainy seasons. This means a higher risk of both drought and floods, at the same time as the seasonal and tide patterns are changing and becoming more unpredictable. In the coastal areas, salt intrusion caused from the sea level rise obstructs the conditions for agriculture and water supply. (UNDRR, 2019; Germanwatch, 2016; ADB 2015)

80 percent of Cambodia's population live in rural areas, of which a vast majority depend on a combination of fishing and farming for their livelihoods with few available livelihood alternatives. Since the productivity of both agriculture and aquatic ecosystems is highly dependent on climatic conditions, they are particularly vulnerable to the impacts of climate change. Previous research shows that aquatic ecosystems will be continuously and severely affected by rising temperatures and longer periods of drought (FAO, 2016; UNDRR, 2019). However, fishery-based livelihoods have not yet received as much focus as other areas within the scientific field of climate change adaptation and in climate adaptation policy. Also, the social values of the fishery industry has often been overlooked in the government's policies in sectors concerned, such as agriculture, water and energy (Almack, 2012; Badjeck et al 2010).

Cambodia has one of the world's most productive inland fisheries, and the country's free flowing rivers and big Lake Tonle Sap provide fish that is the main protein source for the population. Because of the flood-pulse phenomenon that occurs in the complex aquatic system including the Mekong river and Tonle Sap lake, big areas of land and forests in the country are annually flooded and 30 percent of Cambodia is covered by seasonal or permanent wetlands (RGC, 2010). This forms a land-water interfaced environment that shapes the conditions for an

inland aquatic system that is described to be one of the world's most productive ecosystems. "*Where there is water, there is fish*", is a widely known Khmer saying that refers to the country's rich and diverse inland fishery that employs a big part of the rural population for at least some time every year to fish on floodplains, rice fields or in flooded forests. (FAO, 2017; Almack, 2012)

Cambodia's capture fishery was in the late 1900s organised through a leasing system for large scale fisheries, where areas called fishing lots were leased from the government by privately owned companies. In contrast to the overall development, where an economy focused on rapid growth has been favouring large scale production within natural resource management in Cambodia, the government has made several decentralisation reforms for natural resource management since the beginning of the 2000's (Pellini, 2012; FAO, 2017). The reforms aimed to reach a sustainable management of natural resources while at the same time benefiting local societies and resulted in the establishment of a new type of local civil society organisations, so called Community based organisations (CBOs). The CBOs were a new institutional form of organising community based natural resource management (FAO, 2017).

Due to the decentralization reforms, in order to increase the public access to fish, the fishing lot system has been cancelled and the former lots have been transferred to so-called Community Fisheries (CFis), which are a type of CBOs. Following this, the CFis have been established as the "central, local institution for fisheries management in Cambodia" (Kurien, 2017). Being the main local civil society institution responsible for natural resource management, CBOs are often involved in development projects and their work is often done in cooperation with, and support from both local and international NGOs (Pellini, 2012). Beyond management of natural resources, CFis also have a broader social mandate in their communities aiming to reduce poverty (Kurien, 2017, RGC, 2005). Thus, this mandate also gives CFis a crucial role in a situation where various political, societal and climate-related changes put the small-scale fisheries and the local societies relying on it, at risk.

This thesis seeks to understand the role of the CFis in increasing the capacity to adapt to climate change and related impacts, and to reduce livelihood vulnerability. The study is based on semi-structured interviews with CFi members, and members of CFi committees, in four different Cambodian provinces. As a starting point it seeks to understand how Community Fishery organisations are experiencing the local impacts of climate-related changes, moving on to how the measures taken in response to these changes are perceived in relation to livelihood vulnerability and capacity to adapt. Drawing on these themes, the thesis discusses the socio-political role of CFis in a context of climate change and decentralized natural resource management.

1.1 Purpose and research questions

The purpose of this study is to understand how the work of Community Fishery organisations can contribute to reduce livelihood vulnerability and strengthen local communities' capacity to adapt to climate change. The thesis aims to understand Community Fishery organisations' role and function for their local communities' response to climate change impacts, in a context of wider economic and political changes. The thesis contributes to a discussion about the distribution of responsibilities for adaptation within the system of decentralised natural resource management in Cambodia. The following research questions has been used to fulfill the purpose of the study:

- How do Community Fishery committees and members, in Cambodia, experience environmental change impacts to fishery-based livelihoods in their local communities?
- How do the response measures taken by Community Fishery organisations impact local communities' adaptive capacity and livelihood vulnerability to climate change?

1.2 Disposition

This introductory chapter aims to provide a presentation on my research interest and to present the purpose of the study and the research questions. Subsequently, the research methods and scientific approach are presented in the second chapter followed by a discussion on methodological considerations and the validity and credibility of the study and the results. Thereafter, the third chapter provides background information about the geographical and institutional context of the Community Fishery organisations in Cambodia, as well as a historic background to the establishment of the Community Fishery organisations as part of a larger shift in the politics of natural resource management in the country. The fourth chapter presents the conceptual framework and theoretical approach to the material.

The study's results are thereafter presented in the fifth chapter; starting with a presentation of the field sites, which is followed by an exposition of the impacts of climate change and other related geopolitical changes, along with CFis' responses to these changes and consequences for local fishery-based livelihoods from the views of Community Fishery councils and members. The sixth chapter contains a discussion and analysis of the empirical findings using theory within the fields of vulnerability and climate adaptation, aiming to answer and discuss the research questions presented above. Drawing on the findings analysed in the sixth chapter, conclusions are presented in the thesis seventh and final section.

2 Methodology and methods

The material in this master thesis has been collected during a field study in rural Cambodia between 4 September and 15 November 2019. The field study was jointly conducted with another masterstudent, Felicia Olsson, and was financed through a Minor Field Study scholarship from Sida (Swedish International Development Cooperation Agency). This study seeks to understand climate vulnerability and adaptation through the eyes of people involved, i.e. the informants, and has been conducted with a qualitative approach. Thus, we have been guided by qualitative research methods during the process of collecting data, with semi-structured interviews as a main method.

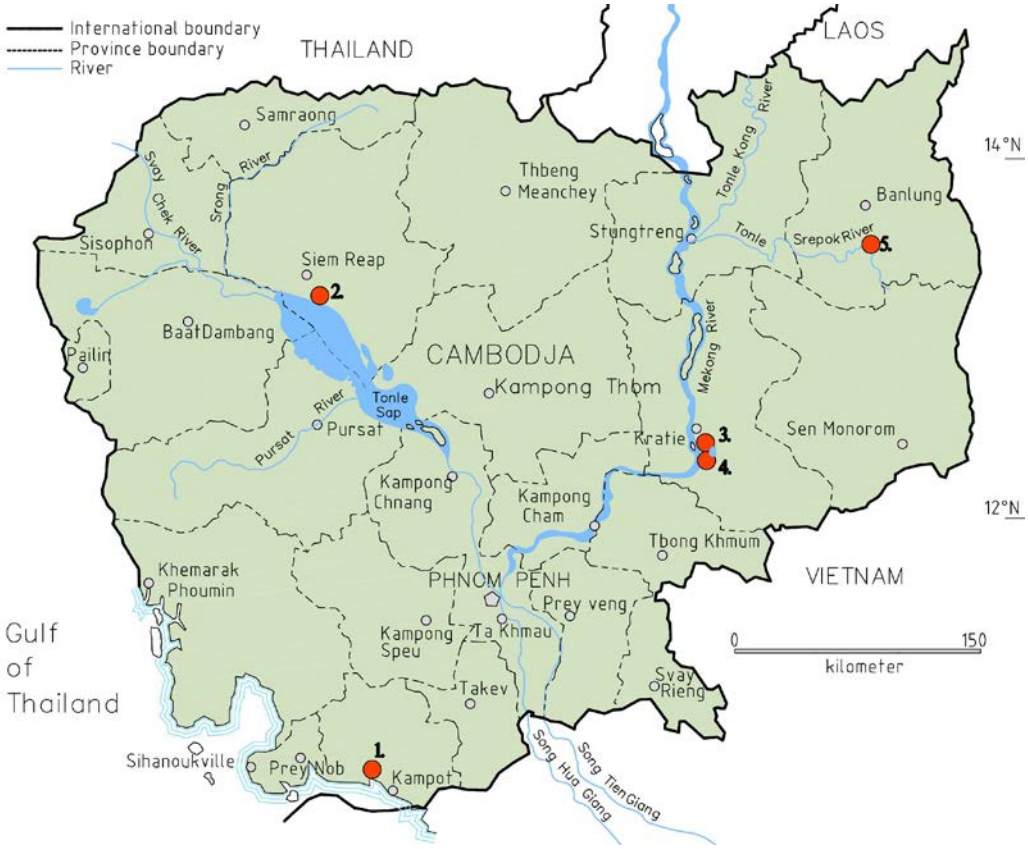
With exception of five key informant interviews conducted in the offices of their respective organisations, the data was collected during field visits to ten CBOs of three different types; Community Forestries (CFs), Community Fisheries (CFis) and Community Protected Areas (CPAs). The ten CBOs we visited are located in five different Cambodian provinces; Kampot, Kratie, Ratanakiri, Kampong Thom and Siem Reap. The interviews have been organised and conducted by a team of three; two master students and one interpreter, but sometimes also together with NGO professionals who work to support the Community Based Organisations with their activities on a daily basis.

The jointly collected data has been used for two separate master theses with different analytical focal points. Hence, the scope of the conducted field study has been broader than the theme of this thesis, which is narrowed down to focus on CFis. Although not presented in this thesis, the field studies to the different types of CBOs have contributed to findings presented in the thesis through contextual understanding of the organisational structure of CBOs and their role in Cambodia's legal system, but also to the local characteristics of livelihoods and climate vulnerability.

The socio-ecological systems of forestry and fishery in Cambodia are strongly interconnected and mutually dependent: most people working with forestry and agriculture are also fishing and vice versa. Annually flooded forests constitute important habitats for inland fish, and wetlands are alternately used for farming and for inland fishing following the monsoon seasons. Hence, the interviews with CFs and CPAs add to the study with relevant information about the context, and have provided a greater understanding of the context and conditions for fishery-based livelihoods in Cambodia.

2.1 Selection of field sites and interviewees

The thesis presents data from field visits to five different Community Fisheries in rural areas distributed over four Cambodian provinces.



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Trapaeng Sangkae CFi (1) is located in the coastal area in the southwest part of Cambodia, Kampot province. Kampong Phluk CFi (2) is located close to the big lake Tonle Sap in Siem Reap province. The CFis Preak Ta Am (3) and Preak Ta Thoeng (4) are located along the Mekong river in Kratie province, and Chey Udom CFi (5) is located along the Srepok river in Ratanakiri province. The Srepok river is a tributary of the Mekong and flows through the Northeastern part of the country to Vietnam.

2.1.1 ForumCiv and the Green Ownership (GO) programme

The field study has been carried out with support from ForumCiv. ForumCiv is a development cooperation organisation that mediates grants from Sida (the Swedish International Development Cooperation Agency) to Swedish organisations in 70 countries, including Cambodia. These organisations are in turn working with local partner organisations within the civil society. ForumCivs programme Green Ownership (GO) has been a three years-long programme aiming to strengthen local

civil society organisations in Cambodia. The programme has engaged and supported a large number of people as well as several local organisations in 14 Cambodian provinces in the work to secure and improve land tenure rights and access to natural resources for local communities. The project focuses on and addresses natural resource management, adaptation to climate change and works to build capacity of civil society and local communities.

In the initial planning phase of this study, the GO programme was used to inform the study about the context as well as NGOs work with related issues in Cambodia. One intervention in the GO programme has been "Improving fishers' rights toward fisheries resources management and greater climate change resilience in a sustainable way". This intervention inspired the research interest of this study, which has been to understand CFis specific role and how their work can contribute to fishers' rights and climate resilience.

The study's research interest was CBOs and climate change adaptation, and ForumCiv facilitated our contact with their partner organisations involved in interventions concerning climate change adaptation and capacity building in Cambodia within the GO programme. Subsequently, when we arrived in Cambodia, these organisations in turn assisted us in the contact with the CBOs. Thus, our choice of appropriate field sites was made in consultation with them and ForumCiv's office in Cambodia based on geographical aspects described in the section below and, in a second step, CBOs that had an established cooperation and contact with the NGOs were selected.

Previous reports from Asian Development Bank (ADB, 2015) highlight all the selected field sites as "hotspots for climate change". The selected CFis cover a large geographic variation and are exposed to diverse climate-related impacts. The field sites also cover Cambodia's three main hydrological systems for fishery: the coast, inland lakes and rivers. Thus, the selection provides the study with data on a broad spectrum of both climate-related impacts and adaptation measures for the different types of fishery. Even though these CFis have all been involved in climate-related projects, the projects themselves have not been in focus in this study. However, the total of activities conducted by the CFis reported by the informants in this study is of relevance for climate adaptation, of which some are part of development projects and programmes.

CFi	**Trapaeng Sangkae**	**Kampong Phluk**	**Preak Ta Thoeng**	**Preak Ta Am**	**Chey Udom**
District	Kampot	Siem Reap	Chetr Borei	Chetr Borei	Lumphat
Members	734	3 780	108	288	404
Villages	3	3	1	1	7
Established	2005	2005	2012	2004	2012
Main livelihoods among members	Fishing, farming, tourism	Fishing, dry season farming, tourism	Farming, animal husbandry, fishing	Farming, animal husbandry, fishing	Collection of non-timber forest products, fishing, farming, work at plantation

Figure 2. The CFis that we visited.

The selected CFis show a wide range in number of members, villages, areal size, assets and capacity. They are also different regarding organisational structure: some are closely connected to local authorities, having the same people as committee members as in the commune council, whilst other CFis are organisationally independent from local authorities. These differences among the selected CFis reflect the great diversity among CFis in Cambodia, concerning size, capacity and organisation (RGC, 2018).

2.2 Data collecting methods

The methods for data collection have been semi-structured interviews and a literature review. A total of 31 interviews have been conducted, out of which five are key informant interviews and the remaining 26 have been carried out with CBO committee members, CBO members, and officials at local and provincial authorities. Of these 26 interviews, 9 interviews have been conducted with Community Forestry committees and members, and 12 interviews with Community Fishery committees and Community Fishery members. Five interviews were conducted with officials from Forestry Administration in Kampong Thom province, Fisheries Administration in Ratanakiri province, the Department of Environment in Ratanakiri province, and officials from local authorities in Kratie and Ratanakiri provinces.

Some of the interviews were conducted as individual interviews and some with several members of the CBOs and CBO committees in a group. Key informant interviews were conducted individually, with professionals from the NGOs FACT

(Fisheries Action Coalition Team), SCW (Save Cambodia's Wildlife) and Recoftc - The Center for People and Forest. The aim of these interviews has been to gain a greater understanding of the NGOs' efforts to support the CBOs in their work and establishment, as well as to gain a deeper understanding of the CBOs work and response to the various changes they are facing.

2.2.1 Semi-structured interviews

This is a qualitative study aiming to understand the world through the eyes of the people involved, by using qualitative research methods based on semi-structured interviews. The interviews were conducted using a battery of open ended questions and we attempted to carry out the interviews in a dialogue manner in order to make the interview situation as comfortable as possible. The semi-structured interview approach gives the flexibility to focus on what is important to the respondent and for them to share their own reflections as well as allowing us as researchers to ask follow up questions, thus acquiring a deeper understanding of the respondent's views on the questions discussed (Kvale & Brinkman 2014).

The various interview formats had different benefits. The individual interviews gave us a possibility to get one person's story and views, how they were personally affected and experienced the issues discussed; whereas questions concerning the CBO, its work and its history, were best answered by several members together, or the whole committee, which allowed people to fill in and contribute to the story with more information.

2.2.1.1 Epistemological approach

Nightingale (2015) states that a common deficiency in adaptation research is that the wider social, economic, cultural and political context often is overlooked. Adaptation issues, she argues, are often simply framed as consequences of biophysical impacts. Instead, Nightingale (2015) suggests a wider approach where plural epistemological perspectives on climate change are considered. Since climate impacts are closely interconnected with other processes and dynamics of change, it is important to step outside the narrow framing of adaptation and not only ask questions of biophysical impacts in research, but also broader and more general questions about significant changes in people's lives.

Drawing on this, the starting point of the interviews concerned the livelihoods in the villages and how it has changed during the last two decades. The interviews thereafter moved on to focus on livelihoods, how the CBOs have responded to the changes they experience and how effective this response has been for local livelihoods. The questions also concerned the CBOs institutional role and their relations to other actors involved in climate risk and adaptation policy, such as

local authorities and regional agencies and governmental ministries. (See list of questions in Appendix 1)

We strived towards being clear and concrete in our wording during the interviews to avoid misunderstandings. Therefore, we have been careful and restrictive with the use of complex concepts and terms that have various definitions and tend to be perceived differently, such as “climate change”. During the interviews, we initially chose to talk about weather in more practical terms, such as temperature, precipitation, seasons and wind in order to make sure that we mean the same thing. Subsequently, we asked about the interviewee’s perceptions of the concept of climate change and what it means to them.

It is a challenge to investigate changes and dynamic processes, as it is dependent on people's memories. By focusing on livelihoods, we could ask about changes concerning the conditions of their occupation, comparing the current situation to ten and twenty years ago, respectively. To understand the context specific characteristics of climate vulnerability and the capacity to adapt, we inquired in responses to changes and asked about which factors had benefited or constrained adaptation and recovery. To learn about capacity, we asked how and by whom the adaptation and recovery work had been carried out and what factors had contributed beneficially to the capacity.

All interviews with the CBO Committees and CBO members were conducted with the help of an interpreter as we did not share a common language with most of the members of the CBO committees. This means that everything said during the interviews has gone through two stages of interpretation; first by the interpreter and thereafter by me. Citations should therefore not be seen as literal representations of the informants’ words. The interviews were recorded with a voice recorder and were selectively transcribed and subsequently analyzed.

2.2.2 Policy and literature review

Before the fieldwork, I conducted a methodical review on literature of relevance for CFis, natural resource management and climate change adaptation in Cambodia. The literature review includes previous research within the scientific fields of climate adaptation, climate vulnerability, adaptive capacity, resilience and sustainable livelihoods. Furthermore, the review includes previous research and reports concerning CFis in Cambodia. The literature review also includes previous studies and reports from IPCC, WWF, FAO, UNDRR and the WorldFish Center that address community-based natural resource management, how small-scale fishing in general and Cambodian in particular are affected by climate change and related natural disasters.

Furthermore, I conducted an overview of relevant policies and frameworks for climate adaptation and fisheries in Cambodia. The policies have provided contextual understanding of the CFis institutional relations, position and legal conditions. The policies studied are Cambodia's nationally determined contribution (NDC) to UNFCCC and the Paris Agreement, Cambodia National Adaptation Programme of Action (NAPA), Cambodia's Climate Change Strategic plan: 2018-2023, Climate Change Priorities Action Plan for Agriculture, Forestry and Fisheries Sector 2014-2018, MAFF 2014, Cambodia's Strategic Planning Framework for Fisheries: 2010 – 2019, and the Sub Decree on Community fisheries.

2.2.3 Contextual understanding and informal interviews

Being new to Cambodia and in the process of developing our understanding, we were eager to discuss our material and results to understand it in its context. This resulted in a number of informal and spontaneous interviews with NGO professionals, guides and interpreters. We have had the benefit of working closely with several local and international NGOs in Cambodia, from whom we have been able to get feedback and discuss our results. In discussing the CFis, we have turned to SCW in Kratie and Ratanakiri, FACT's head office in Phnom Penh, FACT in Siem Reap, Recoftc in Kampong Thom, and the program officers at ForumCiv in Phnom Penh.

We have also had the great privilege to participate in several meetings concerning the CBOs activities, including one internal meeting with Recoftc and ForumCiv in Kampong Thom district, two meetings together with CBOs and Recoftc in Kampong Thom, and two meetings with FACT and Kampong Phluk CFi in Siem Reap. These meetings were held in Khmer and we could participate with the help of a translator.

2.3 Working with NGOs

The political landscape of natural resources in Cambodia involves a large number of stakeholders where NGOs play an important role. The CBOs in Cambodia are in general working with scarce financial resources and are often highly dependent on international and local NGOs for financial, technical and administrative support. Hence, both local and international NGOs have worked closely with local societies supporting them through projects aiming at a sustainable community based natural resource management during the past two decades. This makes the role of NGOs working in the field crucial to the development of the CBOs and their activities.

This study is carried out with support from the NGOs ForumCiv, Recoftc, Fisheries Action Coalition Team (FACT) and Save Cambodia's Wildlife (SCW). ForumCiv has provided places for us to work at their office while we were

processing and analysing our findings and preparing visits to CBOs. They offered us the opportunity to attend their meetings with the local NGO Recoftc and accompany them on field visits. They also mediated contact with local NGOs and recommended and mediated contact with suitable interpreters. The local NGOs Recoftc, SCW and FACT have mediated contacts with CBOs, allowed us to participate in their meetings and often joined us on our visits and interviews with the CBOs' members and committees. All NGOs generously offered their time to discuss our results and provided us with their invaluable inputs to interview questions and the design of the study.

These NGOs are working in close contact with several CBOs all over the country. Thereby, cooperating with them has given us credibility and legitimacy in our meetings with the CBOs and has been a contributing factor to our respondents feeling safe about discussing otherwise sensitive matters and political issues with us. Given the short time frame and limited resources that are available in writing a master's thesis, this support has been crucial for the possibility to conduct the study.

With this said, the relationship between the NGOs and communities will inevitably be characterized by a donor-beneficiary relationship. During the field study we consistently had to weigh the disadvantages of being associated with NGOs against the support provided to us by the NGOs which have made the study possible to conduct. To minimize the possibly negative consequences of being associated with beneficiary organisations, when presenting ourselves to the informants, we clearly introduced ourselves as students.

2.4 Ethical considerations

Before the interviews, we informed the interviewees about the purpose and the methods of the study and that it will result in two master theses. Information about the study is essential for people who participate in research processes to give an informed consent (Bryman, 2012). During the research process, we were transparent about the purpose of the study and our roles as students. All interviewees were asked for permission to record the interviews with a voice recorder before the interviews started.

During the whole research process, it has been our aim to understand our informants' perspectives and to treat them and their information with our greatest respect. Since we discussed sometimes political and sensitive issues during the interview, I have chosen to consequently anonymize the interviewees in the thesis.

2.5 Limitations of the study

This study has focused on CFi committees and a limited part of their members. No household surveys in the villages have been made. Therefore, this study does not include views from a representative selection of villagers. In order to evaluate vulnerability and power aspects within communities, the household level is crucial to consider. However, this study does not attempt to give a complete assessment of livelihood vulnerability in the selected communities. Instead, the empirical study is narrowed down to CFis committees' and members' views on fishery-based livelihoods vulnerability and the contribution of responsive actions.

Even though some of our respondents are women, our target group has been CBO committees in which the majority of members are men. That, in itself, clearly points towards the need for future focus in research on women's role and vulnerability to climate change within the fishery sector, not least since women as a group are often considered to be particularly vulnerable to disasters and climate-related impacts. (UNDP, 2017)

2.6 Validity and credibility

In this study I seek to understand people's views and perceptions of reality, their perspective on things that are important to them. At the same time, I acknowledge that my own pre-understandings will shape the lens through which I look at the world, and these pre-understandings will inevitably affect my decisions when designing the study and analysing its results (Jackson, 1996). I therefore strive to be transparent about the research methods used to conduct this study and to present a material rich and extensive enough for the readers to make their own judgements on the interpretations made in the thesis and the presented material.

To fulfill the purpose of this study and answer the research questions, I find that the semi-structured interviews have been adequate in providing the possibility to learn about our informants' views and perspectives by allowing them to freely express their opinions and thoughts during the interviews. This has allowed us the flexibility to focus on what the informants express is most important to them, and for us to ask follow up questions.

However, it is important to recognize that even though semi-structured interviews strive to resemble conversations, it is not a conversation between equal participants. The informants neither decide the theme of the interview nor control how their answers are interpreted. It is also important to bear in mind how the researcher can impact and shape the informant answers by how the questions are shaped (Kvale & Brinkman, 2014). Therefore, it has been important to be self-critical and to continuously reflect on how we affect the informants. Working in a team has been a great advantage, since we have been able to discuss and reflect

on the interview situations together with interpreters who are familiar with the context and culture.

The study has been dependent on support and facilitation from the NGOs ForumCiv, Recoftc, SCW and FACT, which have played a crucial role in the selection of field sites, interviewees and interpreters. The local NGOs have facilitated our contact with translators, who have not been experienced as translators, but NGO staff and guides working in the local areas. The collected data for this thesis should thus not be seen as representative of Cambodian fishery villages in general, but of rather of fishery villages with NGO support.

The interviews and field visits have, with a few exceptions, been carried out in a team of three, including two masters students and one interpreter. This has had both practical and analytical advantages; all interpretations made during the research are based on the perception of three individuals instead of just one which can reduce the risk of misinterpretations in the interview situation. However, to conduct interviews with an interpreter will inevitably mean that the information passes through two steps of interpretation instead of one - first the interpreter's and then mine. The disadvantage of being dependent on an interpreter is that translation can reduce exactness and nuances in the data. The quotes in this essay are therefore not literal but a translation. In order to increase the accuracy and to facilitate the communication in the interview situations, we discussed the interview questions with the interpreter before the interviews. During the interviews, the interpreter often repeated the question in his own words before translating to ensure reciprocity.

Kvale & Brinkman (2014) emphasize the importance of the translator being familiar with the cultural context. However, the interpreter's involvement with the CBOs and the NGO system in Cambodia caused us to constantly consider and be concerned with their translations, and how their attendance affected what the CBO members and committees were comfortable saying during the interviews. We met with our interpreters before the interviews in order to discuss the study and interview questions, and to establish a relation with them, which made us more confident in the reliability of their translations.

This process of collecting the data in collaboration with NGOs has been an important prerequisite for us to collect our material, but it has affected the selection of both field sited and interpreters, and thus the results of the study. The material focuses on issues of adaptation and vulnerability at community level. We have not been able to, nor attempted, to go deeper into power relations within the communities and households, as this would have required longer time to get acquainted with the local context.

The data we have been able to collect could be considered to be biased in favor of the project support that the CFis have received from the NGOs, whose support our field visits have been dependent on. Our study has thus not focused on assessment of the support for adaptation, but rather on the CFis' committees' and members' view on vulnerability, its causes, and their possibilities to adapt, based on local conditions.

The results of this study are case specific reflections of the informants' experiences and perceptions and are not general. However, there is a value in the knowledge about the specific. This study can contribute to the understanding of similar cases as well as to a broader discussion about the subjects. CFis are Cambodia's main local institutions for fishery management and case specific studies can provide important insights contributing to a general discussion about how climate change issues can be managed at local level. The geographically broad scope of this study with material from several regions makes it relevant for various conditions.

3 Background

The following chapter provides background information on the Cambodian fishery sector's historical and current situation. First, I briefly present the CFis' climatic and geographical conditions. The second part presents information about the economic and political development in the country. Lastly, in the third part, a brief presentation of natural resource management in Cambodia is presented, with a focus on the fishery sector and its institutional framework for climate change adaptation. My aim with this chapter is to describe the CFis geographic, socio-political and institutional context, in order to better understand their challenges and conditions.

3.1 Climate and geography

Cambodia has a monsoon climate with two distinct seasons; the dry season in November to April and the wet season from May to October. 30 percent of the land area in Cambodia is seasonally flooded and this annually flooded area is of great importance for the inland fisheries. The fishery sector in Cambodia can be divided into three main geographical systems: the coast, the big lake Tonle Sap, located in the country's western part, and the Mekong river that flows from north to south in the eastern part of the country. The Mekong River and the Tonle Sap lake can be described as Cambodia's geographical key features and with its complex aquatic ecosystems and hydrology, it is providing an inland fishery that is among the world's most productive (World Fish Center, 2012).

Fish constitutes a major part of Cambodia's food supply. Studies from the Inland Fisheries Research and Development Institute (2013) shows that fish, together

with other aquatic resources, is the biggest food source in Cambodia after rice and that 76 percent of the population's total protein intake comes from aquatic resources. In addition to being an important food source, fishing is also an extremely important part of the livelihood. Small-scale fishing contributes to livelihoods for millions of people in the country, either in whole or in part. Many of the people who are depending on fishery for their livelihood have few livelihood alternatives. It is estimated that 46 percent of the Cambodian population partly or mainly rely on fishery for their livelihoods, a number that is significantly higher in rural areas (Johnstone et al., 2013).

The largest part of Cambodia's fishery is located by the Mekong river, the Tonle Sap river and the Tonle Sap lake. Cambodia's inland hydrological systems are unique, both due to its great biodiversity and its seasonal fluctuations. Cambodia's inland capture fisheries production is estimated to around 400 000 tons per year, and the rivers and the Tonle Sap lake inhabits more than 500 fish species (Johnstone et al., 2013). The flood pulse phenomena, that I will further describe below, generates great river flow fluctuations according to the seasons, and thus also nutrients availability. Thus, the fishery in Cambodia is highly dependent on the annual floods during the rainy season (Sneddon, 2007).

During the rainy season, lasting from June-July until October, the water flows in the Mekong river increases. This causes the Tonle Sap River that connects the Mekong river with the Great Lake Tonle Sap to change its course - from flowing downstream from Tonle Sap to Mekong, to flow from the Mekong towards the lake (Sneddon, 2007). The reversed water flows into the Tonle Sap lake expands the lake's surface, from 2500 km2 in the dry season, to approximately 15,000 km2 during the rainy season (Sarkkula et al. 2005).

Valbo- Jørgensen, Sokheng and Chhea (2001:121) describe the flooded area around the Tonle Sap lake as "a mosaic of flooded forest, shrubs, grassland, rice fields and permanent and seasonal water-bodies". These flooded areas are vital aquatic habitats for fish to seek shelter and spawn. In conjunction with the Tonle Sap river changing course and the expansion of the Tonle Sap lake, large amounts of plants, aquatic preys, and organic material are made accessible for fish that now can reach flooded surfaces covered with vegetation. This great amount of fish feed generates an enormous fish production. Thus, the fish productivity depends on the expansion of the Tonle Sap lake, caused by the monsoon rains and the reversion of the Tonle Sap river, which in turn depends on the water flows from the Mekong river (Sneddon, 2007; (Sarkkula et al. 2005). When the water recedes in the beginning of the dry season in November, fish migrates from the flood plain of Tonle Sap, and back to the Mekong river (Sneddon, 2007).

The fact that the productivity of lake and riverine fisheries is dependent on the Mekong river's annual flooding, its timing and its magnitude, makes the

disruptions of these water flows and the fish' migration a threat to the fisheries productivity (Sarkkule et al. 2005). Over the past decade, lower water levels have been measured in the Mekong River, which also affects the Tonle Sap lake. There are various causes to the lowering water levels, including higher temperatures and less rainfall, as well as upstream hydropower dam development in the Mekong River. Changes in the hydrological system are expected to have major consequences for inland fishing, but there are yet many uncertainties in the estimates of these impacts. However, previous research estimates that there will be changes in fish migration patterns as well as changes in the size of annually flooded land areas. According to calculations in previous reports, the water temperature, nutrient levels and water levels in the dry season will change. These changes lead to a greater uncertainty in capture fisheries.

The forest land coverage in Cambodia is rapidly decreasing due to extensive and unsustainable logging and the country's deforestation rate is one of the world's highest (Ek, 2017). Forests and wetlands are important buffer systems to climate change impacts for the agriculture and fishery sectors. The degradation of these ecosystems therefore contributes to make the aquatic systems more vulnerable to the consequences of climate change and exacerbates its impacts (World Fish Center, 2012).

Impacts on the fisheries resource, due to loss of available food and habitat for fish, and changing hydrological patterns, poses a threat to the millions of rural livelihoods depending fully of partly, and more or less directly, on fishery (Sarkkula et al. 2005). Thus, the effects of climatic and geopolitical changes on fisheries will, with all likelihood, increasingly be felt across all societal scales; as well in the national economy and in local households. (Johnstone et al., 2013)

3.2 Rapid economic growth and shrinking democratic space

During the past two decades, Cambodia has experienced rapid economic growth. By reducing poverty in half over ten years, the country has moved from being classified as a low income country to now being categorized as a lower middle income country (UNDP, 2019). Nevertheless, poverty still remains a great problem in Cambodia and particularly in the rural areas which are inhabited by 80 percent of the country's population. The increasing economic growth has a distinctly uneven geography and is mainly concentrated in the bigger cities. A vast part of those who have been lifted out of extreme poverty are still very close to the poverty limit (Ek, 2017).

The Cambodian People's Party (CPP) and prime minister Hun Sen has been in government since the fall of the Pol Pot regime and the end of its horrific genocide in the 1970s. In recent years, Cambodia has experienced severe setbacks for

democracy since the government has acted increasingly authoritarian and has moved towards a one-party state through dissolution of the opposition party. Furthermore, the government has enacted several repressive laws that severely curtail the rights to free expression. Human rights organisations and international media report that the government has intensified arrests of human rights activists, land rights activists and independent media. Thus, this development has severe consequences for civil society (Human Rights Watch, 2019).

3.3 Natural resource management

During the 1990s, large-scale production was favoured in Cambodia's agricultural sector in line with the rapid economic development (Pellini, 2012). Considering the general focus on macro level economic growth, this was paradoxically recognized to be an undesirable development by the Royal Government of Cambodia (RGC) at the end of the 90's. According to this recognition and an international decentralisation trend amongst development partners, a community based approach for natural resource management was introduced in Cambodia through several reforms starting from the early 2000s (Pellini, 2012). Community based natural resource management (CBNRM) is performed as a collaboration between actors and stakeholders in the local community and public authorities and agencies. The CBNRM approach emphasizes the necessity of local knowledge in order to change towards a more sustainable management of natural resources by focusing on the participation of Civil Society Organizations and community members in policy making processes. Involvement of people concerned does not only have crucial values for democracy and civil rights, but is also assumed to contribute to such processes through reduced poverty and improved livelihoods (Pellini, 2012).

The political reforms within the area of natural resource management in Cambodia around the turn of the century resulted in the establishment of so called Community-Based Organizations all over the country. Three different types of community based organizations were established; Community Fisheries (CFi), Community Forestries (CF) and Community Protected Areas (CPA). The three different types of CBOs focus on the management of fish, forest and forest conservation areas respectively. There are various explanations for this shifted approach from the government since 2000, towards what Kurien (2017) describes as the only "conscious government-driven policy dedicated to the "small scale-isation" of the fishery" in Asia. The decentralisation reforms has been a way for the government to resolve previous conflicts between communities and large-scale fishers, while at the same time transferring financial and administrative responsibility for natural resource management to other actors. Another explanatory model is that Cambodia as both a transition economy and post-conflict country, has had the opportunity to be creative when reorganising management structures (Kurien, 2017).

3.3.1 Cambodias' fishery sector

Cambodia has two main marine sub-sectors: the coastal fishery and the inland fishery. The country's marine fishery sector is very small compared to the inland fishery. The coastal fishery, operating in the short coast on the eastern side of the Guld of Thailand, is divided in two zones. Small-scale fishers, including community-fisheries, operate in zone one, which stretches from the coast to a depth of 20 meters, whilst commercial fisheries, that are mainly large-scale fishing, operates in the second zone between 20 meters deep and the limit of the exclusive economic zone (EEZ) on international waters. (FAO, 2011)

The inland fishery in Cambodia is considered to be one of the worlds' richest natural resources due to its great biological diversity. Inland capture fisheries in Cambodia are divided into three main categories: large-scale, middle-scale and small-scale fisheries. Large-scale fishery refers to commercial fishing and was prior to the fishery reforms based on fishing lots leased from the government to private people and companies through auctions every second year (FAO, 2011). The fishing lot areas were the only places where gear for large scale fishing were permitted and fishery in these areas was only allowed in the season October-May. The large-scale fishery gear include barrages and dais, which is a type of trawl that can be up to 100 meter long and is used to filter the current in rivers (Blomley et al., 2010). Middle-scale fisheries require a license and use large-scale fishing gears, but are not allowed in fishing lot areas. Small-scale fishery (subsistence fishery) is the only type of fishery that is allowed in the community fishery areas. The gears most commonly used for small scale fisheries are castnets, traps and dipnets. No license is required for this kind of fishery, which employs a large part of the rural population for part of the year (Kurien, 2017).

Due to a fishery reform in 2000, 56 percent of the fishing lots were released and transferred to areas for community fishery. The reform has been called both surprising and radical, and Kurien (2017) expresses that the CFis appeared "out of the blue" around year 2000. Some contributing reasons, he mentioned, is previous conflicts between fishing lot leases and small-scale fishers in the communities. Dina and Sato (2014) suggests that the shift in policy can be explained by political interests, to garnering election votes (Dina and Sato, 2014). Community fisheries are institutionalised in Cambodia's legal system in accordance with a sub-decree for Community fisheries that received legal status in 2005 (RGC, 2005). The sub-decree is a detailed specification of a topic in the main law, which in this case is the Fishery law (Kurien, 2017).

Since 2012, all fishing lots left have been released for community fisheries. However, despite this shift there are still severe problems with illegal fishing in

the country, using large-scale fishing gear (Kurien, 2017; Blomley et al. 2010; Marschke et al. 2014).

3.3.2 Policy framework for climate change adaptation in Cambodia's fishery sector

In the section below, I aim to give a brief presentation of Cambodia's three main public policies for climate change adaptation and its relevance for the work of the CFis.

In accordance with the Paris Agreement, Cambodia has presented its Nationally Determined Contribution (NDC) to the UNFCCC (RGC, 2015). The NDC includes both climate adaptation and mitigation actions and describes Cambodia's strategic priorities in the implementation of the national climate change adaptation policy. Among the priorities are the National Adaptation Action Plan (NAPA) and Cambodia's Climate Change Strategic plan (CCSP).

Cambodia's National Adaptation Programme of Action (NAPA) identifies the main climate-related hazards in Cambodia as flooding, salt water intrusion, coastal zone inundation, drought and low flows, windstorms and storm surge. Cambodia's National Adaptation Plan aims to "strengthen ongoing climate change adaptation processes through cross-sectoral programming and implementation at the national and sub-national level and pool them under one roof". It highlights the fishing industry as particularly climate vulnerable at the same time as it emphasizes the fisheries' important role for both livelihoods and the national economy. (RGC, 2006)

Cambodia's climate change strategic plan (CCCSP) 2014-2023 was prepared following a suggestion in the National Strategic Development Plan (NSDP) 2009 – 2013. The NSDP declared that "to effectively deal with the implications of climate change, the capacity of RGC institutions needs to be strengthened to identify and develop a strategy to deal with the anticipated impact of climate change, and strengthen disaster management capabilities". For this purpose, the CCCSP was prepared with one of its four goals of "[r]educing vulnerability to climate change impacts of people, in particular the most vulnerable, and critical systems (natural and societal)".

The mission of the CCCSP is described as "[c]reating a national framework for engaging the public, the private sector, civil society organizations and development partners in a participatory process for responding to climate change to support sustainable development." Further, the plan states that "Cambodia is highly vulnerable to climate change and the RGC recognizes the need for mainstreaming climate change into the NSDP and national policies at all levels based on selected key guiding principles." According to the CCCSP, there is an aim to integrate climate change into national development processes and

operationalise it in sectoral planning through Sectoral Climate Change Strategic Plans (SCCSP) with related Action plans. Cambodia's Climate Change Action Plan for fisheries (2014-2018) identifies priority actions in order to deliver to the CCSP, in which one priority action is to “enhance climate resilience in the fishery sector and to promote aquaculture production systems and practices that are more adaptive to climate change”.

Cambodia's strategic planning framework for fisheries: 2010-2019 highlights loss of breeding habitat and declining wild stocks, because of climate change, dam constructions, land conversion and deforestation as main threats to the fishery in Cambodia (RGC, 2010). As a possibility for the fishery highlighted in the plan, it suggests improved natural resource management through moving decision making closer to the people reliant on the sector.

4 Conceptual framework

During the field visits, we have collected data concerning the CFi’s experience of impacts from climate and geopolitical changes, their response to these impacts and consequences for livelihoods in the communities. To understand what the CFi’s work means to reduce livelihood vulnerability and strengthen adaptive capacity, the data has been analyzed against a theoretical framework based on the concepts of vulnerability, resilience and adaptive capacity.

There is a comprehensive scholarship related to climate vulnerability that contains a plurality of definitions and frameworks. These frameworks contain contributions from several scientific fields such as disaster risk reduction, climate change adaptation, sustainable livelihood research and entitlement theory. Agrawal and Perrin (2009) argue that a definition of vulnerability has to incorporate locally specific climate change impacts on livelihoods, such as reduced livelihood opportunities, stresses on institutions and increases in environmental risk. Since climate impacts and characteristics of vulnerability are context specific, adaptation measures must be as well, in order to be locally relevant.

This chapter aims to give an introduction to the scientific field, and the concepts used to understand the specific local situations presented in the study results; vulnerability, resilience and adaptive capacity. Furthermore, this chapter reviews literature on community-based adaptation which can provide deeper understanding of CBOs’ challenges, as well as the potential of their role and function for their communities. It also presents some important perspectives from literature within the field of political ecology, which has inspired this study and its understanding of vulnerability.

4.1 Perspectives from political ecology

The theoretical approach used in this thesis has been inspired by some of the key aspects within the field of political ecology. However, the conditions of data collection did not allow for a full political ecology framework, as we did not have the possibilities to research deeper into power relations affecting and differentiating vulnerability and adaptation. When studying human response and adaptation to changes and stresses in their environment, we maintain awareness of how governing of natural resources is always political, and that politics affects ecology and the environment (Robbins, 2012). Power relations, equality and access to natural resources are central in political ecology research, and the research holds an intrinsic normative value with a goal to empower disadvantaged social groups (Zimmerer, 2000). This perspective provides a guiding light for our research.

The CFis' conditions and environments are highly affected by politics outside the communities; as well as there are inequalities within the communities that affects community members in differentiated ways depending on social groups. This study has not had the possibilities to go deeper into these aspects, but has focused on CBO committees on a community level. This thesis therefore does not focus on power relations within the communities and households, but on community adaptation and vulnerability. Political ecology can illuminate how environmental problems on a local level are embedded in larger political and economic systems outside the local communities, and thus how systems impact the conditions for the CFis' work for adaptation. (Robbins 2012) These perspectives within political ecology has inspired the discussion in this thesis, regarding the CFis' embeddedness in wider political processes. First, people are not always able to adapt to environmental changes, such as drought, floods and salinization, although they have deep knowledge about their local environment and experience of adaptation. Secondly, environmental and climate related changes are driven by large-scale political and economic processes. Thus, theory within political ecology provides an analytical focus on the communities' embeddedness in larger political and economic systems, in order not to blame local communities for environmental degradation (Paulson & Gezon, 2005).

4.2 Community based climate change adaptation

A community-based approach to climate change adaptation has been adopted in various forms, and with various results, worldwide during the past three decades. Research on community-based approaches to adaptation has evaluated community-based organisations' role and function for local societies. This theoretical field has worked as a starting point for the study of some of the institutional and organisational conditions and challenges of the CFis, in general as well as in a Cambodian context.

Reid et al. (2009) describes community adaptation as a community-led process that is based on the communities' priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change. The community-based approach aims to allocate power and control over adaptation processes to the community. Community-based approaches are intended to be adaptive to change, in order to encompass experience and learning, and are by many considered to have a great potential to ensure that communities can form their own agendas (Allen, 2003).

However, Reid et al. (2009) state that while community-based adaptation focuses on communities, there are inevitably differences within communities in vulnerability and needs and thus in priorities and capacities. Based on that, community-based adaptation approaches have been criticized for not paying enough attention to differences in power within communities and households (Dodman and Mitlin, 2013). For example, people perceive stress from different hazards in different ways, depending on their age, gender, and economic situation, since they are not equally affected. Because of the large differences in power, vulnerability and priorities within both societies and households, some argue that the community-level is not the most adequate for planning adaptation measures (Dodman and Mitlin, 2013).

Yates (2014) express that, considering the great differences within communities, the community level should not be a pre-given scale for addressing vulnerability and climate adaptation. This view criticizes the assumption often underlying community-based approaches to adaptation, that communities are fixed units that are at the same time the problem and the solution. Yates (2014) stresses that communities should not be seen as given entities but are instead the result of exercise of power and negotiations between a plurality of perspectives. Therefore, Yates (2014) suggests that communities instead can be understood as networks, consisting of flows of resources and diverse relations.

Allen (2003) furthermore describes how community-based approaches to reduce vulnerability has tended to work to depoliticize issues and drivers of vulnerability. Allen argues that a project discourse has tended to associate vulnerability with hazard events, and that it generally has treated other causes and drivers of vulnerability as being "outside the scope of the project". Furthermore, she states that the depoliticization of vulnerability issues tends to allocate responsibility for adaptation at local communities, instead of illuminating the political and economic processes that causes environmental degradation (damming, deforestation, economic land concessions) and thus determines local vulnerability, although local societies lacks power and mandate to address wider issues beyond the local level. Allen (2003) argues that it is the embeddedness in hierarchical governance systems and the hegemonic view of vulnerability with

main focus on natural hazards, and not the community-based approach itself, that has contributed to depoliticization.

4.3 Climate vulnerability

O'Brien et al. (2007) divide the wide spectra of vulnerability research into two main epistemological paradigms, with different focus within research on what creates vulnerability. Theory within the first paradigm is generally using definitions of vulnerability that the authors categorize as "outcome vulnerability", putting the main emphasis on hazards and environmental stressors in its analysis, and then secondly takes social aspects into account. The second paradigm is referred to as "contextual vulnerability" and has, according to the authors, in contrast to the former its primary focus on social stressors such as poverty, aspects of inequality and uneven distribution of resources. From this view, environmental hazards are primarily seen as aggravating these social inequalities.

As there are various focal points to the causes of vulnerability, there are consequently variations within vulnerability research regarding what kind of measures that need to be taken in order to address and reduce it. Some have a more technical risk management oriented focus, whereas some are more political, drawing on theories within the field of political ecology and thus focusing on social and economic reform and distribution of resources. This thesis is mainly drawing on the latter approach, using theories within the field of political ecology as a main analytical view. However, both these approaches are used and are sometimes combined in order to understand the specific local situations studied as well as to contribute to the general discussion. Nightingale (2015) suggests a pluralistic epistemological approach to research on climate change, and thus also to climate vulnerability and adaptation, to encompass all its dimensions:

> *"Accepting that the world's climate is changing rapidly requires us to interrogate all dimensions of it: the climate as atmospheric chemistry, the climate as abstract analytical objects, the climate as a political tool, etc. All of these dimensions are 'real' and equally powerful 'drivers' of climate change and each of them requires profoundly different research techniques. By approaching climate change in epistemologically plural research designs, we are more likely to produce ecologically and politically robust solutions."*

Vulnerability to climate change is in this thesis further understood as a process that is created, sustained and reproduced across all scales in society through its economic and institutional dynamics (Adger, 2006; Agrawal, 2008). Vulnerability can further be understood through three main components, described in the sections below.

4.3.1 Sensitivity and exposure

IPCC has in its fifth assessment report (2014) described climate vulnerability as a function of the three components; *exposure*, *sensitivity*, and *adaptive capacity*, of which the latter will be discussed in a separate section below. Some of the literature within vulnerability research considers exposure and sensitivity together, presented as "exposure-sensitivity". In the assessment report, however, exposure is defined by IPCC as "the extent to which a given system is exposed to climate change-related hazards" (2014). IPCCs definition of exposure contains a biophysical dimension that focuses on the severity and the frequency of climate change related impacts, as well as a social dimension that covers the distribution of populations and assets. These assets can be for example croplands, livestock, and infrastructure. Regarding how this thesis addresses exposure, the main focus is on its social dimensions in seeking to understand the way people construct their livelihoods and how fishery-based livelihoods are affected by climate change impacts.

Sensitivity is described by IPCC as "the degree to which a system is affected, either adversely or beneficially, by climate variability or climate change". The determinants of sensitivity presented in the report includes the extent of dependency on natural resources, access to alternative livelihoods, health status and age of the population.

Recently, most studies on climate change have focused on an understanding of sensitivity with a focus other than exposure to biophysical impacts (O'Brien et al. 2007). Instead, the focus is usually on sensitivity as created and reproduced by political and economic dynamics in a society. These dynamics often create an unequal distribution of resources and influence. Hence, there may be a difference between how people are affected at local level and even within households, pointing towards questions of power, since structural factors and characteristics of various social groups such as gender, age, ethnicity, and indigeneity are often shown to be closely linked to the degree of sensitivity (Adger, 2006).

4.4 Resilience and adaptive capacity

Resilience is a wide concept further described below, which is in this thesis used and understood as a flipside to vulnerability. Thus, the same factors that determine vulnerability also affect resilience conversely; increased resilience within a social-ecological system means decreased sensitivity to climate risk, thus lower vulnerability.

Being one of three main parameters of vulnerability according to IPCC's definition (2014), adaptive capacity affects exposure and sensitivity reversely. In similarity to resilience, and a high adaptive capacity hence means reduced vulnerability. However, adaptive capacity is more specifically referring to a

group's ability to implement adaptation measures. In this thesis, adaptive capacity is used in order to understand what the CFi's institutional relations and arrangements means for the ability to adapt and respond to the challenges they are facing, as well as to understand the outcomes for the capacity of CFis actions.

4.4.1 Resilience and socio-ecological systems (SES)

Resilience can be defined as "the ability of socio-ecological systems (SES) to absorb disturbance without flipping into another state or phase" (Nightingale and Cote, 2011; Gunderson, 2000). The concept of resilience has originally developed from scientific fields connected to ecology, but has during the past two decades been developed to encompass a larger focus on the social part of social-ecological systems and social resilience, which can be understood as "the ability of groups or communities to cope with external stresses and disturbances as a result of social, political, and environmental change" (Adger, 2000). Nightingale and Cote (2011) mean that social resilience, according to Adgers definition, can be understood as the "social factors that allow change to happen while retaining similar feedback and functions of the SES."

The recognition of local ecological knowledge in adaptation is an important aspect in resilience theory; knowledge about the characteristics of local ecological change is considered a driver of changes in institutions for natural resource management, which through shaping the ways the resources are managed in turn changes the landscape as a dynamic system (Gadgil et al., 2003). Nightingale and Cote (2011) highlight the way that resilience thinking can shift the focus from "quantitative availability of resources and towards the scope of available response options to social and environmental change".

However, attempts to merge and interlink social and ecological dynamics have sometimes been considered problematic for their tendency to assume that those dynamics are similar, based on intrinsic assumptions originated in natural sciences. The concept of resilience has been used to assess environmental governance and how different types of management regimes manage to handle social or ecological stress. Thus, theory and frameworks based on resilience and adaptation are often used as policy tools for SES management. Nightingale and Cote (2011) argue that when it is used as a prescriptive tool, and not only a descriptive framework, the concept lacks adequate analytical tools to analyse social action, culture and power. The authors (2011) state that for SES theory to be adequate for such purpose, it has to address questions of power and normative questions, such as 'resilience of what and for whom'?

Walker et al. (2006) write:

> *"some system regimes may be considered desirable by one segment of society and undesirable by another. In addition, some regimes that are considered*

undesirable can also be very resilient, e.g., harsh dictatorships and desertified regions of the Sahel."

Resilience, in conclusion, has been considered to overemphasize the bio-physical aspects at the same time as "under-theorizing" political and economic factors when conceptualizing vulnerability (Nightingale and Cote, 2011). Resilience is in this thesis understood as the ability of the communities to cope with the stresses and challenges they are facing and is used as a flipside to vulnerability. Thus, I aim to pay attention to political and economic factors by understanding resilience based on the same determinants as for vulnerability.

4.4.2 Adaptive capacity

Adaptation to climate change is defined by IPCC (2014) as "adjustments in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities", and adaptive capacity is defined as "the whole of capabilities, resources and institutions to implement effective adaptation measures". Agrawal (2006) defines adaptive capacity as "the ability to return to or exceed functional capacity that existed prior to exposure to a hazard". Factors that determine adaptive capacity includes institutional arrangements and entitlement security, knowledge and information, assets and flexible governance (Levine et al. 2011). Adger (2003) further emphasizes the importance of social capital to increase adaptive capacity, since social capital determines how vulnerable groups can mobilize their assets.

In this thesis, adaptive capacity is used in order to understand what decentralisation, institutional arrangements and entitlement security mean for CFis' ability to adapt and respond to the challenges they are facing. Furthermore, it is also used to gain a deeper understanding in what type of capabilities and resources that can be improved by the measures conducted by the CFis in terms of specific and generic capacity, further described below.

Lemos (2016) divides adaptive capacity into two different types; specific capacity and generic capacity. Generic capacity is built through political and socio economic reform, while specific adaptive capacity can be addressed through climate risk management. The authors argue that these factors together determine the overall climate vulnerability. Income and livelihood are linked to generic capacity, while specific capacity is primarily associated with risk management. Lemos (2016) emphasizes that these two capacities are developed in different ways and that capacity building must be a process that includes both of these.

Lemos (2016) concluded that increased generic capacity that leads to higher prosperity can make households more flexible in dealing with climate volatility and other stress factors. Livelihoods are closely linked to capacity and therefore livelihood analysis is a useful way of assessing capacity. Sen's (1981) entitlement

theory highlights that research on sustainable livelihoods can address the link between households' various resources, that is, assets, households' entitlements, and how these factors affect the households' well-being. Entitlements are determined by the institutional context that concerns rights and access to resources. Access to entitlements can help households to mobilize the assets they actually have to improve their welfare. It can be through trade or social interactions.

People living in rural areas who depend on natural resources for their livelihoods are considered particularly vulnerable to climate change and variability, as climate conditions have a direct impact on the productivity of these resources. Thus, these people and the resources they depend on are particularly exposed to climate change impacts, while limited assets in combination with lack of entitlements are limiting their ability and capacity to adapt and respond (Eakin et al. 2014; Agrawal and Lemos, 2016).

However, Lemos (2016) states that poverty reduction is not enough to reduce climate vulnerability. Instead, previous studies show that because the environmental conditions remain and are difficult to cope with even if the income level is raised because they are always thrown back. Therefore, it is necessary to reduce the climate vulnerability of poor households whose livelihoods are based on natural resources. Hence, policies must also include risk management policy and create synergies between measures for both generic and specific capacity.

In summary, this means that the aim of my study is to analyse how the work of CFis can contribute to reducing livelihood vulnerability and strengthen local communities' capacity to adapt to climate change, by using a theoretical framework based on the concepts of vulnerability, resilience and adaptive capacity. The thesis is mainly drawing on theory within vulnerability research that is emphasising social and political aspects of climate change adaptation. The use of the concept of resilience is limited to be understood as a flipside of vulnerability. Adaptive capacity is mainly used to understand the CFis' institutional relations and arrangement, and its meaning for the communities' ability to adapt and respond to the challenges they are facing.

5 Empirical findings

The following section presents the data collected in this study. The section is divided in three parts; initially, the legislation surrounding CFis and the establishing process is presented, followed by an introduction of the field sites. The second part presents the interviewees' experiences of climate change impacts in relation to local fishery-based livelihoods. Subsequently, the third part presents the actions taken by CFis to meet the climate-related challenges and threats they are facing.

5.1 Community fisheries and their mandate

Cambodia's Fishery Law (Chapter 11, Article 59) states that “all Cambodian citizens have the rights to form Community Fisheries in their own areas on a voluntary basis to take part in the sustainable management, conservation, development and use of fishery resources”. Following this article, the main objectives of the CFis are stated in the sub-decree on Community Fisheries Management (2005), which provides a framework for fisheries management as well as for the CFis’ establishment process and organisational structure.

The sub-decree starts with declaring the main objectives and the intentions with the Community Fisheries, of which the fifth is “[t]o improve standard of living and reduce poverty”. Further, CFis’ responsibilities and duties are listed in article 10, which concerns the institutional relation to public authorities, natural resource management and conservation measures, and democratical aspects of the responsibility towards the members in the communities.

The establishment of a CFi is a process that includes nine steps (Article 11), which includes conducting a management plan, and mark the CFi’s boundaries. The process of completing these nine steps often takes several years, and requires contribution from both NGOs and national authorities. MAFF (Ministry of Agriculture, Forestry and Fishery) is the responsible ministry under which the FiA (Fisheries Administration) is responsible for the registration of CFis. (The nine steps are presented in a table in Appendix 2)

The management plan and demarcation of the CFi boundary are often carried out with support from local NGOs. The result of the completion of the process is a leasing contract. The contract states the conditions for management of the area and gives the CFi rights to lease the community area from the state for a period of 15 years (RGC, 2005). Kurien (2017) describes Community Fisheries as a “co-management arrangement” between local communities and the government, through which the government aims to get support from development partners as well as to engage citizens to actively participate in management of natural resources. The work described by the objectives in the sub-decree on community fisheries is voluntary, and CFis are usually initiated by citizens who live in a village in connection to the fishing area (RGC, 2005).

The fifth of the five main objectives show that the community fisheries are intended to have a social function in their societies. Thus, CFis have a broad assignment that aims to manage fishery resources and related ecosystems, secure livelihoods and reduce poverty in their local communities. All community fisheries have a committee that is elected by the members at a village meeting. The community chief is elected by majority vote. The person who receives second

most votes becomes vice-chief of the CFi committee. In some cases, the CFi's committee are the same members as the commune council (Articles 14 and 15). See tables with the main objectives of the sub-decree, the CFis' responsibilities and rights, and the steps required to receive full recognition as a CFi in Appendix 2.

The following section presents background information about the five CFis, in which the committees have been interviewed in this study.

5.2 Presentation of the CFis

5.2.1 Kampong Phluk, Siem Reap

The CFi Kampong Phluk is located on Tonle Sap, and was established in 2002, the same year as the national fishery reform that allows CFis was presented. Most of the buildings in Kampong Phluk are built on stilts on the lake. Kampong Phluk is both a commune and a CFi, which means that the members of the CFi committee are also members of the commune council. There are three villages in the commune, with a total population of 961 families, which equals 3 780 persons. 90 percent of these are members of the community fishery. Fishery is the most common source of livelihood in the villages and 97 percent of the households have fishery as their primary source of income. The second most common source of livelihood is to drive tourist boats and in the dry season when water recedes, many people are also farming.

The NGO FACT was involved in supporting the establishment of the CFi 2002 and has continuously worked with the CFi since then. Since 2005, FAO has supported the CFi's work to develop alternative livelihoods in Kampong Phluk with a focus on ecotourism.

5.2.2 Preak Ta Am, Kratie

Preak Ta Am CFi is located along the Mekong river next to a national road in Kratie, an upland province in northeastern Cambodia. Preak Ta Am CFi was established in 2012. The establishment was carried out as a collaboration between the commune council, citizens in the village and technical officers from the regional Fisheries Administration with support from Oxfam.

The original intention with the CFi was to protect the flooded forest from logging and to protect and conserve the declining fish stock in the area. Since 2012, the CFi has elected a community committee consisting of nine persons of which two are female. The main occupation in the village is rice farming and fishing and other important livelihoods are vegetable farming and animal husbandry including cow-, chicken- and duck-farming.

5.2.3 Preak Ta Thoeng, Kratie

Preak Ta Thoeng is also located along the Mekong river and is neighbouring to Preak Ta Am CFi. The CFi was established in 2004 after a proposal from the Fisheries Administration and local authorities. The original purpose with the CFi establishment was protection and conservation of fishery resources and to reduce overfishing.

The main occupations in the village are rice farming during the dry seasons, vegetable farming and animal husbandry. Earlier, pig farming was common in the village, but due to the spread of diseases such as African swine fever, the pig farming has decreased. Approximately 30 percent of the families in the village are mainly dependent on fisheries for their livelihoods. Fish is the most important food besides rice and those who do not fish themselves buy fish from the fishermen. Due to its location along the Mekong river, the village is exposed to annual flooding and therefore many of the buildings are built on stilts.

5.2.4 Trapaeng Sangkae, Kampot

The community fishery Trapaeng Sangkae in Kampot was established in 2005, and is now registered as both a CFi and a community ecotourism. In 2009, the first election to the committee was held and today there are nine members in the CFi committee. Trapaeng Sangkae has been supported by ADB, FACT and Plan International and is often highlighted as a successful example for its work with plantation of mangrove forest and ecotourism.

Trapaeng Sangkae is located by the coast outside Kampot town. Big parts of the area surrounding the community are exploited for large scale plantations. The original purpose of the community fishery was to protect the mangrove forests from logging and to improve the fishery resource in order to support fishery-based livelihoods. Before the CFi was established, many of the fishermen in the village had to go abroad to work to have an income, since they could not make a living from the fishery due to declining fish stock.

5.2.5 Chey Udom, Ratanakiri

Chey Udom Fishery community in Ratanakiri is located along the Srepok River, a tributary river to the Mekong. Due to its location by the river, the villages are exposed to a high flood risk, particularly because of the impacts from damming of the river upstream in Vietnam. The community has members from six different villages and was established in 2012, developing from a ten year long cooperation between the villages.

The main livelihoods in the villages are farming, fishing, collection of non-timber forest products such as mushrooms and animal husbandry including buffalo-, pig-

and chicken-farming. Some people in the villages are working at a banana plantation company nearby. The community fishery was created to combat illegal fishery and to conserve knowledge about fisheries for future generations.

5.3 On the frontline of climate change

The following section presents the interviewees' experiences of major changes and challenges that impact their communities and livelihoods, including both climate-related impacts and other, by the community, associated changes, which are mainly geopolitical such as damming and deforestation, but also socio-economic and political.

The section is structured based on the Cambodian fishery sector's three main geographical systems; the coast (Trapaeng Sangkae CFi), the lake Tonle Sap (Kampong Phluk CFi) and the Mekong river and its tributary river Srepok (Preak Ta am, Preak Ta Thoeng and Chey Udom CFis). This categorization is relevant for the different characteristics of climate-related challenges the communities are facing, and thus also characteristics of vulnerability and the actions taken to respond.

5.3.1 Coastal fishery: Trapaeng Sangkae CFi, Kampot

5.3.1.1 Exposure-sensitivity

Before the Trapaeng Sangkae CFi was established, fishing and agriculture were the main livelihood opportunities accessible in the villages now connected to the CFi. Hence, the villagers previously relied on farmable land and fishery resources for their livelihoods. The fishery's resources, in turn, depend on the surrounding mangrove forest and the health status of the coastal aquatic ecosystems.

The community area in Trapaeng Sangkae is highly exposed to various climate impacts; tropical storms, rising water temperatures and sea level rise that leads to salt water intrusion and salinization of farmland and groundwater. Around the community area, mangrove forests, that would otherwise function as a buffer for these environmental changes, have been cleared and transferred to farmland for large scale plantations. Increasingly warm water temperatures and loss of fish habitat from the mangrove forests have forced the fish to migrate to deeper water farther from the shore. This makes fishing difficult with traditional fishing gear and small boats that are limited to fishing in shallow waters. A fisherman and member of Trapaeng Sankae CFi says:

"We have small boats that can only have one or two people go fishing. Compared to the big fishing boats, they can fish in the deep sea, but we cannot. We only fish in shallow water. It is a big problem when the water gets too hot, because the fish move to deeper waters."

Before the CFi was established, work migration was common since the possibility to make a living on fishery decreased due to declining fish catches. Since there were few alternative livelihoods in the villages, the diminishing possibility to make a living on fishery had devastating consequences for many households, states the community chief of Trapaeng Sangkae CFi:

"Many fishermen had to go abroad to work, even though it was illegal and they had no passport. Their children could not go to school because of their living conditions and economics, they did not have enough money or food."

5.3.1.2 Activities and livelihood strategies

Trapaeng Sangkae CFi was established as a response to the work migration in the villages and the declining fish stock. Since the CFi started, Trapaeng Sangkae has developed an extensive ecotourism where visitors can stay overnight in bungalows and participate in planting mangrove trees. The CFi has been the subject of several climate, fishery and livelihood related projects, and has received support from both local and international NGOs for their work.

The tourist activities to replant mangrove have not only provided income for the villagers who drive tourist boats. Also, according to one fisherman and CFi member, the fish and biodiversity have increased in the area due to beneficial effects from the replanting of Mangrove. Thus, to reduce livelihood climate vulnerability and work migration, the livelihood strategy in Trapaeng Sangkae has primarily been to diversify accessible income opportunities through ecotourism and to work for fish conservation as well as to restore biodiversity through planting and restoration of mangrove trees.

Mangrove forests buffer against storms, protect farmlands against soil erosion and landslides and provide habitat and shadow for fish and other aquatic animals. As we travel along the coast in Trapaeng Sankae, where the community fishery has planted 340,000 mangrove trees in ten years, we notice the huge differences it makes for the land along the coastline. Where the community area ends, and mangrove forests have been cleared, flood banks have collapsed in the water due to landslides and erosion, which can have damaging impacts on the coastal ecosystems.

5.3.1.3 Outcomes for livelihood vulnerability

The extensive mangrove planting and restoration in Trapaeng Sangkae has according to CFi members contributed to increasing fish stocks in the community area. Furthermore, the forest protects the community area against storms and high waves, as well as preventing landslides. A fisherman living in the community testifies that less people are migrating to work elsewhere since the CFi has been established and that fish stock in the local area is now increasing due to restoration

of fish habitat. This has resulted in higher fish catches and income improvement among fishermen in the village. The community chief says:

At the weekend there were many fishermen here that left to other places to take another job, because they could not get money from fishing, they could not earn. But since the community was established, the fishermen actually did not get money from the mangrove, but from the effect of the mangrove. Mangrove gives more fish.

Furthermore, the CFi chief explains that the establishment of the CFi has improved the cooperation with local authorities. Initially, he says, the establishment of the CFi was hindered by the authorities because of conflicting land interests. Now, in contrast, local authorities are encouraging the work and supporting the CFi in the fight against illegal fishing. Encouragement from other local organizations can contribute to reducing vulnerability since the support can facilitate adaptation. With an organisational structure in place through the CFis, the communities' ability to mobilize and manage financial support from NGOs has improved. However, it is important to see adaptation in both a long term and short term perspective. The community chief expresses that it is hard to address major long term changes, such as sea level rise and its increasingly damaging effect on the community locally. He perceives the CFi's actions for climate change adaptation and mitigation, such as mangrove planting, as insignificant compared to the environmental degradation caused by large-scale industries:

"We see no solution. The sea water level is increasing from year to year, so the idea we have now is to make the boundary of the land higher. But that is it. Climate change is mainly caused by the big countries. We try to plant more trees, but in the city, they build new factories. I have spent ten years planting mangrove trees. And we can plant on 28 hectares of land. But compared to a factory... Sometimes, when I think about that, it makes me feel hopeless."

The Trapeang Sangkae CFi's work has, according to the findings, enhanced biodiversity, improved income and reduced poverty. As a result of this, work migration has drastically decreased according to the interviewees. However, the community chief expresses that on a local level, these activities do not, and cannot, address the large scale environmental change, such as sea level rise, increasingly affecting the society.

5.3.2 The lake Tonle Sap: Kampong Phluk CFi, Siem Reap

5.3.2.1 Exposure-sensitivity

The main livelihoods in Kampong Phluk are fishery, rice farming during the dry season and ecotourism. The ecotourism activities mainly consist of driving tourist boats through the protected mangrove forests that are habitat for birds and

monkeys. Thus, the villagers in Kampong Phluk depend on the mangrove forest, both as a tourist attraction and fishery resources for their livelihoods. The mangrove is essential for the fishery resource since it is an important habitat for the fish, as well as a buffer, which protects the village from storms and high waves.

The CFi members we talk to tell us that the main threats they experience to their livelihoods in the area are tropical storms, longer and more severe droughts and lowering water levels. The storms present great difficulties for fishing farther out on the lake, as the small traditional fishing boats cannot tackle the high waves. However, the droughts are described by the CFi committee and members as the biggest threat to fish stock and thus to fishery-based livelihoods in the area. As in Trapaeng Sangkae, fish migrate from the shallow waters when the temperature gets too high, or die, as areas that are usually permanently covered with water dry out in the dry seasons. A commune council member says:

"We can see declining fish catches, since the lake became very shallow in the dry season the last few years. It is probably because of the hydropower dams built upstreams in the Mekong that decreases the water flows. A second reason is because of the forests around the lake that have been cut down to be used as farmland. So there is no home for the fish to breed. The fishermen were not able to catch enough fish to support their family"

Deforestation around the lake has been extensive which has, together with the expansion of hydropower dams upstream in the Mekong river, also contributed to the declining fish stock. The community is exposed to environmental stress from rising temperatures and longer periods of drought. Since this, together with geopolitical changes such as damming and deforestation, has been damaging the fishery resource, they have increasingly relied on tourism for alternative livelihoods.

5.3.2.2 Activities and livelihood strategies

Kampong Phluk CFi has conducted various measures and livelihood strategies to improve local livelihoods, which were originally based mainly on fishery, but also dry rice farming in the dry season. A main activity for the CFi is to patrol the community area in order to protect it against illegal fishing. Since the CFi in Kampong Phluk is organisationally connected to the commune, lack of support from local authorities is not an issue. However, members in the CFi express that they are scared and feel threatened during the patrols since they are outnumbered by the illegal fishermen who are also armed and equipped with larger boats. The CFi committee expresses that the CFi and the commune lack the resources and support for law enforcement. Thus, illegal fishing and overfishing remain a great problem for the villagers since the fish stock they depend on is declining.

The CFi has worked to establish an extensive ecotourism, which is mainly based on tourist boat tours driven through the flooded forest conservation area. Furthermore, the CFi has a three hectares big fish conservation area. The CFi also has a savings group, with mainly female members, which provides micro loans to CFi members at a low interest rate, aiming to benefit new businesses and small scale investments in the community.

To deal with the current situation of drought and water scarcity that are the most imminent stress to the villagers, the CFi is considering expansion of agriculture by preparing more land for agriculture to improve food security in the villages. This would entail that flooded forests, which the community has worked to protect, would be cleared and converted to farmland. The community chief of Kampong Phluk CFi says:

"The community has grown two hectares of mangrove, and protected an area of 48 hectares of mangrove forests for ecotourism. Now, the plan is to make farmland on some of that land."

5.3.2.3 Outcome for livelihood vulnerability

The CFi has turned to ecotourism for livelihoods alternatives when fish stock is declining in the area. However, livelihoods supported by ecotourism seem to also be dependent on climate conditions and the political situation. Although the CFi's members and its committee express that ecotourism has had great benefits for the local society, including improved income, at the same time as natural resources are conserved; ecotourism seems to face the same threats from drought and environmental changes as fishery. In Kampong Phluk, the tourist boats lay empty at the port as tourism drops. When water levels are low, it is difficult to reach the tourist sites and the ecosystems that are the biggest source of attraction for tourism are harmed by both climatic impacts, deforestation and damming; harming the conditions for both fishery and tourism at the same time.

The consequences of clearing flooded forests in order to prepare more land for agriculture could have damaging long term effects on the fisheries. It is an act of response to an emergent situation where food security is threatened, but could be considered an counteract to long term adaptation since clearing of flooded forests would have damaging effects on biodiversity, fish stock and the function of the mangrove forest to act as a buffer against storms.

5.3.3 Mekong river: Preak Ta Am and Preak Ta Thoeng CFi, Kratie, and Srepok river: Chey Udom, Lumphat

5.3.3.1 Exposure-sensitivity

The main livelihoods in Preak Ta Am and Preak Ta Thoeng CFis are agriculture, animal husbandry and fishing. The number of households in the villages who are

mainly relying on fishing for their livelihoods has decreased in recent years. Both villages are located close to the Mekong river and are annually exposed to flooding.

In the six villages connected to Chey Udom CFi, the main livelihoods are agriculture, animal husbandry, collection of non-timber forest products and fishing. Some people are also working on nearby banana plantations. Fish catches have decreased drastically over the past decade due to more severe drought, lowering water levels and overfishing. An officer at the Fisheries Administration's office in Ratanakiri tells us:

"In the past, the fish pools never dried out in the dry season. But now that happens. So, we came up with the idea to dig deeper pools, but it still dries out. This could be because of the dam upstream, on the Vietnamese side, 80 kilometers from the Cambodian border. Sometimes they need to store the water, so that is the reason why the river dries out."

Another notable change in climatic conditions that is described by the interviewees in these villages, is that season variability has changed. More and more frequently, it rains during the dry season and the dry season starts later than it did before. The unpredictable weather obstructs the conditions for farming. One committee member of Preak Ta Thoeng CFi explains:

"Ten years ago, the seasons were regular. The rainy season, - the dry season. But now, there is an extreme change. Sometimes it rains, but sometimes there is no rain at all. It is difficult for our community, we don't know when the rain is coming. It is difficult to know when to plant."

Many households in the villages are poor and have scarce resources to restore and replant what has been destroyed. Members of the Preak Ta Am CFi committee express that despite the fact that they are experienced with the floods and the development of technology that has given them better access to forecasts and weather reports, the weather's new extremes and irregularities have made it more difficult to prepare for floods. The community chief of the Preak Ta Am CFi tells us that floods rise both faster and higher than in the past, which makes evacuation harder to arrange. In 2019, the village was flooded for one month. After the flood, as a board member of the Preak Ta Am community fishery describes how everything was damaged: *"All vegetables and plants, all the banana, the corn, rice, everything was destroyed by flooding."*

Another factor contributing to the increasingly high, fast and unpredictable floods is damming upstream in the Mekong and the Srepok river. In Ratanakiri, a member of the Chey Udom CFi says that when the dam opens, the villagers have to evacuate within three days to move to a camp with temporary houses. When

the flood comes, the water rises to above floor level even in the houses built on stilts. A community member explains:

"I have never seen such extreme flooding before, as the flooding in July this year. This village has experienced many floods, but this year's flood was not normal. The water level was very high and very fast".

5.3.3.2 Activities and livelihood strategies

Despite the local knowledge and experience of dealing with extreme weather and seasonal floods, the increasingly unpredictable and extreme weather is hard to prepare for and thus also to respond to, for the local communities.

All three CFis answer that the response to flooding and other disasters is carried out on a household level with little support from the public sector and local authorities. However, evacuation of particularly vulnerable people such as elderly people and kids, is carried out with support from both local and international NGOs. Animals are moved up to the main road, which is located on higher ground than the village next to the river, and are kept there while the village is flooded. Vulnerable groups such as children and elderly people are evacuated to the highlands. Lower houses and buildings are often destroyed by the flooding, but some of the houses are built on stilts and can withstand the flood, even if the water sometimes reaches above the floor surface on these as well.

The CFis Preak Ta Am and Preak Ta Thoeng work to promote agriculture expansion as their main livelihood strategy. Since fish catches are decreasing, the CFis have cooperated with local and provincial authorities to encourage a shift to farming, as livelihood diversification.

The Chey Udom CFi is working to patrol the community area in order to stop illegal fishing and thus reduce overfishing. Furthermore, deep pools are built to protect fish against drought in the dry seasons. The work is carried out in cooperation with provincial authorities as well as NGOs.

5.3.3.3 Outcome for livelihood vulnerability

The community chief of Preak Ta Am CFi states that illegal fishing has reduced since the CFi was established and the CFi has begun working to support alternative livelihoods in the village. The CFi has managed to promote and support livelihoods such as agriculture and animal husbandry, in order to improve the villagers income. This has provided alternative income sources to depend on, other than fishery resources. Also in Preak Ta Thoeng, the illegal fishing seems to have decreased, whereas it is still described as a major problem in Chey Udom due to overfishing.

All CFis are experiencing damaging impacts from longer periods of drought in the dry season and more severe and unpredictable floods. The droughts damages the fish stock, and the activities carried out in order to restore habitat and protect fish from drought are not described to yet have had any impact on fish catches or fishery-based livelihoods. In Chey Udom, some villagers are working for a nearby banana plantation since fishing is not an available option due to decreasing catches.

6 Analysis and discussion

The following chapter aims to discuss how the CFis' actions can reduce fishery-based livelihoods climate vulnerability. Furthermore, it discusses the CFis' socio-political role and institutional relations, as well as the contextual meaning of climate change adaptation. The first part discusses the CFis' activities and its contributions to reduce livelihood vulnerability and increase resilience. The second part discusses the CFis' entitlements and institutional relations in terms of adaptive capacity. Lastly, the third section contains a discussion concerning decentralisation and levels of responsibility for climate change adaptation and natural resource management in Cambodia.

6.1 Exposure and livelihood vulnerability

The following section discusses what the CFis' activities have meant for livelihood vulnerability and resilience in their local societies. In order to understand adaptation to climate change, it is essential to understand what climate vulnerability means and how vulnerability is shaped by social and economic processes. As previously mentioned, vulnerability can, according to IPCC's definition (2014), be considered based on three main parameters; *sensitivity*, *exposure* and *adaptive capacity*. Sensitivity is understood as the degree to which climate change or climate variability affects a system and is, according to IPCC, determined by factors like dependency on natural resources, access to alternative livelihoods, health status and age of the population. Exposure concerns both biophysical dimensions, such as frequency and severity of climate hazards, and social dimensions such as distribution of population and assets. Exposure and sensitivity are often considered together. Resilience is in this thesis understood as the flipside of vulnerability. Adaptive capacity determines the possibilities to reduce vulnerability and increase resilience. This will be discussed in section 6.2 below.

6.1.1 Vulnerability characteristics

The CFis in this study are exposed to different hazards and types of environmental stress and therefore the characteristics of their vulnerability are different. However, some stressors seem to be similar in all CFis visited. Interviewees from all of the communities express that they are exposed to increasingly extreme

drought during the dry seasons and lowering water levels, which has damaging impacts on both fishery and agriculture that are the main livelihoods in all CFis in this study.

Another environmental stress described by all CFis is loss of mangrove forest. Since mangrove provides shadow and habitat for fish and other aquatic animals, the loss has caused damage to the fishery resource and the aquatic ecosystems that the communities depend on for fishery. The loss of mangrove is described as aggravating the impacts from climate change with lowering water levels and higher temperatures in the shallow waters. This harms the fish stock and causes it to migrate to deeper water, which is a problem for the traditional fishermen whose equipment is limited for fishing in shallow areas. Upstream damming of the rivers further contributes to lowering water levels.

The high dependency on fishery and agriculture in the communities makes their livelihoods sensitive to stress that damages these resources and its productivity. Hence, these livelihoods are vulnerable and highly exposed to both climate impacts entailing longer periods of drought and geopolitical changes involving deforestation and damming.

The villages along the Srepok and Mekong rivers; Preak Ta Am, Preak Ta Thoeng and Chey Udom, are exposed to increasing flood risk due to more extreme weather and increased precipitation during the monsoon season. Over the years, the villagers have developed ways to live with the tides and annual flooding, thus adapting their way of living and farming to cope with the floods. However, the damming upstream in both Srepok and Mekong in combination with changes to climate extremes are causing more severe floods that are both higher and faster, and therefore more difficult to prepare for, and thus causes more damage to agriculture and belongings. The CFi members describe that the response to flooding is mainly carried out at household level. The increasing flood risk damages agriculture, which has expanded as a consequence of the decline in fish stock.

Trapaeng Sangkae, located in the coastal area, is exposed to the impacts of sea level rise, entailing salt intrusion and higher water levels, which impact the farmlands and possibilities for irrigation. The CFi community chief of Trapaeng Sangkae CFi expressed concerns that these changes cannot be addressed at a local level, since large scale infrastructure investments will be required to keep water away in a long term perspective.

6.1.2 CFis activities' impact for reducing livelihood vulnerability

All CFis in this study have been working to restore and plant mangrove forest. According to members from Trapaeng Sangkae CFi, Preak Ta Am and Preak Ta Thoeng, the restoration and conservation of mangrove have, in combination with

fish conservation areas, generated healthier and more productive ecosystems and thus increasing fish stock. Hence, they highlight mangrove restoration as efficient for improving fish catches and as a result this has generated both income improvement and increased food security. As a result of that, work migration in Trapaeng Sangkae has diminished since the community was established. Even though the CFi is still exposed to environmental and climate stress, reduced sensitivity seems to have made the fishery-based livelihoods less vulnerable.

Regarding drought, several CFis have dug deep pools to protect fish during the dry season. However, the outcome seems to depend on the degree of exposure in the different areas. In Ratanakiri province, the officer at the Fisheries Administration tells us that deep pools for fish are dug even deeper in order not to dry out, as the dry seasons are getting longer. The situation in Kampong Phluk is similar. Thus, the longer droughts and lowering water levels seem hard to respond to in a sufficient way in order to improve the conditions for fishery.

All CFis have worked to decrease the vulnerability through livelihood diversification. However, the outcome has been varied. In Preak Ta Am and Preak Ta Thoeng, the shift from fishing to agriculture as the main livelihood source seems to have reduced overfishing and illegal fishing, as well as it has improved villagers' income according to the interviewees. This also seems to be the case in Trapaeng Sangkae, where an extensive ecotourism seems to have contributed to income improvement for villagers as well as alternative livelihoods that are less exposed to climate impacts, and thus less vulnerable.

In Kampong Phluk and Chey Udom, however, the CFis' members do not seem to experience the same improvement of livelihoods from their activities as the other communities. The villages connected to Kampong Phluk CFi report being highly exposed to environmental stress due to impacts from deforestation in the areas around the lake Tonle Sap, as well as lowering water levels due to both the damming of the Mekong river and increasing drought. During the past years, fish stock and fish catches have radically declined. The community has made major investments in ecotourism, which has provided alternative livelihoods at the same time as mangrove forest has been protected as an ecotourism site. However, livelihoods based on ecotourism in Kampong Phluk seem to be exposed to the same stress as fishery; the drought that damages fishery resources, does at the same time impact the ability to drive the tourist boats through the shallow areas in the flooded forest conservation areas.

Furthermore, the number of visiting tourists is uneven over the years. During 2019, a CFi committee member tells us that the number of visitors has more than halved. Thus, livelihood diversification does not seem to have increased the community's ability to cope with the impacts and challenges it is facing. Kampong Phluk CFi is now considering agricultural expansion to increase food

security and support livelihoods, which would require land that is now covered with mangrove, which would thus have to be cleared. In a long term perspective, this could further aggravate the situation for fishery. In Chey Udom, the fishery resource is exposed to both overuse, and the impacts from drought and damming, and the CFis activities' does not seem to have managed to improve the situation.

The CFi in Kampong Phluk has established a so-called savings group that works to provide micro loans to members at a low interest rate. This can allow members to make small scale investments and start up new businesses in for example ecotourism. Trapaeng Sangkae's system with a "community tax" from community member's income from ecotourism activities, functions in a similar way. The income is used to finance various small scale investments in the community. According to interviewees in both Kampong Phluk and Preak Ta Am, the improved income from both mangrove planting and the livelihoods diversification has contributed to a reduced vulnerability.

6.1.2.1 Actions against illegal fishing - 'resilience for whom?'

To patrol the community areas in order to protect the fishery resource against illegal fishing is an activity that all CFis highlight as both important and resource consuming in terms of both time, work and petrol. As the CFis were assigned exclusive tenure rights to their community waters, several CFis tell that they have received increased support from local authorities and police for their work against illegal fishing. However, illegal fishing in Cambodia is a complex question and there seems to be various causes to illegal fishing. While Kampong Phluk CFi describe the illegal fishing as well organized medium-scale fishing, committee members of the CFis Preak Ta Am, Preak Ta Thoeng and Chey Udom describe the people who are fishing illegally as in general very poor, using illegal gear such as mosquito nets since they cannot afford legal fishing equipment. An officer at the Fishery Administration in Ratanakiri, tells us:

"We are supposed to send them [illegal fishers] to jail, but it is really hard to make that decision. If it is the first time he does that [illegal fishing], he can sign a formal contract with us to not do it again. If we look at the law, we do wrong - but if we look at his family and how it would affect them… The question is why - why they are poor families, and why they thought there is no other actions they can do to earn their living. The last time I got a call about illegal fishing from a community fishery, I found out that the fisher's family was very poor. I could not put him in jail, I just confiscated his equipment. And we made a contract between the fisher and the community, to make sure he will not do that again."

According to the Fishery Administration Officer as well as members of Chey Udom and Preak Ta Am Cfi, it seems like the poorest in the villages do not always benefit proportionally from CFis activities. Blomley et al. (2010) has in a review of Cambodian CFis interviewed several poor non-CFi members living in villages

connected to CFis, and highlight the requirement of fishing equipment that cannot be afforded by the poor as a hindrance for poor households to benefit from CFis activities. Another hindering factor for poor households to benefit from CFis work, the author stresses, is lack of available time to participate in the often time consuming activities and meetings voluntarily, due to the stress of making ends meet in their livelihoods.

Thus, activities can increase resilience among some groups within societies, at the same time as it risks leaving others behind and even increase their vulnerability. This dilemma is highlighted by Nightingale and Cote (2011) who stress the importance of asking normative questions when prescribing actions aiming to increase resilience and adaptive capacity, such as ´resilience for whom?´ Such questions can highlight how adaptation measures, due to power-structures and unequal share of assets, affect people within communities and even within households in different ways.

A similar discussion is also relevant in relation to conflicting land interests. In Kampong Phluk, expansion of agriculture, carried out as a livelihood strategy aiming to improve food security and decrease climate vulnerability, can due to lack of alternative accessible land result in deforestation and clearing of mangrove forests. This can in turn have negative impacts on aquatic ecosystems and fishery-based livelihoods. Thus, some of the livelihood strategies and actions can improve resilience for a group of people, or increase a resource's productivity, whilst negatively affecting another group or another resource.

6.2 Decentralisation and institutional relations

The following section aims to discuss how the establishment of CFis following the decentralisation reforms has affected the communities' relations to national and subnational authorities. Further, it aims to discuss what this has meant for the conditions for adaptation, in terms of adaptive capacity. Climate adaptation is closely connected to the question of livelihoods, and thus also to the political and institutional structures that affect and determine livelihood conditions. Since the CFis' members are depending on natural resources for their livelihoods, the political and institutional structures that affect tenure rights and access to these resources are crucial for the possibilities to deal with climate impacts.

6.2.1 Entitlements and vulnerability

Through the sub decree on CFis and the CFis own bylaws, CFis now have a joint assignment to work for sustainable fisheries with local and provincial authorities, and some CFis mention the experience that local authorities have turned from being a hindering factor for local small scale fisheries, to an encouraging one. The Community chief in Trapaeng Sangkae tells us:

"In the beginning, we [the CFi] had problems with local authorities that tried to stop the establishment of our community. They used to support only projects that could make money. But since we knew the [fishery] law, and got support from the NGOs, we kept on working. Now, we have good communication with the local authorities, The CFi participates in the monthly commune meeting. And when we have any problem, we always meet the commune officer to solve it."

Thus, in Trapaeng Sangkae, the community's awareness of their legal rights to form a CFi encouraged them to work for the establishment of the CFi. Since it was established, the CFi's land and water entitlements seem to have improved the relations between CFis and local and provincial authorities. The increased support from local authorities as a result of entitlements to land and water, seem to encourage CFis work to implement various adaptation measures and activities, and strengthen adaptive capacity. This is consistent with the findings of Adger & Kelly (1999), which state that a group's climate vulnerability is closely connected to its access and entitlements to natural resources.

Lemos et al. (2016) argue that adaptive capacity, in order to be sufficient for reducing climate vulnerability, has to be both generic and specific. The land and water entitlements that CFis has been ascribed following the decentralisation reforms and their legal registration processes, seem to have strengthened the CFis ability to conduct adaptation measures of both specific and generic character. The CFis has conducted measures for specific capacities to manage climate risk, such as to restore and plant mangrove and digging deep pools for fish, as well as measures aiming to improve generic capacities, such as strategies for alternative income sources for livelihood improvement. However, according to the interviewees, the specific measures seem also to have contributed to strengthen generic capacity, through improving the ecological status and productivity of the natural resources, and thus income from it.

Hence, land and water entitlement seem to increase adaptive capacity through institutional arrangements that improve the communities' ability to conduct adaptation measures. However, the land rights cannot mitigate negative impacts from the environmental stress to which the fishery resources are exposed, and thus to which fishery-based livelihoods are highly vulnerable. Entitlements can be considered a crucial condition that enables adaptation measures. According to the findings in this study, however, it does not fully reduce vulnerability to the various environmental hazards and stress that these communities are facing.

6.2.3 CFis' relations to national authorities and NGOs

Whereas the institutional relations to local authorities seem to have been improved since the establishment of CFis, some CFis' members and committee members still express a lack of trust towards national ministries and agencies. Legal processes are described as arbitrary and unjust, which hinder and delay the

conducting of measures that require legal permission, such as building of deep pools or reservoirs to deal with water scarcity. Some of the CFis express concerns regarding their land rights, and say that they fear that the community will be deprived of them, despite their legal tenure rights as a registered community, due to economic interests in the land from investors. Furthermore, some CFis express that they feel discouraged and counteracted by national authorities in their work for sustainable natural resource management. The community chief of Trapaeng Sangkae CFi says:

"During the process of establishing this community we had a lot of problems with government officials. They did not want to have this community, because they knew that if this community exists, they cannot do anything with this land."

The CFis' responsibilities for natural resource management could be seen as the responsibility of the state, with its greater financial and administrative resources. The CFis have been commissioned with the management responsibility, although there has been no significant allocation of resources to the local level following the mission. Instead, that gap is filled by NGOs and civil society that support measures for mitigation, adaptation, and poverty reduction. In consistency with these findings, Adger (2000) suggests that a lack of action for risk management by state institutions, "exacerbated by inertia in the decentralized planning system", is often compensated for by civil institutions taking a major responsibility for environmental and climate-related risk management.

CFis are intended to increase local influence and decision making, and the CFis' committees are elected by, and thus responsible towards, their members. The CFis' work and actions are hence intended to be governed based on the needs of its members in the local society. A crucial aspect of Community based natural resource management is the democratic value of local decision-making, and to move decision-making of resource management closer to those who use and depend on the resource. Based on that, it is important to consider how CFis' relations to both authorities and NGOs determine the CFis' work, when assessing the CFis' function for its members in terms of accountability and local decision making. Due to the political situation in Cambodia, with shrinking democratic space, CFis sometimes seem to be accountable not only towards their members but also upwards. Furthermore, the work of CFis is strongly influenced by and aligned with NGOs and their donors' projects, since the CFis are financially and administratively dependent on support.

NGOs involvement and connection with the CBOs has been the subject for criticism and discussion, both from research and involved actors. Norman (2014) describes a trend according to which the civil society in Cambodia is increasingly professionalised and transformed in alignment with a technocratic NGO-model, at the expense of it's grassroots connections. In the context of NGOs role in

Cambodia's governance system, questions about accountability are raised, pointing towards larger discussions regarding to what extent the CBOs sets their own agenda.

Norman (2014) argues that CBOs are often results of NGO interventions, albeit NGOs are not part of the local communities. This constitutes a challenge to the community-based approach to adaptation, according to which adaptation is supposed to be community-led. Henke (2011) argues that there is a paradox to donors' support interventions and activities that requires detailed and sophisticated activity plans that involves the communities, albeit not produced or initiated by the communities. Since there are also requirements for accountability from the donors, Henke (2011) furthermore expresses that this can result in that active community members are engaging in training and advocacy activities that are externally initiated, and that is conducted outside their own community.

Allen (2003) describes how community-based approaches to reduce climate vulnerability sometimes has tended to depoliticize issues and drivers of vulnerability. In a Cambodian context, such depoliticisation may be a necessity in a situation where the possibility to illuminate sensitive political issues, such as human rights in relation to geo politics that include damming, deforestation and corruption, are hindered due to the political situation of shrinking democratic space and an increasingly authoritarian government.

6.3 Decentralisation and responsibility for climate change adaptation

This section discusses general questions regarding the distribution of responsibility for adaptation in a decentralized system.

Decentralisation is in many ways an adequate way to allow for local initiatives in managing and reducing climate vulnerability. There may be a difference between how people are affected by the changes these communities are facing, not only between different communities but also within communities and within households. Since structural factors and characteristics of social groups such as gender, age, ethnicity, and indigeneity are often shown to be closely linked to the degree of vulnerability, to varied extent depending on the local context and culture, most research in the field agrees that adaptation to climate change must be local (Wisner, 2004; Adger 2006).

However, Marschke et al. (2014) state that although local institutions for many reasons are well suited to manage climate change adaptation measures, it is not possible for them to "tackle bigger issues" determined by national and international economic, social and geopolitical changes in connection with damming, sea level rise and changing climate extremes. Thus, even though local

institutions have great local knowledge and experience with coping-strategies that can inform locally relevant measures, they lack both financial and administrative resources in order to deal with challenges of great magnitude.

The institutional framework for climate adaptation in Cambodia has been criticized for being sectorized, lacking cross cutting perspectives, and for not capturing past or local experiences well enough. Even though most documents stress the importance of the subnational level's role for natural resource management and adaptation, the strategies have not resulted in allocation of sufficient resources to the local level for de facto implementation of measures. On the one hand, activities at local level carried out by CFis and NGOs seem to work to reduce climate vulnerability in several ways. The CFis' efforts to address local issues, such as restoration of mangrove, control of illegal fishing and livelihood diversification, are in many ways successful and seem to, in some cases, have worked to reduce livelihood vulnerability and build adaptive capacity in the communities. On the other hand, the sensitivity to stressors from changes of larger scale seem to remain, and to be hard to address at a local level.

The concept of climate change adaptation has been criticized for implying that climate change is a natural, external force, which tends to take focus away from the economic and political dynamics that are drivers behind the changes and the environmental degradation that people now need to adapt to. Ribot (2003) writes that the term adaptation *"lends itself to shedding the burden of response onto vulnerable parties; naturalizing what are socially generated conditions"*. Nightingale and Cote (2011) suggests a focus on normative and ethical questions in order to understand and illuminate the politics of climate adaptation, such as *´who, is adapting to what*?´.

Allen (2003) argues that a project discourse further has contributed to a depoliticization of vulnerability issues, which has contributed to allocating the responsibility for adaptation at local communities, instead of illuminating the political and economic processes that causes environmental degradation (damming, deforestation, economic land concessions). This critique is not towards the communities or the community-based approach to adaptation itself. Rather, as expressed by Allen (2003), it is suggesting that the hierarchical governance systems and a hegemonic view of vulnerability, containing a main emphasize on exposure to natural hazards instead of economic and political drivers of vulnerability, has contributed to depoliticization.

The various challenges that the community fisheries are facing in their work to handle environmental changes are both social, political, economic, and environmental. However, these aspects are intertwined; many of the environmental changes that the CFis are facing have social, political and economic roots. Some of these challenges, such as illegal fishing, have been

addressed by the local societies for many years without them receiving much outside support. Some now argue that climate change can work as a lens through which a broader range of challenges that the fishers are facing can be discussed in a bigger context and receive increased support (Marschke et al. 2014).

7 Conclusions

Community Fisheries in Cambodia experience climate impacts that obstruct the conditions for fishery-based livelihoods in their societies. The main climate impacts and related challenges described by the CFis are consistent with previous climate research estimates. These challenges are the results of changes in climate variability and extremes; heavier storms and rain falls during the monsoon period, and longer periods of drought during the dry season. Furthermore, the CFis experience changes in seasonal variability and tide patterns, which makes annual flooding and precipitation more unpredictable. Since the floods are getting both more severe and increasingly unpredictable, they are becoming harder to prepare for, and communities located close to the country's free flowing rivers are thus increasingly exposed to flood risk.

CFis describe how changes in land use, such as deforestation and upstream hydropower dams, further aggravate the damaging effects of climate change on fish stock in the Tonle Sap lake and the country's free flowing rivers. Rising temperatures, longer periods of drought and lower water levels have damaging effects on fish living in shallow water. Stock declines and migration of fish into deeper waters, creates difficulties for small-scale fishers whose traditional equipment is limited to fish in shallow waters. Cambodia's coastal areas are increasingly affected by sea level rise and salt intrusion, whilst drought and declining water levels are described as the major problem around Tonle Sap, and the eastern part of the country is increasingly exposed to flood risk.

Hence, several biophysical, economical and socio-political factors are involved in making fishery-based livelihoods particularly sensitive to the impacts of climate change. High poverty rates, and insufficient resource allocation to the local level following the decentralization of responsibility for natural resource management undermine the local capacity to cope with and adapt to these changes. CFis implement various actions relevant to climate adaptation, aiming to reduce livelihood vulnerability in their communities. The activities are mainly addressing the dependency on fishery and agriculture, for which productivity is negatively affected by environmental change. Many of the activities carried out with support from local and international NGOs, are perceived by the CFis' members to have positive effects on local fishing and non-fishing livelihoods.

Many CFis conduct fish conservation measures that respond to local climate change threats, such as building fishpools to protect fish from drought and planting mangroves to create shade and habitat for fish. In the studied locations, the CFis tell us that such actions have increased the fish population in the community areas and resulted in continued possibilities to sustain fishery-based livelihoods in the villages. According to members of Trapaeng Sangkae CFi, labour migration has declined since the CFi was established. Nowadays, it is possible to earn money on ecotourism, and the conservation measures and the replanting of mangrove forests have generated increased fish stock and catches in the areas. In Kratie, the CFis says that the access to alternative livelihoods in the villages has resulted in reduced illegal fishing.

In Kampong Phluk, the CFi is affected by low water levels and severe drought. However, ecotourism has generated improved incomes since the CFi was established. Although several communities suffer from extensive problems regarding illegal fishing, the establishment of the CFi has strengthened the possibilities to receive support from local and provincial authorities to work on such issues. Livelihood strategies include livelihood diversification, agriculture expansion, and resource conservation. The findings of this study suggest that these strategies reduce livelihood vulnerability through income improvement, increased biodiversity and diversification of livelihood-possibilities. However, the immediate responses to flooding often occurs at a household level and not on a community level.

CFis have potential to reinforce both generic and specific adaptive capacity in their communities. Through improved relations to local authorities as well as through local organisational structure, the CFis enable increased collective action for climate change adaptation by establishing common rules and plans for joint management of common natural resources. The CFis' measures can strengthen their communities' generic capacity by generating income improvement; both from livelihood diversification, and from restoration of ecosystems and fish conservation, leading to increased productivity of fishery resources.

However, it is now almost 20 years ago since the fishery reform that allowed CFis in Cambodia was implemented, but the communities are still facing major challenges. The differences in vulnerability may be high within both communities and households, and it is important to pay attention to what degree the work of CFis benefit the most vulnerable, both in research and in practice. It is a continuous challenge for both CFis and donors to ensure accountability and to improve decision-making processes, in order to respect and reciprocate the members diverse perspectives, priorities, and opinions. Furthermore, the issues of climate vulnerability that CFis work concerns, are embedded in larger political and economic processes which the CFis do not have the power or mandate to address. The CFis organizational embeddedness in a hierarchical governance

system, and a rapidly shrinking democratic space, contributes to depolitization of vulnerability issues.

Considering the highly political environment that the CFis operate within, it is of interest to conduct further research into the CFis' function for its members in terms of accountability and local decision making, considering the CFis' relations to both authorities and NGOs, when assessing CFis' work to improve livelihoods.

To conclude, this study suggests that CFis can play an important role in climate adaptation and reducing livelihood vulnerabilities to climate-related change in rural fishing communities in Cambodia. However, it is crucial to recognize that the CFis are embedded in a wider political context, and that climate adaptation is a political issue driven by economic and political processes. Local institutions are, with their experience and local knowledge, essential for climate adaptation. However, the notion of local climate adaptation has also been criticized for putting the burden of adaptation on the most vulnerable people. The environmental changes that the CFis adapt to have geopolitical dimensions and require responsibility and action not only at a local level, but also at national and international levels.

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Appendix 1: List of questions

INTRO
What does the river/the forest *(depending on type of CBO)* mean for you and your life in the village?
How has your life here in the village changed over the years? *(What are the main changes compared to 10 years ago? Compared to 20 years ago?)*

LIVELIHOODS
What is your main occupation?
What food do you buy? And what food can you produce?
Do you sell something - what, where and to whom?
How have the conditions for agriculture changed in any way over the years? Since when?
(Changes such as weather, productivity, erosion, drought, heavy rains, access to land, fishing gear, fish stock, support)
How has the conditions for fishing changed in any way over the years? Since when?
Do you remember any years that were particularly difficult for farming? What happened?
How did you respond? (*How did you get food? Income?)*
Do you remember any years that were particularly difficult for fishing? What happened?
How did you respond? (*How did you get food? Income?)*
What else do you think could have helped the situation?

THE CBO
How did it all begin with the Community Forestry/Community Fishery?
Who initiated it, and why?
How does the CBO work?
What are the CBO's activities?
Has this work had any impact on your livelihood? How?
How is the CBOs contact with authorities? *(including commune, regional departments and ministries)*
What are the main challenges for the CBO?
What are the challenges to your livelihood today?
How do you think that the CBO could work to meet these challenges?

CLIMATE CHANGE
What do you think about climate change? (*Do you talk about it? When and with whom?)*
What do you think about adaptation to climate change? *(What do you think it means in this village?)*

Appendix 2: Objectives from Sub-Decree No. 80 on Community fisheries management

The five main objectives of the sub decree on community fisheries:
1. To manage the inland fisheries and the related ecosystems in places where fishing lots was canceled;
2. To manage the fisheries resources in sustainable and equitable manner;
3. To increase the participation in protection and management of fisheries resources, and thereby increase the understanding and recognition of its benefits;
4. To provide a legal framework to establish the community fishery
5. To improve standard of living and reduce poverty.

RGC, 2005.

Community fisheries duties and responsibilities:
1. To participate in managing and conserving fisheries resources in compliance with the by-laws and community fishing area management plan which are in conformity with laws and other legal instruments related to fisheries
2. Respect instructions of the department of fisheries and ministry of Agriculture, Forestry and Fisheries
3. Participate in establishment of conservation areas within the community fishing area, protection and reforestation of inundated forest and mangrove forest, and restoration of shallow streams and lakes to improve ecosystems and fisheries environments
4. Guarantee that all members of the community fisheries have equal rights in the sustainable use of fisheries resources as stipulated in the by-laws
5. Implement the by-laws of the community fisheries and formulate the community fishing area management plan
6. Enter into community fishing area agreements with the department of Fisheries in order to manage the fisheries resources sustainably
7. Keep all documents related to the community fisheries

RGC, 2005.

CFi members have the right to:
1. to collaborate with FiA and request support from local authorities to assist in the control of illegal activities
2. to use and manage the resource and habitats in accordance with provision of the law and agreement
3. to undertake small scale fishing

4. to participate freely in all activities of the CFi
5. to file complaints to protect the interests of CFi members

RGC, 2005.

CFis are required to complete the following steps to receive full legal recognition:
1. The establishment of a community group and the lodging of a formal request to FiA for the establishment of the CFi
2. A needs assessment of the potential CFi
3. Awareness raising and seeking registration of members
4. Preparation of relevant legal documents
5. Convening an initial meeting of the members to elect CFi committee
6. Physical delineation and demarcation of the CFi boundary
7. Submission of application for approval to MAFF
8. Signing the CFi agreement (commune, district, province and FiA) and registration of the CFi with MAFF
9. CFi fishing area management planning and its implementation

RGC, 2005.