University of Zurich[UZH]

Against the Current? Using Local Ecological Knowledge to Negotiate Impacts from Large-Scale Mekong River Development

GEO 630 Master's Thesis

Author
Rapichan Phurisamban
17-709-825

Supervised by
Prof. Dr. Norman Backhaus

Faculty representative
Prof. Dr. Norman Backhaus

29.04.2019
Department of Geography, University of Zurich

Acknowledgements

I would like to express my sincere gratitude and deep appreciation to several people, who have supported this master's thesis along various parts of the process. First and foremost, I would like to thank my supervisor, Prof. Dr. Norman Backhaus, for his helpful advice and guidance throughout this project. I also would like to thank current and former members of the UZH Geography Department, particularly Prof. Dr. Benedikt Korf, Dr. Mollie Chapman, Dr. Rony Emmenegger, and Mathew Bukhi Mabele, who provided suggestions during the earlier stage of my writing and challenged me to think more deeply about the framing of my thesis. Moreover, I am very grateful for the financial support provided by the UZH Human Geography Unit and the Geographisch-Ethnographische Gesellschaft Zürich (GEGZ).

To all of my respondents: Thank you very much for your time, hospitality, and interesting insights. I have learned so much from speaking with each and every one of you. It has been a real pleasure.

I would also like to extend my gratitude to those who had provided background resources for my thesis, including Dr. Apisom Intralawan, Khun Ratana Kumphorn (P'Nop), Khun Ekachai Pinkaew (P'Ek), Sayan Khamnueng (P'Kul), Khun Theerawat Sampawamana, and Dr. Yuttana Theparoonrat.

Furthermore, I appreciate the support from my fellow specialized master's students in the Geographies of Global Change program: Heidi, John, and Laura. Thank you for your input and more importantly for sharing this journey with me.

Finally, I am forever grateful for the care, encouragement, and patience of my family and partner, Zoli. Thank you so much!

Summary

The global drive to transform rivers into engines of poverty alleviation and economic growth has produced spatially unequal benefits and costs, often with localized negative impacts. For the Mekong River in Southeast Asia—the world's largest inland fishery and second most biodiverse river after the Amazon—at least six dams have been constructed in its upper reaches, while eight more are under development. Furthermore, a river engineering project between Simao, China to Luang Prabang, Lao PDR, has completely removed ten major rapids that are important habitats for aquatic species. These large-scale projects systematically change the river's hydrological regime, causing cascading impacts on aquatic and other species, and disrupting local livelihoods and resource access.

In the midst of anthropogenic environmental change, local ecological knowledge (LEK) emerges as a valuable resource for communities to mitigate impacts and secure their livelihoods. This study broadens an understanding of LEK in environmental change literature to take into account the political and social implications of its usage and mobilization. It adopts the concept of agency to critically examine the role of LEK, the ways people interpret and negotiate environmental transformations, and the implications of those responses on human-river relations. This qualitative research is based on a case study of riparian (i.e., along river) communities in Chiang Khong and Wiang Kaen, Chiang Rai, Thailand. Data was collected via a combination of participant observation, semi-structured interviews, and document research, and analyzed using the qualitative content analysis (QCA) method.

Findings show that while riverine transformations have sped up the shifting away from river-based livelihoods, LEK usage helps mediate or resist the reconfiguration of human-river relationship. The process of LEK hybridization underpins diverse strategies to cope with, adapt to, as well as resist against the ongoing Mekong River transformations. LEK serves as a source of personal agency and potential empowerment for local resource users, who have been marginalized by the process of development. Individual- and collective-oriented strategies also draw on social network to improve access to information or external support. Furthermore, LEK contributes to the exercise of political agency through place-based strategies of conservation and villager research projects. Its use as a political tool allows the multi-scale network of resource users, NGO workers, and academics to move beyond the local and mobilize their struggles at the regional and international levels.

Table of Contents

Figures

1. Introduction

Rivers are materially, culturally, and economically important to millions of people across the globe. Beyond providing water for drinking and sanitation, a source of livelihoods, and food security, rivers have become engines of economic growth worldwide through large-scale development, such as hydropower, irrigated agriculture, and commercial navigation. This global process of river development, which aims at maximizing human access and economic productivity, produces spatially unequal benefits and costs, often with localized negative impacts on human water security, livelihoods, and biodiversity (Vörösmarty et al. 2010). A re-accelerating construction of hydropower dams since the 1990s, for example, is projected to fragment 25 of the 120 free-flowing large river systems (Zarfl et al. 2015), causing social-ecological impacts such as fish migration disruptions, blockage of sediment and nutrient transportation, flooding of dam sites, riverbank erosion, displacement of local communities, and loss of river-based livelihoods (World Commission on Dams 2000; Baran et al. 2015; Liermann et al. 2012). While these changes can reconfigure human-river relationships in profound ways, many communities are not necessarily passive recipients of impacts. Local ecological knowledge (LEK) and its variants (such as indigenous knowledge) are increasingly recognized as local communities' a source of resilience and adaptive capacity (e.g., Vogt et al. 2016; Blanco and Carrière 2016; Gómez-Baggethun, Corbera, and Reyes-García 2013; Hopping, Yangzong, and Klein 2016). Response to environmental change, however, can be conceptualized in broad ways beyond the preservation of resilience to take into account the socio-political dynamics that contribute to change. This empirically-grounded research, thus, aims to examine the use of LEK as a response strategy in the context of development-led river transformations. Taking into account that LEK, as a social construct, has many purposes, functions, and forms, this in-depth study can uncover the multi-scale and complex processes of LEK mobilization that ultimately serve to mediate and shape the changing human-river relationship.

The case of the transboundary Mekong River provides the empirical basis for this study. Extending over parts China, Myanmar, Laos, Thailand, Cambodia, and Vietnam, the Mekong is one of the most biodiverse rivers in the world. It also provides a key setting for the regional drive for economic growth and development due to its vast hydropower development potential (MRC 2010). Over the past two decades, upstream hydropower and other river development projects have

caused significant social-ecological changes. Many communities caught in the stream of top-down river development are adapting to changes at their local level as well as using local knowledge to engage with the wider national and global political-economic processes in various ways. Accordingly, I argue that research into LEK needs to understand its various dimensions. By exploring the dynamic, multi-scale, LEK-based responses to significant riverine changes, this thesis contributes to a better understanding of local livelihoods and human agency within the context of development and environmental transformations.

To begin, I provide a discussion of the literature on the social-ecological changes from large-scale development of the Mekong River. I also outline my research objectives and questions in the subsequent section.

1.1 The Significance of the Mekong River

As one of the major rivers of the world, the Mekong River ranks first in supporting the world's largest inland fishery, second as the most biodiverse river after the Amazon (Barlow et al. 2008), eighth in terms of flows (Frenken 2012), and twelfth in length (MRC 2010). The river basin spans an area of 795,000 km^2 that is inhabited by over 80 million people. Due to geopolitical reasons, the international basin is divided into Upper Mekong or Lancang for stretches in China and Myanmar, and Lower Mekong for those weaving through Lao PDR, Thailand, Cambodia, and Vietnam. Originating in the Tibetan Plateau, the Mekong River has a defining feature of extreme seasonal variations in flow, largely controlled by snowmelt from the north and monsoon rainfall-runoff from the Mekong tributaries in Lao PDR (Adamson 2009; Beilfuss and Triet 2014). The regional monsoonal climate drives a typically regular annual flood pulse during the wet season between June and October, but cyclonic disturbances from July through September can cause heightened risks of flooding. Geomorphically, rugged terrain and mountainous areas in the Upper Mekong and northern part of the Lower Mekong contribute to fast river flows conducive to hydropower development, while the more flattened landscape especially from Cambodia onward creates extensive alluvial floodplains before the river empties into the South China Sea at Vietnam's Mekong Delta.

Due to its broad range of geographic and climate zones, the Mekong River Basin is one of the world's 35 biodiversity hotspots (Mittermeier et al. 2011). Aquatic species depend on the

Mekong's bio-hydrological seasons characterized by flood-recession pulses, for access to feeding areas, spawning grounds, and nurseries (MRC 2009). The Mekong River Basin supports an estimate of 20,000 plant, 430 mammal, 1,200 bird, 800 reptile and amphibian species (Thompson 2008). It also supports an extraordinary number of fish species, which has been estimated at about 850 species and possibly more if including coastal or marine visitors (Hortle 2009). The river is home to some of the largest fish species in the world, such as the Mekong Giant Catfish (*Pangasianodon gigas*), which has a maximum recorded weight of 350 kilograms as well as a length up to three meters (FishBase, n.d.). Historically distributed from the coast of Vietnam to China's southern Yunnan Province and commonly found along the Thai-Lao border, this migratory species swims long distances upstream to spawn and has become both culturally and economically significant for many local communities. The thicklipped barb (*Probarbus labeamajor*) is also another giant fish species that can reach a maximum weight of about 70 or 80 kilograms and about 1.5 meters in length. It is endemic to the region, and is only found in the Mekong mainstream between Nakorn Phanom Province in Thailand's northeastern part, and Sambor District of northeastern Cambodia (Roberts 1992; Chea 1999; cited in Baird 2006). These large fish species, however, are in decline and considered endangered or critically endangered by the IUCN due to multiple stressors on the freshwater ecosystems.

The Mekong River Basin's biodiversity and abundance support the largest inland fishery in the world. Most of the Mekong fisheries are based on wild capture, while a relatively small portion comes from aquaculture and reservoir captures. According to Baran et al. (2008), some estimates indicate that the Lower Mekong capture fisheries amount to 2.64 million tons annually, which could account to one-fourth of the world's freshwater fish harvests. The total value of fish production averages at least $1,700 million USD per year, more than two-thirds of which are from riverine captures. It is unsurprising that the annual consumption of freshwater fish in the Lower Mekong Basin is among one of the highest rates in the world (Baran and Baird 2003).[1] Total estimates range between 1.5 and 3.1 million tons per year, with a per capita average ranging between 36 and 56.6 kg per person per year (Baran et al. 2008). Accordingly, fish is one of the region's main sources of protein and its biodiversity and abundance are important for maintaining ecosystem functions and communities' food security and livelihoods (Orr et al. 2012).

[1] Based on national levels.

1.2 Impacts of Mekong River Development

This section focuses on changes in the Mekong River brought about by river basin development initiatives. It is important to note that the Mekong river, like other river systems, goes through ongoing, dynamic changes irrespective of human activities, such as from monsoon and tropical storms (MRC 2010). Anthropogenic climate change will likely affect the hydrological cycle through a combination of changes in temperature, rainfall, and sea level, causing subsequent impacts on the river ecosystems (Vu, Yamada, and Ishidaira 2018; Keskinen et al. 2010), but these impacts manifest over an extended period of time and are beyond the scope of this study. Rather, emphasis is placed on existing literature that discusses actual and anticipated impacts from large-scale projects, particularly hydropower development, as they have broad implications over the entire river systems and are directly tied into local residents' perception and experience of riverine changes.

The Mekong River Basin went through rapid hydropower development in recent decades as Mekong countries, especially China, aim to tap into the river's significant hydropower potential. Since the 1990s, 47 hydropower projects have been developed throughout the Mekong River Basin, totaling over 22,000 megawatts (MW) in installed capacity (WLE 2016). About 31 more projects are being constructed, most of which will likely be completed by 2020. While hydropower development on the Mekong's tributaries can cause transboundary impacts, projects on the mainstream river are much more contentious due to significant cross-border upstream and downstream impacts. China's position as a headwater country and an influential economic and geopolitical force facilitated its numerous hydropower project constructions and it became the first nation to build dams on the Mekong mainstream in 1995 (Hirsch 2011). As of late-2018, at least six dams have been constructed in the Chinese stretch of the Mekong River, eight more are under development in both China and Lao PDR, and an additional 16 projects are planned for future development (WLE 2016).

Several authors have investigated into different impacts of the Upper Mekong dam cascades. Lu and Siew (2006) were among of the first groups of researchers to systematically examine hydrological impacts of Chinese dams on the Lower Mekong River, using historical data spanning from 1962 to 2000. They found that the Manwan dam (commissioned in 1995) has influenced downstream water discharge regime, but impacts were relatively small over the study

period. The decrease in sediment flux along the Lower Mekong, however, has many implications for fisheries and agriculture downstream as well as the physical state of the Mekong and its delta. A decade later, (Liu et al. 2016) applied remote sensing methods to understand the hydrological dynamics and impacts from the impoundments of the Jinghong (commissioned 2009) and Xiaowan dams (2010). They detected that these projects have changed river flow patterns compared to earlier years, but impacts may dissipate further downstream as new water sources enter the mainstream Mekong from its tributaries.

Räsänen et al. (2017), however, published findings that contradicted earlier suppositions about downstream impacts. Using river discharge data supplemented by a hydrological model, they found that hydropower operations in the Upper Mekong since 2011 have caused significant variations throughout the river as far downstream as in Cambodia. These changes include more flows in the dry season, and less flows in the wet season, but fluctuations may be large and rapid especially in the dry season. The completion of the Nuozhadu dam in 2014, currently the largest hydropower project in the Mekong River Basin, marked some of the largest changes in river discharge. The authors suggested that the impacts of hydropower development on downstream discharge will vary, but are expected to increase due to future development. Relatedly, hydropower development is shown to dominate the changes of sediment dynamics of the Mekong Delta in Vietnam, when compared to the effects of climate change and sea level rise (Nguyen Van Manh et al. 2015). The trapping of sediments behind reservoirs would likely have significant implications on agriculture and fishery in the Mekong Delta, including loss of nutrients for rice production (N. V. Manh et al. 2014) and reduced fish productivity (Kummu and Varis 2007).

Changes to the river's flow and sediment regimes would likely lead to cascading impacts on aquatic life and communities depending on river resources. Existing studies on the Mekong fisheries, however, are less clear about the actual impacts of river development due to a lack of monitoring data (Baran and Myschowoda 2008) and the difficulty in assessing vast numbers of different species over the entire basin (Friend, Arthur, and Keskinen 2009). Many studies instead used ecological modelling and scenario development to predict future impacts. For example, Ziv et al. (2012, 5609) found that the completion of 78 dams on Mekong tributaries would have "catastrophic impacts on fish productivity and biodiversity." Additionally, Orr et al. (2012) showed that future development of 11 dams in the lower section of the Mekong River would

drastically reduce wild fish catch by 340,000 tons. This reduction would put significant pressures on local residents to find a replacement for the loss of a key source of protein. The decline in fisheries is, thus, not only impact local economy, but also food security.

As debates around regional hydropower development increasingly focus on transboundary trade-offs over electricity production and the loss of fish resources (and associated income and food security), Kuenzer et al. (2013) further examined the roles and influences of various types of players in shaping hydropower debates and transboundary costs and benefits. The authors concluded that these trade-offs do not reflect contestations between upstream and downstream countries. A complex power play underlies the Mekong River water governance, which also involves supranational entities such as the MRC and the Greater Subregion Initiative (GMS). Transboundary trade-offs ultimately arise between the influential and powerful elites who have an interest in developing the Mekong for economic gains and a large population of the rural poor who must bear social and environmental costs. Indeed, existing statistics have shown that dam projects have caused displacement, especially of farming or rural households living near the reservoir area. The construction of the Manwan dam alone caused the displacement of 7,260 people from 114 villages in China's Yunnan Province (Tilt, Braun, and He 2009).

Generalizations about winners and losers often fail to provide a nuanced understanding of impacts at the household and community levels, where studies have generated mixed results. In many of these cases, the contextual underpinning of hydropower impacts and methodology are of crucial importance in shaping research outcomes. For example, in investigating the social impacts of a downstream community, Sivongxay, Greiner, and Garnett (2017) employed the sustainable livelihoods framework, surveyed 160 households affected hydropower projects in central Lao PDR, and quantified impacts across environmental, financial, physical, human and social domains. The authors found that positive impacts outweighed negative impacts for most case study households, as shown by the level of employment, social programs, and infrastructure development. Kura et al. (2017), using a similar quantitative approach, studied the changes to villagers' livelihoods after they were resettled upstream of dam projects. Instead of the more static sustainable livelihood framework, they adopted the concepts of livelihood adaptation and determinants of coping strategies were to determine impacts and adaptation processes. Their findings suggested that households employed a diverse and dynamic set of strategies that may

change by necessity or choice to restore or improve income and livelihoods. The researchers, however, warned against oversimplified assumptions that households follow a similar pattern of recovery from the shock of resettlement.

Despite the highly contested nature of transboundary development projects, few research have closely examined the perspectives of downstream residents. Emphasis on displaced communities is understandable, but this thesis argues for more attention on those who have historically been excluded from social impact assessments. To fill this research gap, this master's thesis aims to contribute to a better understanding of local residents living along the Mekong River and their agency, as reflected in the use of LEK to respond to environmental change.

1.3 Objectives and Research Questions

This thesis has two main objectives. Firstly, it aims to understand the multi-levelled interconnectedness of social-ecological processes and problems experienced by villagers living along the Mekong River. Secondly, as impacted villagers are not necessarily passive victims of anthropogenic environmental change, this study investigates the usage and mobilization of local ecological knowledge (LEK) to adapt and respond to changes in active ways. In addressing these objectives, this study asks:

How does local ecological knowledge (LEK) mediate the reconfiguration of human-river relationship in the context of anthropogenic riverine transformations?

The following sub-questions help guide this research by orienting the focus on river-based livelihood practices and how LEK emerges from the close interactions between riparian villagers (i.e., those living along a river) and their riverine ecosystems.

- How do impacted groups relate to the Mekong River and its ecosystems?
- How are riverine changes perceived, experienced, and distributed along the axes of gender and livelihood-related uses of the river?
- How is LEK employed and mobilized to respond to riverine changes? To what objective(s)?

1.4 Thesis structure

Following this introductory chapter, Chapter 2 covers the development of a conceptual framework for the study. Discussions of the research methods for data collection, analysis, as well as ethical considerations are provided in Chapter 3. Chapter 4 describes the research context in northern Thailand and the specific field sites. Chapters 5 through 7 present the results to the research sub-questions on human-river relations and livelihoods, experiences and perceptions about riverine changes, and response strategies. Chapter 8 discusses the results with regards to the key research question and offers caveats on LEK mobilization. Finally, Chapter 9 provides conclusions to this study by summarizing research findings, critically reflecting on the methodology, and offering further research directions.

2. Conceptual Framework

This chapter discusses the conceptual framework that guides this research. By drawing on different bodies of literature, this study aims to foster a more interdisciplinary dialogue and guide a nuanced understanding of local ecological knowledge by framing it around the perceptions and experiences of local residents, and how their local knowledge is used and mobilized to respond to anthropogenic environmental change. Relevant concepts are discussed below.

2.1 On Knowledge and Knowing

The concept of knowledge has taken up different forms depending on its contextualization. A general approach for thinking about knowledge has focused on two perspectives, namely on 'knowledge' and 'knowing' (Antweiler 1998; Lorenz 2001). At a deeper level, these views reflect the ontological position of the researcher and is worth highlighting here. The 'knowledge' perspective sees knowledge as an object, which reflects "*that* which is known [italics in original]" (Antweiler 1998). Such thinking implies that that as an object, knowledge can be disassociated from individuals, its applications, and social context (Ibert 2007). In contrast, the 'knowing' perspective views knowledge as a process, in the sense of "*how* something is known" (Antweiler 1998). This perspective facilitates seeing the performative aspect of knowledge as an "ability to act" (Stehr 2001, 89). Knowing is dynamic, constitutes itself in action, and cannot be separated from its social context and relations. It is under this performative notion that I base my conceptual framework on and further discuss local ecological knowledge.

2.2 Defining Local Ecological Knowledge

Researchers have used various terms, sometimes synonymously, to refer to the knowledge of local groups in relation to their ecosystems. These include traditional ecological knowledge (TEK), indigenous knowledge (IK), local environmental knowledge or local ecological knowledge (LEK). Amaru and Chhetri (2013) argue that the choice of term is significant as it hints to the direction from which the researcher has approached the subject and the assumptions made. For clarity, I adopt the term 'local ecological knowledge' throughout this thesis as 'indigenous' does not apply to my research area, which comprises of people with multiple histories and origins. The notion of

indigenousness is also ambiguous and has attracted debates over its definition and political implications (Gausset, Kenrick, and Gibb 2011). The term 'traditional' is also avoided in most cases as it suggests an opposition to the 'modern' or scientific knowledge. Such framing would be counterproductive to bringing various forms of knowledge together to make use of different worldviews and approaches for solving social-ecological problems. Some researchers have also argued that the term 'traditional' might suggest that such body of knowledge is static or archaic, leading to a disregard of its dynamic nature (Usher 2000). Instead, the term 'local' helps to highlight that such body of knowledge is place-based and emerges from direct experience with a local ecosystem. Furthermore, rather than using the term 'environmental,' which only implies abiotic components or the elements surrounding an entity, I prefer 'ecological' to refer to both biological and physical components and their interactions.

In defining local ecological knowledge (LEK), I begin with a definition of traditional ecological knowledge proposed by Filkret Berkes and other authors to provide a basis for contrast and discuss this definition using insights from other researchers. Berkes (2018, 8) defines TEK as "a cumulative body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (including humans) with one another and with their environment." By contrast, LEK has resulted from more recent human-environment interactions (i.e., fewer generations) by non-indigenous people in a specific area "rather than being embedded in deeper cultural practices" (Raymond et al. 2010). It is often associated with practical knowledge, particularly with regards to the management of natural resources (Cook et al. 2014; Rist et al. 2010; Johnsen, Hersoug, and Solås 2014). Olsson and Folke (2001, 87) suggest that the differences between LEK and TEK are based on historical and cultural continuation of resource use. Gilchrist, Mallory, and Merkel (2005) further emphasized that LEK better describes "current local knowledge" obtained from "the observations of individuals during their lifetimes and, to varying degrees, was interspersed with some historical information provided by their older relatives." Accordingly, this research uses the term LEK to refer to a body of practical knowledge, practice, and associated beliefs held by non-indigenous peoples in a specific locale, that have resulted from direct human-environment interactions, and to a limited degree, have been passed down from an older generation.

A general description of LEK as a knowledge-practice-belief complex is taken from the works of Berkes (2018) given that empirical knowledge of the landscape and ecology is embedded in the social and cultural context. This view acknowledges the perspective that knowledge is not a bounded object, but one that is performative and involves multiple linkages to the broader social system and processes (Section 2.1). The knowledge-practice-belief complex includes four key inter-related levels. At the first level is the knowledge of species identification, taxonomy, life cycles, and other ecological processes. This level of LEK is often taken as technical knowledge, incorporated into reports, and sometimes taken out of its cultural context when attempts are made to combine LEK and scientific knowledge (Ramos, Shenk, and Leong 2016, 18; Simpson 2005). However, under the performative conception, LEK also encompasses the knowledge of practices, tools, and techniques related to resource use and management. Human expertise and ecological practices come to the fore at this second level of LEK. Another level up involves the knowledge of social institutions, norms, and codes of social relationships that frame "the processes of remembering, creativity, and learning" (Davidson-Hunt and Berkes 2003), underlying LEK and its practices. Finally, LEK at the fourth level reflects what Whitehead (1929; cited in Berkes 2018) argues as a *conceptual order* of knowledge. Beyond the first three levels of knowledge constituted by direct perceptions and observations, this conceptual order is constituted by the assumptions and beliefs about the universe (Berkes 2018). The terms worldview or cosmology have been used synonymously to describe this order of knowledge (Houde 2007), which underpins how human-nature relations are conceived and interpreted (Peterson 2000; Berkes 1988). Accordingly, this final level of LEK relates to the belief systems, including religion and ethics.

As a social construct, local ecological knowledge (LEK) is dynamic, continuously shaped by the ecological, socio-cultural (Berkes, Colding, and Folke 2000; von Glasenapp and Thornton 2011), political (Nadasdy 1999), technological (Iniesta-Arandia et al. 2015), and economic processes (Reyes-García et al. 2007; Aswani, Lemahieu, and Sauer 2018). The embeddedness of LEK within these collective processes suggest that efforts at separating it from other forms of knowledge (i.e., scientific) is futile (Agrawal 1995). People both consciously and unconsciously engage with different kinds of knowledge (Nightingale 2014), which have resulted in knowledge hybridization (Gómez-Baggethun, Corbera, and Reyes-García 2013). For example, fishing practices (second level of LEK) changes over time with the introduction of new technology and technique. This hybrid aspect of knowledge may lead many to question the need for referencing

LEK and using the qualifiers of 'local' and 'ecological.' LEK also has practical limitations (e.g., context specific, validity, precision) and there are possible danger of romanticizing it (Ruddle and Davis 2013; Rist et al. 2010). For example, activities informed by local knowledge, including LEK, "are not necessarily sustainable nor socially just" (Antweiler 2012). I however argue that the focus on LEK in this research is necessary to emphasize the situatedness of knowledge, particularly its relations to the people and place from which it emerges and how it facilitates the "ability to act" (Stehr 2001, 89), thus making clear the attention on local responses to ecological change. These limitations are fully acknowledged and care will be taken to analyze and interpret research findings.

2.3 Locating LEK within the Environmental Change Literature

Research on LEK and similar forms of knowledge have often been framed within the resilience framework, highlighting the potential contribution of such body of knowledge to help local residents cope with and adapt to change within the interlinked, complex, co-evolving social-ecological systems (Berkes and Jolly 2001; McMillen, Ticktin, and Springer 2017). Under social-ecological resilience theory, LEK is seen as dynamic and evolving over time through long-term observations and adaptive management (Folke 2006; Gómez-Baggethun et al. 2012). LEK also provides a link between social and ecological systems as it is used to understand, interpret, and respond to ecosystem change (Berkes, Colding, and Folke 2000). LEK literature within social-ecological system (SES) and resilience thinking thus emphasizes the linkages between ecosystem change, adaptive capacity, and the maintenance of LEK within the context of global environmental change. Framing LEK this way allows for an in-depth investigation into institutions, management practices, and the generation, accumulation, and transmission of local ecological knowledge, which help to explain the improvement or decline of social-ecological resilience. For example, (Fernández-Llamazares et al. 2015) found that the understanding of past conditions changes with every generation due to age-related differences in perception as well as a decrease in the sharing of knowledge across generations. This suggests that when the use of LEK fails to capture new realities of environmental change, response becomes ineffective and resilience is compromised. In other cases, LEK can enhance resilience through informal and formal institutional responses. The case of a fishing community in Sweden exemplifies how LEK-informed adaptive management practices embedded within local institutions are key to resilience building (Olsson and Folke

2001). The authors found that when villagers faced with a new threat of the acidification of rivers and lakes, they came together to share and develop mitigation responses, including the development of a local fishing association. This development contributed to the process of institutional learning and passing on knowledge about similar threats, thus helping the community to implement appropriate management practices over time. This institutional memory, accumulated through years of experience, is particularly important during periods of change and crisis (Olsson and Folke 2001).

Adopting LEK under resilience framework, however, bears important limitations, and its research approach has been widely debated. Originating from the field of ecology, resilience framework emerges in part to challenge the static equilibrium notions of ecology. It takes an inspiration from complex systems theories to describe the social-ecological system as far from being deterministic, predictable, or mechanistic, but rather as complex and process-dependent relying on multiscale feedbacks to help the system self-organize (Folke 2006). The adaptive renewal cycle or "panarchy" serves as both a heuristic model as well as an analytical tool by depicting cross-scale dynamics that underpin the resilience of a system (Gunderson and Holling 2012; Folke 2006). However, several social scientists have offered valuable critiques on the resilience framework, particularly on its overemphasis on the role of physical shocks or disturbances, limited consideration for political and economic factors, and adherence to structuralist explanations by emphasizing systems-modeling and institutional-oriented approaches (Turner 2014; Cote and Nightingale 2012; Fabinyi, Evans, and Foale 2014). The extension of the theories and concepts of ecological resilience to the resilience within a social-ecological system is also problematic because it hides certain social dynamics that pertain to the questions of power and culture, such as the "resilience of what" and "for whom" (Cote and Nightingale 2012, 479). While these critiques mirror those from the late 1970s between systems theorists and critical social scientists (Kull and Rangan 2016), cross-pollination of ideas have occurred in the past few decades. For example, Peterson (2000), a student of C. S. Holling whose work introduced the contemporary usage of the resilience concept, seeks to integrate a resilience-oriented approach and political ecology to examine the political dynamics in the management of the salmon in the Columbia River Basin.

2.4 Supplementing LEK with the Concept of Agency

As discussed earlier, LEK research as informed by resilience thinking has emphasized the *content* of knowledge or the *institutional* arrangements or conditions that facilitate adaptive management. However, this master's thesis also recognizes the need for a more critical examination of the role of local ecological knowledge. The incorporation of the concept of agency can facilitate an understanding of the various ways people interpret and negotiate environmental transformations. This framing places less emphasis on the analytical unit of organized social groups (e.g., communities, institutions) dominant in resilience research and allows for a multi-scale understanding of LEK and the agency exerted through decision-making at the individual level as well as at the more organized, broader societal level. Furthermore, it broadens the analytical frame by not taking environmental problems for granted, and situates human response at the intersection of socio-political and ecological dynamics. As the strategies people take to respond to environmental change relates to their perceived vulnerability, this thesis also acknowledges the three reasons offered by McLaughlin and Dietz (2008) for an integration of agency in social science research on environmental change (though the authors' emphasis is on the topic of vulnerability). These include (1) humans are never just passive when faced with environmental threats and their actions are not just responses to change; (2) people have their own priorities that may diverge from those of researchers and development agencies, so it is important to understand how they frame their problems; and (3) the framings under which people live and act play an important role in how their struggles are legitimized or delegitimized and it ultimately determines the levels of vulnerability experienced.

The definition of agency is multiple, but it is generally understood as the "socioculturally mediated capacity of to act" (Ahearn 2001). While the concept of agency has been influenced from both structural-functional approaches that stress the collective and the agent-based philosophical approaches that emphasize the individual, this thesis takes inspiration from practice theory by considering the recursive dynamics in people's actions as being shaped by, but also shape social relations and structures (Giddens 1979, 1986; Bourdieu 1977). Taylor (2011, 787) argues that "the capacity to act is not simply an individual resource, but is contextual and depends upon the ability to mobilize self in the context of and with others – it is relational." Accordingly, Lister's (2004) typology provides a useful framework for understanding agency as pertaining to both the individual and the collective. While it was developed in the context of people in poverty, it can be

applied to the case of resource-dependent residents experiencing rapid environmental change as many of them have limited sources of financial income deriving from the local resource-based economy. The framework has also been adopted by research that seeks to understand the agency and well-being of those experiencing a fisheries crisis (e.g., Coulthard 2012).

Lister's matrix of agency is illustrated by two continua from the 'everyday' decision making and actions (i.e., making ends meet) to the more 'strategic,' reflecting the significance of choices people make and the consequences on their lives; and from the 'personal,' which emphasizes individual's livelihood and interests, to the 'political,' which challenges existing power structures. Each dimension of agency is highly interrelated. As Lister (2004, 1997) suggests, a sense of personal agency or a belief that one can act is essential for the development of political agency, and in turn, acting as a citizen, especially through collective action, can strengthen personal agency. This connection between personal and political agency is significant in understanding agency as socially embedded, requiring social relations to function (Sarah Coulthard 2012; Lister 2004, 2015; Long and Long 1992). Moreover, the framework emphasizes the actions (i.e., forms of agency) rather than the actors, who could exercise some combination of the forms of agency, or switch between them, at any point in time. The forms are identified in the quadrants of the matrix as (1) getting by; (2) getting (back) at; (3) getting out; and (4) getting organized. The following subsections explain these forms of agency in further detail.

2.4.1 Getting By

'Getting by' lies in the everyday-personal quadrant of the taxonomy matrix. Despite that this form of action can be taken for granted and not easily recognized as an expression of agency, it requires both skills and knowledge (Lister 2004; Canvin et al. 2009) to cope with hardships or changes. The notion of getting by is closely related to that of coping, which refers to short-term, immediate actions, oriented towards survival. It is an active process of everyday struggling that may involve complex and sophisticated survival and budgeting strategies (Lister 2015). The uncertainties surrounding subsistence-based livelihood strategies due to seasonality or other environmental factors suggest that people's perception of the need to adapt will vary with time. The recognition of agency at the everyday-personal level, however, comes with a danger of overemphasizing people's resourcefulness and overlooking the strain and hardships they endure (Lister 2004). In

the case of fisheries, fishers may choose short-term, and often inadequate coping strategies to 'get by' during a challenging period (Binkley 2000; Coulthard 2008; Sarah Coulthard and Britton 2015). Some of these short-term coping strategies may involve hidden costs. For example, by extending the geographic reach of a fishing trip, fishers would need to invest more time and other resources (e.g., gas) to cope with the decline in fish catch.

2.4.2 Getting (Back) At

Rather than addressing immediate needs within the constraints of the situation, 'getting (back) at' is a form of everyday resistance, which underscores informal and often covert actions for short-term gains aiming at survival (Lister 2015). This form of agency may in some occasions indicate a resentment against the system or social structure at large, such as the case of 'illegal' fishing in an ancestral fishing ground. While it can be carried out by the individual, 'getting (back) at' actions tend to draw on social networks and collective participation to minimize the risks taken through rule breaking or other forms of everyday resistance.

2.4.3 Getting Out

As Lister's (2004) notion of 'getting out' centers around actions taken to get out of poverty, the same explanation may not work well in the context of environmental change and LEK-informed strategies. A modification is made to this notion by regarding 'getting out' as quitting subsistence, river-based livelihood strategies. The maintenance of those livelihood activities may cease to provide sufficient food and income security in the face of rapid environmental change. The shift can be difficult due to the lack of knowledge, skill, or experience in other livelihood strategies, or due to the lack of social network needed to identify new opportunities. Nevertheless, Ellis (2000, 56) has argued that "choice, or [the] lack of it, does not obey some sort of definable break point between two mutually exclusive states…households and individuals can also move back and forth between choice and necessity, seasonally and across years." This suggests that line dividing strategic and immediate, everyday agency can blur when people make and switch decisions that are most appropriate to them.

2.4.4 Getting Organized

David Taylor's (1998) conceptualization of the ontological and categorical facets of identity underpins Lister's notion of 'getting organized.' Ontological identity refers to the sense of self one possesses as underscored by the uniqueness and experiences that engender differences. Categorical identity, on the other hand, refers to the sense of belonging through the recognition and identification of commonalities between oneself and others. Accordingly, this latter faucet of identity contributes to the sense of collective identity. Several interrelated factors hinder the development of a categorical identity among people in poverty (in Lister's case) and disempowered, local residents experiencing rapid environmental change (in this thesis' case). Through shared struggles, however, many have gotten organized and tried to effect change. This form of agency includes forming groups to negotiate access rights and partnering with civil society organizations. In many cases, the everyday agency of 'getting by' or 'getting (back) at' can evolve into 'getting organized,' such as the co-management of fishery resources by fishing groups (Hilborn, Orensanz, and Parma 2005) or letter-writing campaigns and public protests for access rights (Ratner, Åsgård, and Allison 2014).

2.4.5 Getting…?

The categories outlined above are by no means discrete and rigid. Further development of Lister's (2004) agency taxonomy has included the works of Williams and Churchill (2006), which applies to on early childhood support programs. The authors identified these forms of agency as part of the processes for empowerment and added other everyday-oriented forms of agency, including "getting better at (everyday living)" and "getting on," as well as collective-oriented forms, "getting together" and "getting involved." Some of these additional categories can be useful for thinking about the various ways local people exercise agency in response to environmental change. The concept of "getting better at," for example, emphasizes the enhancement of one's capacities, competence, and skills, paralleling to the notion of long-term adaptation. The extent to which these forms of agency are adopted, and further refined, will depend on the empirical results.

2.5 Finalizing the Framework

Local ecological knowledge (LEK) is useful for informing strategies to respond to environmental change. Integrating the concept of agency broadens the understanding of LEK-informed responses by addressing the resilience framework's apolitical limitations and emphasis on coping and adaptation, and extending it to include resistance, as captured by the notions of 'getting (back) at' and 'getting organized.' This modified framing places the experiences and knowledge of impacted people at the heart of the empirical investigation, and simultaneously acknowledges both the practical and political dimensions of LEK.

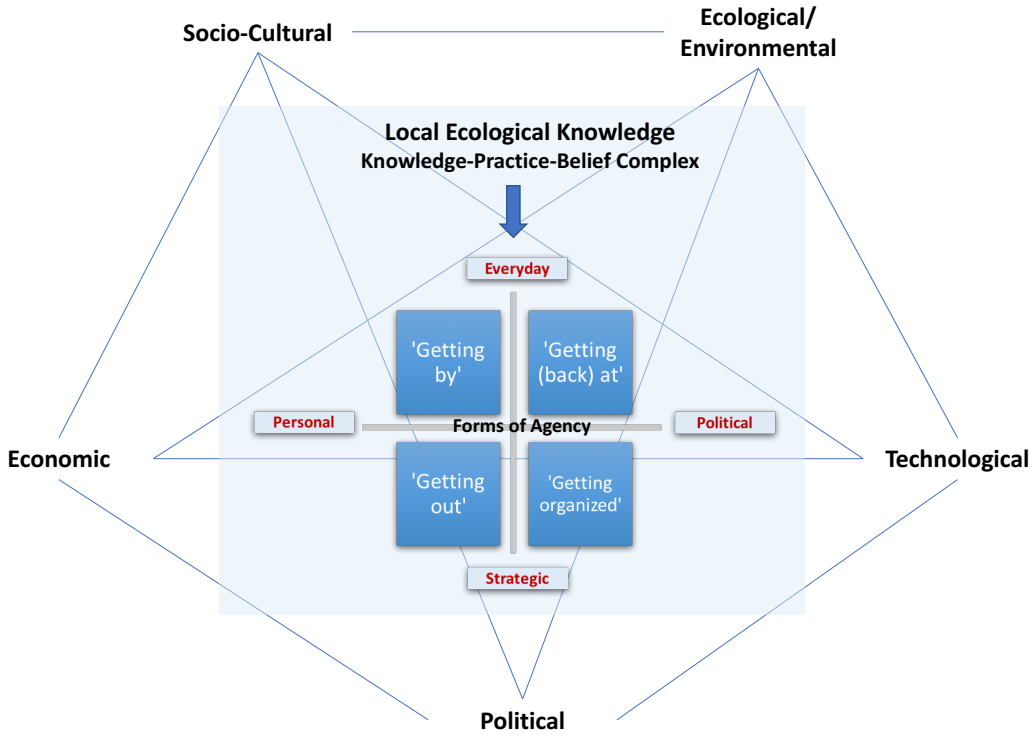


Figure 1. Conceptual framework
[Source: author's draft. Agency matrix drawn from Lister (2004)]

Figure 1 illustrates the conceptual framework in this study. As mentioned in Section 2.2, the dynamic and hybrid LEK exists within, and is shaped by, ecological, socio-cultural, political, economic, and technological processes. All of these processes are interlinked and illustrated by the pentagon diagram with interconnected lines. LEK is shown to engender various forms of agency by informing strategies to respond to change. To simplify, other forms of agency (Section 2.3.5)

are not depicted, but they may be discussed as appropriate in the discussion. Arrows connecting the forms of agency to other processes are also not shown. However, the framework is intended to capture the *dialectical relationship* between structure and agency, and is helpful in investigating how the use and mobilization of LEK unfolds.

3. Methodology

My empirical research is qualitative as it seeks to explain human experiences, motivations, and different ways the problems of environmental change are addressed. It distinguishes clearly from positivist empiricism, which centers on the belief that the world has fixed and knowable properties that can be discovered as true knowledge through incremental research processes (O'Neill and McGuirk 2014). Instead, this qualitative research rejects that there exists an objective explanation or a single truth regarding observed phenomena, while pursuing the multiple and partial understandings of reality that is bounded by social and historical contexts (Ormston et al. 2014).

Qualitative approaches have risen to prominence in human geographical studies since the 1980s following the critiques of spatial science as well as the recognition of "the power of epistemology, critical feminist perspectives on the research process and products, and the 'cultural turn' in geography, which turned a newly critical eye towards all stages of research" (Cope 2010, 25–26). While human geography's adoption of qualitative approaches had four key influences, naming humanism, postmodernism, feminist scholarship, and cultural studies (Dyck 2001), postmodern perspectives, in particular, underpins this research in questioning objective explanations of reality and in setting knowledge claims "within the conditions of the world today and in the multiple perspectives of class, race, gender, and other group affiliations" (Creswell 2013, 27).

The adoption of a qualitative methodology is appropriate for this master's thesis as I aim to provide an in-depth understanding of the interconnectedness between resource-dependent villagers and the Mekong River ecosystem, and of the usage of LEK to inform response to riverine changes. My fieldwork was guided by a list of research questions and key topics to delve more deeply into. While the research did not have a concrete framework or hypothesis to test, it is not entirely based on a grounded theory methodology as it assumes some degree of relationship between LEK and practical as well as political responses of local residents. The research remains open and exploratory in understanding and establishing those linkages.

In the following subsections, I describe my positionality, the case study approach, research scope, and fieldwork timetable. I also discuss data collection and analytical methods in detail. In concluding this chapter, I provide a short discussion about the ethical considerations of my research.

3.1 Situating the Researcher

An important consideration within the research process is the subjectivity and positionality of the researcher. Background and experiences as well as own roles and perspectives can deeply influence research process and outcomes. Accordingly, this section delves into my positionality in relation to my study. As a Thai middle-class female from a Thai-Chinese family in Central Thailand, I have generally lived in an urban setting with limited exposure to a village life, and possess limited knowledge about subsistence livelihoods and their associated worldviews. My academic training has spanned social science disciplines of economics, public policy, and human geography, and I have observed how my ontological and epistemological positions, shaped by my academic background, have evolved from realism to one that straddles the line between critical realism and soft constructivism. Drawing on Maxwell (2012), I regard my ontological stance as one of realism as I believe there exists a real world, independent of human perceptions, theories, and constructions. Nevertheless, I remain critical in accepting that an 'objective' knowledge about the world can be obtained, and instead, believe that there are multiple valid accounts of any phenomenon. I also hold what Robbins (2012, 128) describes as a soft version of constructivism, which maintains that the objective world is "filtered through subjective conceptual systems and scientific methods that are socially conditioned." While some false or socially-biased categories of the world (i.e., social constructions), such as 'race,' does not objectively exist, they still can have real effects in the world (Mitchell 2000, cited in Robbins 2012). This stance reflects a constructivist epistemology, which holds that the understanding about the world is constructed from own perspectives and standpoint (Maxwell 2012). An important implication of my position is an understanding that all knowledge is socially constructed, partial, incomplete, and fallible. I thus rely on a reflexive approach to critically think about my position and connection to the research, and to identify my sources of bias. Such bias includes how I consider myself both a humanitarian and an environmentalist/conservationist, and therefore I believe in the strong interdependencies between nature and society (albeit not at all scales) and in the importance of promoting human well-being while ensuring biodiversity and ecosystem health.

With regards to my research topic, I first came across the issue of hydropower development and its impacts on local communities and environment over seven years ago during a work trip to one of the Mekong River's tributaries. My interests in water and energy issues took shape and I

have been following the Mekong River development initiatives at a distance ever since. While I have never been to the case study area before my research commenced, I learned about it through reports and the media. Considering my personal, academic, and professional experiences, I could be described as an empathetic observer of the river development process and the impacts it entails. In an attempt to avoid my biases and preconceptions including romanticizing my research topic and participants, I often reflected on my roles as an outsider looking in and kept my distance from specific interest groups, especially during the early days of my fieldwork. For example, one of my interview gatekeepers works for a local conservation group and I decided not to volunteer with them in order to be more neutral in my positioning. An outsider position both limited and permitted access to different groups, but it is appropriate given the limited fieldwork period of two and a half months and my aim to understand the usage of local ecological knowledge at various levels and by different, but potentially linked, groups of people.

3.2 Case Study Research

Qualitative research offers significant opportunities to probe into and understand a social phenomenon. While the tradition is often criticized for its lack of transferable or generalizable insights, its value lies in "providing in-depth explanations and meanings rather than generalizing findings" (Carminati 2018), and thus it is highly relevant for extending the understanding of LEK and the critical linkages between LEK and agency. The case study methodology adopted here involves the study of a small number of instances of a phenomenon within a particular place "to explore in-depth nuances of the phenomenon and the contextual influences on and explanations of that phenomenon" (Baxter 2016). The research strategy is designed to be an explanatory one, appropriate for answering "how" (or "why") questions when the researcher has minimal control over events and the research concerns real-life, contemporary phenomenon (Yin 2014). Accordingly, this research relies on cases of LEK usage to respond to rapid riverine changes within the complex and contested processes of river development. A close examination of the context, from the day-to-day experiences of local residents to the constellation of actors involved, is central to revealing how LEK is mobilized at various levels.

3.2.1 Research Scope

As the focus of this research is on LEK, I narrowed the scope of research subjects to those who are impacted by riverine changes and historically or currently involved in food production livelihood practices. The notion of "human-river relationship" in the research question thus centers around such practice-based relations. From this core group of respondents, I sought other relevant actors through their local interactions and involvement in the mobilization of LEK. Initially, the research area was identified based on existing literature, particularly from news and reports about hydropower impacts on the Mekong river and riverbank communities in Thailand. As Chiang Khong and Wiang Kaen districts, Chiang Mai Province in Northern Thailand, has been widely mentioned in multiple news and reports (e.g., Board and Promchertchoo 2016; Pokaew 2018; Matichon Online 2017), it became the starting point for my field investigation. Chiang Khong is also home to a local conservation group, which plays a significant role in bridging local and regional concerns about development, the maintenance of traditional skills and livelihoods, and nature conservation (Santasombat 2011). Accordingly, the research area provides a complex and intriguing site for examining cross-scale dynamics of river development and LEK mobilization. Further details on the context are provided in Chapter 4.

3.2.2 Fieldwork Timetable

The fieldwork was conducted over the course of two and a half months between July and September 2018. While this was during a rainy season and the timing was based on practicality and convenience, it allowed for the observation of a seasonal transitioning of livelihood activities and how local residents prioritize the types of activities they engage in. The timing also came with important limitations of not being able to closely observe other activities, such as riverweed foraging, which only occur in the summer when the Mekong water level recedes. Climatic and sociopolitical factors that occurred during the fieldwork period may also influence how research participants perceive and communicate their concerns and response strategies. For example, anomalous typhoon activities that caused heavy rainfall, the collapse of the Xe-Pian Xe-Namnoy hydropower dam in southern Lao PDR in July 2018, and the discussions around dam management and remedial measures may to some extent affect interview responses. It is thus important to keep those processes in mind during the course of research.

3.3 Data Collection Methods

The research project employed mixed methods, qualitative approach, including participant observation, semi-structured interviews, and an unobtrusive strategy of document research. The use of various sources of evidence was critical to extend the scope of collected data and enrich findings. These approaches seek in-depth understanding of a social phenomenon, especially the underlying processes, conflicts, and relationships, which influence individual and collective response. Semi-structured, problem-based interviews of local residents and key informants provided the main source of data, which was supplemented by participant observation to gain a better understanding of non-verbal behaviors and physical and social contexts. Documents and other forms of records also helped to substantiate or fill the gaps in data collection.

3.3.1 Semi-structured Interview

The research primarily relied on semi-structured interviews for data collection as it provides some degree of order for investigating complex behaviors and motivations pertaining to environmental impacts experienced and responses taken in particular through the use of LEK. At the same time, it also allows for flexibility in the way the respondent addresses the issues discussed. Following Witzel and Reiter (2012), this research adopted the "problem-centered interview" approach to guide the data collection process. The approach reorients the researcher to take the role and attitude of a *well-informed traveler*, who have certain priorities and expectations, and thus have some degree of knowledge about the context and phenomenon of interest. Such position differs from a *miner-interviewer*, who has clear targets and well-defined interests in what kinds of answer are deemed valuable (mirrors structured interviews), or a *traveler-interviewer*, who is openly curious and is guided principally by the responses of the respondents encountered (mirrors unstructured interviewing) (Witzel and Reiter 2012).

Problem-centered interviewing (PCI) is appropriate for this research as it focuses on the "societal problem with immediate relevance for individuals" (Witzel and Reiter 2012, 5). The related assumption is the crucial linkages between LEK and agency in dealing with riverine changes. One key aspect of PCI is problem centering, which aims to encourage and support the respondent to reconstruct "research problems by means of reconstructing practical problems" (Witzel and Reiter 2012, 6). This suggests that the interview is designed to be flexible in problem

definition. The task of PCI is to take the perspective of the respondents and trace how they perceive and make sense of *their* situation and problem, within the thematic frame of environmental change and LEK as identified by the researcher. The approach is oriented toward understanding socially relevant problems as well as the motivations and practical knowledge the respondent has to address them. Furthermore, PCI as a discursive-dialogic procedure treats respondents as experts of their actions and perspectives (Witzel 2000). This recognition of the respondents' expertise and knowledge is crucial at both stages of field data collection (e.g., establishing trust and gaining deeper insights) as well as analysis (e.g., identifying agency and interpreting the use of LEK).

In following the PCI approach, I designed my interview guide (see Appendix A) to cover broad topics, including livelihoods and relationships with the Mekong River, key riverine changes and impacts, response strategies and LEK mobilization, and future outlook and views on mitigation measures. I used this approach to combine the advantages of open-ended questions with those more targeted to follow-up and draw out their perspectives on the socio-political and ecological processes surrounding changes of the Mekong, and the relevance of LEK in their ongoing response strategies. Specific probing and mirroring techniques – summarizing, feedback, interpretation by the interviewer – were used to deepen the understanding of responses. As PCI is "more of a skill and craft than a (specialized) technique or tool" (Witzel and Reiter 2012, 9), its usefulness was likely improved over the course of the fieldwork.

With regards to the sampling methods, there remains much inconsistencies and ambiguities in their characterization (Gentles et al. 2015). This research follows the general approach of theoretical sampling as outlined in Patton (1990), and further clarified in Gentles and Vilches (2017) and Gentles et al. (2015). This method fits well with PCI, whose concept "borrows largely from the theory-generating procedure of grounded theory" (Witzel 2000). Initial sampling was made based on the type of river user, with emphasis on fishing, foraging for riverweed, and riverbank agriculture rather than for tourism or transportation. Despite that there are likely overlaps in these river uses, the aim was to include respondents that identify with one or more activities. Other initial criteria included those with age 30 and above, who have pre-dam experiences, gender (i.e., both males and females), and ethnicity (i.e., at least three of the local ethnic groups that depend on the river to capture local complexities). Reflections over the course of sampling led to the modification of these criteria during fieldwork. For example, multiple responses suggested that riverine changes were more clearly observed within the past 10 years, thus leading to the discard

of the age requirement. Ethnicity also became a less important criterion as each village has one dominant ethnicity and it was more crucial to focus on livelihood activities, experiences of impacts, and key responses. Attempts were made to include inputs from residents of both sides of the Mekong river, but due to the sensitivity of the research topic and difficulty in obtaining a research permit in Lao PDR, the inclusion was limited to Lao people who have frequent visits, and hence stronger ties to the Thai side. Furthermore, it became clearer towards the end of the fieldwork to identify more villagers who had participated in past LEK research, but the main challenges were time constraint and the fact that many of those villagers are very old or no longer remain in the study area.

Theoretical sampling is a highly purposeful process, allowing for flexibility in identifying respondents relevant to the process of LEK mobilization and to seek input from the constellation of actors involved. The core group of respondents (i.e., villagers) was expanded to village heads and sub-district headman, conservation practitioners, fisheries officers, teachers, and academics, with interview questions modified accordingly. However, it is arguable whether data saturation was reached in this study as it is also influenced by time availability and access to specific information-rich individuals. Within the existing constraints, many responses obtained near the end of the fieldwork were redundant, and hence data appeared sufficiently saturated.

In addition to theoretical sampling, snowball sampling (Patton 1990) was used particularly at the beginning of the data collection process to accelerate access to the field. Opportunistic sampling strategy (Patton 1990) was also adopted to take advantage of new opportunities during the fieldwork period and expand the range of responses. This strategy helps to supplement snowball sampling, which tends to rely on existing social networks (Browne 2005).

3.3.2 Participant Observation

From its roots in social anthropology and ethnography, participant observation has been adopted and adapted by many geographers who sought to understand the context of everyday life (Kearns 2016). The approach is useful in moving beyond the reliance on formalized interactions, such as interviews and focus groups, and in developing further understanding about the observable environment, including daily life experiences and interactions. There are no set rules on how the approach is carried out as each participant observation is unique (Kearns 2016), but emphasis

should be placed on the process of introspecting, reflecting, and linking observations with what is being researched (Jorgensen 2015).

Participant observation generally requires the researcher to be involved or to participate in social situations. Even when the researcher attempts to be non-participating, such as observing from a distance, it is possible that the observer is also observed by others within the community and this can influence or moderate behaviors. Beyond the false dichotomy of participant/non-participant in fieldwork, it is worth noting that the researcher's participation can range from passive to active (Jorgensen 2015), and can vary along this continuum depending on the research approach and the level of openness or trust the individuals being observed have. Passive participation refers to a case where the researcher is present in a social setting, but not engaged with the people being observed. On the other end of the spectrum, active participation suggests that the researcher is actively involved in the lives of the people under the study, for example living and eating with the villagers.

Notwithstanding the difficulty in describing participant observation approach, Kearns (2016) offers commonly recognized stages of the observation process, which helped guide this master's thesis fieldwork. These stages include: (1) choice of setting; (2) access; (3) field relations; (4) talking and listening; and (5) recording data. *Choice of setting* links closely to the goals of the research project. There is, however, a danger of being 'over-familiar' with the observed, thus risking "too much participation at the expense of observation" (Evans 1988: 205; cited in Kearns 2016). Kearns advises that it may be most appropriate to find the balance in being a participative observer, recognizing that while the researcher is a stranger to the community, he or she is not necessarily marked by non-belonging, and some opportunities for engagement may allow deeper understanding of the observed groups of people. *Access* or gaining entry to social settings is often a challenge at the start of the fieldwork. The identification of gatekeepers, who can facilitate opportunities to interact with others, can be of crucial importance at this early stage. Furthermore, having a known role can make gaining access easier in some situations, but it may risk being typecast, so caution should be exercised when entering the field. The role adopted by the researcher within an observed setting can greatly influence *field relations*. Kearns also stressed how the researcher's embodiment, which encompasses the overall physical appearance and codes of behavior, can enable or constrain participant observation. Knowing the 'how' and 'where' of *talking and listening* contributes to successful observation. Informal interactions, such as casual

talks, can help build rapport and open more observational opportunities. An important consideration is the *recording of data* in those situations. While the standard practice of recording data is with a notebook or audio recorder, it is not always appropriate for participant observation approach. These tools can potentially disrupt the flow of interaction or conversation, or causing the observed people to feel uncomfortable and act differently. The researcher must then rely more greatly on recollection and detailed notetaking after field encounters. Here, Kearns advises the researcher to develop a discipline for documenting field notes at the end of the day or as soon as the occasion permits, as they are invaluable data sources and can prompt further reflections.

As I have positioned myself as an outsider, who is deeply interested in the usage of LEK and the process of mobilizing it across scales, I approached participation observation with an open mind, but with some level of caution to avoid misunderstandings and being typecast. I followed Kearns' (2016) advice and careful consideration was given to how I dressed and presented myself as a master's student with genuine interest and concerns about local residents and the changes of the Mekong river. Observation encompassed everyday activities along the river at various times of day, especially at the fishers' resting house, and as I widened my field access, I also joined meetings and a workshop organized by non-governmental organizations to increase my understanding of how different groups frame their problems and solutions, and how they relate to each other. Notetaking was done whenever possible, mostly with a notebook and then transferred to an electronic file at the end of the day with additional reflections.

3.3.3 Unobtrusive Method

An unobtrusive method is employed to extend data collection and analysis of observation and interview approaches. Unobtrusiveness refers to the process of data collection, which must be independent of the processes that produce it (Lune and Berg 2017, 146). In practice, this means that materials were examined as research data after they were created. Despite that unobtrusive methods are broad, encompassing the collection of any usable research materials from garbage to historical artifacts, this thesis particularly relies on documents, and to a much lesser extent, maps and photographic images. Bowen (2009) has outlined the specific usefulness of documents in qualitative research, I also argue that these benefits apply to other types of records as well. They include (1) provision of the context within which research participants operate, offering

background information and historical insight; (2) extending or deepening the scope of what needs to be asked and observed as part of the research (e.g., aid in generating new interview questions); (3) supplementary research data as insights derived from documents can invaluably add to a knowledge base; (4) aid in tracking change and development of a social phenomenon; and (5) verification of findings or validity checks of evidence from other sources (Bowen 2009).

This thesis takes on some elements of an archival research to incorporate historical contexts, which help improve understanding about the context of the case study. However, this engagement remains limited due to a larger emphasis on interviews and participant observation. Documents are used as a means of triangulation, drawing on multiple sources of evidence to seek corroboration as well as to develop a comprehensive understanding of social phenomena (Patton 1999). More importantly, they provide supplementary data to examine the use of LEK beyond everyday practices by different groups of actors. For example, research on Chiang Khong-based LEK has been done in the past to document traditional subsistence practices, knowledge, and beliefs. I did not follow any particular approach in sampling documents, but sought those that are relevant to the local context and the associated socio-political processes, keeping in mind the questions of who produced it and for what reasons. These documents range from texts about local history and culture, LEK-based research undertaken by villager researchers (e.g., Jao Baan Research, 2004), to fisheries report published by a local or regional fisheries authority.

3.4 Analytical Method

Qualitative content analysis (QCA) provides the methodological approach for analyzing data collected in this research. Referred to a "method for subjective interpretation of the content of text data through the systematic classification process of coding and identifying themes or patterns" (Hsieh and Shannon 2005), QCA was developed in the field of communications research to overcome the limitations of quantitative content analysis, particularly the issues of oversimplifying and distorting the meaning of text as it is broken down into quantifiable units during the analytical process (Mayring 2000; Kracauer 1952). After decades of development, QCA emerges as a suitable method for various kinds of research due to its strength and flexibility in using inductive or deductive approaches or both to extract manifest and latent content from communication materials (Cho and Lee 2014). QCA is appropriate for this research as it aims to explain how LEK

plays into response strategies through themes, categories, or connections that are extracted from the data, rather than to develop a theory or to gain insights into how particular knowledge (e.g., LEK) produce certain "truths." Using the software, MAXQDA, the analysis is based on notes from participant observation, 33 semi-structured interviews (29 of whom are resource users, 2 are NGO workers, and 2 are academics), spanning from 20 minutes to 80 minutes, and documents from Jao Baan Research (further explained in Section 7.2.3).

Mayring's (2014) techniques for conducting QCA is employed to guide this analysis. It should be noted that some basic principles of QCA as outlined by Mayring (2014), such as the integration of quantitative steps of analysis and certain quality criteria (e.g., objectivity and inter-coder reliability), do not apply in this research given its research design (i.e., quantitative step is unnecessary) and constructivist epistemology. Rather, Mayring's QCA approach provides a structure to systematically interpret data, and this systematization is helpful in building confidence in the validity of the results. Mixed procedures adopted in this research aim at content structuring or theme analysis, and include (1) inductive category formation; (2) contextual analysis; and (3) deductive category assignment.

Inductive category formation is used as the initial step to summarize categories in a fast and economic manner. It intends to provide a more neutral description of the data and curtail the researcher's preconceptions applied to the material. Nevertheless, some elements of deduction are used to determine the level or theme of categories and the criterion for the selection process in category formation. In the first instance, the category definition is formulated as: relations to the river, perceptions and experiences of riverine changes, social, cultural, and economic impacts of change, ways of LEK usage, and hopes and future outlook. The level of abstraction is: concrete choices of action as linked to perceptions and experiences.

Contextual analysis is adopted for specific cases where the text of interest is obscure and requires further clarification. This procedure helps to define a particular piece text using its context (e.g., references within the interview transcript). It begins with the identification of the portion of text to be interpreted, after which a decision is made whether it is interpreted based on grammatical or lexical analysis. A broader context may be used to assist in interpretation.

Finally, *deductive category assignment* contributes to extracting a certain structure from the material. The focus here is the application of Lister's (2015) forms of agency to the empirical

study, which aims to extend the understanding of LEK and how it informs response strategies. The map of codes on responses and agency can be found in Appendix B.

3.5 Ethical Considerations

Ethical issues are of critical concern as this research involves interacting with human subjects. While the research did not have to go through an approval process by an ethics committee, careful attention was given to ensure informed consent, privacy and confidentiality of participants, and the protection of both participants and researcher from harm. In guaranteeing informed consent or "the knowledge of consent of individuals to participate as an exercise of their choice, free from any element of fraud, deceit, duress, or similar unfair inducement or manipulation" (Lune and Berg 2017, 46), a short description of the research and the researcher's intentions were explained prior to every interview with an assurance that all data collected would only be used for the purposes of writing this master's thesis. I also provided opportunities for the participants to ask any questions about the research and interview protocol. Consent was obtained verbally at the beginning of an interview, after which the participant was given a choice of being audio recorded—for the sole use of facilitating notetaking and transcription. The recordings would then be deleted one year after the fulfillment of my specialized master's degree.

Anonymity and confidentiality of respondents deserve important considerations in qualitative research. While these two concepts are similar, they differ in specific ways. Anonymity suggests that the identity of research participants will not be known (i.e., subjects remain nameless), while confidentiality requires active avoidance of any direct or indirect attribution of comments to identified participants (Lewis 2003). Given the nature of this research, an assurance of anonymity is not possible. The identity of participants is known to the researcher, and some context is necessary to understand who knows, perceives, or experiences what. Nonetheless, their privacy and some level of confidentiality are protected through pseudonymization and caution is taken to not associate participants and their responses in the discussion of this research whether in this thesis or presentations. However, there are certain exceptions made when the matter discussed belongs to the public realm, such as a policy or initiative. These respondents include village heads, government officials, NGO workers, and academics. In such case, no harm to the respondent is

expected if his/her identity is revealed and it is deemed appropriate to attribute the sources of information.

While taking part in this research was highly unlikely to impose any harm on participants, any information deemed sensitive is kept confidential and disassociated from the data source. I also took precautions to ensure my safety, for example, by conducting interviews only during the day in public places or in clear view from the outside. As my field relations improved, I also tried to keep some distance (i.e., not be too involved in their lives and activities) so as to preserve some degree of personal detachment and scientific neutrality.

4. Research Context

This chapter provides an overview of the research context of Chiang Khong and Wiang Kaen districts by describing their geographical and historical contexts and demographics. It further describes and justifies the selection of field sites, highlighting the social, cultural, and ecological aspects of the area.

4.1 Chiang Khong – Wiang Kaen Regional Context

4.1.1 Geography

The districts of Chiang Khong and Wiang Kaen locate in the eastern border of Chiang Rai Province, the northernmost province in Thailand. Geographically, the region is characterized by lowlands alternating with mountainous areas. Three mountain ranges run from the north to the south, from Doi Luang mountain range locating at the western border between Chiang Saen, Doi Luang, and Chiang Khong districts, to Doi Yao range which forms a border between Chiang Khong and Wiang Kaen districts, and Doi Pa Mon-Pa Tang range which is part of Luang Pra Bang mountain range. The region's Doi Pa Mon-Pa Tang ridge and the Mekong River form a natural border between Thailand and Lao PDR. Due to the mountain ranges, regional travel was difficult before the development of road networks. People thus traditionally relied on the Mekong River for subsistence, transportation, and trade with other large cities, such as Chiang Saen in Thailand, and Luang Phrabang in Lao PDR.

Three regionally significant rivers traverse by or through the region. These are the Mekong, the Ing, and the Ngao rivers. As a natural border, the Mekong River flows along Chiang Khong and Wiang Kaen, first entering from the north at Haad Bai Village, Rim Khong Sub-district and flowing into Lao PDR at Pha Dai Rapids. Riparian regions of the Mekong in Chiang Khong and Wiang Kaen are characterized by alluvial plains alternating with rugged mountainous features. The Ing and Ngao rivers, on the other hand, are both tributaries of the Mekong, and thus are affected by the Mekong's flow variability. In the wet season, high Mekong River flows push into and raise the water levels of the Ing and Ngao, providing a seasonal connectivity for fish and nutrient-rich sediments to migrate across the floodplains. In the dry season, these tributaries flow

into the Mekong, turning seasonally flooded areas into arable land for cultivation or feeding grounds of land-based animals.

4.1.2 History

With *chiang* referring to a settled area or town, and *khong* referring to the Mekong River, the name, Chiang Khong, reflects the integral role the Mekong River plays in its historical development as well as in the culture and traditions of many local residents. As Wiang Kaen was a satellite city of Chiang Khong and was not separated into another jurisdiction until 1987, the history summarized below centers around Chiang Khong. The summary is primarily drawn from Roykaew et al. (2004) and supplemented by other sources.

The earliest residents of Chiang Khong were Tammila people, an indigenous group to the Mekong River region, who were also associated to the Lua ethnic group. Due to unknown reasons, the Tammila community became abandoned, and the area was later reestablished as a pre-modern city and incorporated into different ruling city-states over time. The remains of old city walls and brick ruins can still be seen today.

From approximately 638 A.D. to 1096 A.D., Chiang Khong became an important city under the Lavachakkaraj dynasty due to its strategic location to control transportation and trade between city-states of different sides of the Mekong, as well as to rule over and collect tributes from other smaller city-states within the Mekong River Basin. It was later incorporated into the Lanna Kingdom after King Mangrai unified all city-states under his rule and moved the capital to Chiang Mai. When Lanna lost the war with King Bayinnaung of the Burmese Kingdom in 1467 A.D., Chiang Khong was left to rule itself, but must plead allegiance to Burma. The end of the Burmese rule came around the early 1800s when Lanna city-states, in allying with the Siamese Kingdom, fought off Burmese soldiers.

The spread of colonial powers from mid-19th century to the end of World War II marked an important period in the regional history. The Anglo-French rivalry in Southeast Asia triggered an exploration of the Mekong River, also known as the Mekong Exploration Commission of 1866-1868. The expedition, a French naval initiative, served as a scheme to open navigation between the French controlled port of Saigon (colonized in 1962) and inland China (Keay 2005). Control of the Mekong River would facilitate the French presence in the region. While the expedition found

that the river was unsuitable for trade due to the rapids and riffs, it was the first to map over 2000 km of the river's entire course (Keay 2005), paving way for future expeditions.

After its victory over China in the Sino-French war (1884-85), France formed the French Indochina and continued to spread its control westward toward the British-colonized Shan States and Burma. In 1893, the Franco-Siamese War broke out and culminated in Siam ceding Laos to France. The resulted treaty marked the new border between Siam and Laos, with the Mekong serving as a boundary. This boundary would partially reflect present-day border between Thailand and Lao PDR. The treaty also mandated a 25-km demilitarized zone along the west bank of the Mekong (St.John 1998), leading to a state of lawlessness that plagued those areas, including Chiang Khong, for many years (Goss 2006). In 1926, France and Siam signed another treaty to formally recognize the riverine borderline in the Mekong River. This borderline is based on the thalweg (i.e., deepest channel) of the Mekong.

In the case where river islands exist, the channel between the islands act as the borderline (St.John 1998). Nevertheless, the terms of the 1926 treaty were deemed unfair to the Siamese government as enclaves to the west of the Mekong (approximately from Pak Tha to Phalat) as well as the majority of river islands still belonged to French Indochina (Tuck 1995; St.John 1998).

French colonial power continued to spread across Southeast Asia until World War II. Following the Fall of France in 1940, Thailand (formerly Siam) found an opportunity to renegotiate territorial concession, triggering the Franco-Thai War (1940-41).[2] Despite losing the Battle of Ko Chang, Thailand regained some territories in Laos and Cambodia with the backing of the Japanese. The Mekong River temporarily became an international border between Thailand and Laos between 1941 and 1945. The end of World War II re-established the Thai-Lao border, returning it to the one as defined by the 1926 treaty. This borderline remains until today.

The relations between Chiang Khong and Houay Xai, a Lao town on the opposite bank of the Mekong, grew closer after the War. Lao and Thai people could cross freely and stay as long as they'd like for cultural and economic activities. The United States, which became more active in the region, also contributed to improved ties of Chiang Khong-Houay Xai. Having established a military base in Houay Xai, the US army brought in more advanced health care services, and American doctors would often provide medical help to Chiang Khong people. The US-sponsored

[2] Siam changed its name to Thailand in 1939.

airport in Chiang Khong also serviced passengers travelling to and from other Lao cities, such as Luang Prabang and Vientiane.

Worsened conflict situation in Laos led to a takeover of the Lao communist party in 1975.[3] Social and economic relations between Chiang Khong and its neighbor ended; people could no longer cross the Mekong to the other side. Trade, local fishery, and boat crossing services were subsequently impacted due to the hostile situation, and many Chiang Khong residents left to find work in other cities. Chiang Khong became a strategic area in the clash between communism and liberalism as each side tried to amass support from local residents. The political situation eventually eased despite Thailand and Lao PDR remaining under different political regimes. Neoliberal development policies adopted by the Thai government of Chatchai Chunhawan called for a shift "from a battlefield into a marketplace" (Szalontai 2011). To capitalize on trade and tourism, Lao PDR began to open up its borders in the early 1990s. Chiang Khong-Houay Xai crossing became a popular route for travelers going to or returning from Lao's historic town of Luang Prabang. The expansion of free trade in the Mekong sub-region also led to several economic development and cooperation initiatives. For example, in April 2000, China, Myanmar, Thailand, and Lao PDR signed an agreement to improve commercial navigation of the Mekong. The resulting Lancang-Mekong Navigation Channel Improvement Project was designed to clear out rapids, reeds, and shoals over the stretch between the port of Simao, Yunnan, to Luang Prabang, Lao PDR. The project completed the removal of 10 out of 11 major rapids, except the Khon Phi Long at the Thailand-Lao PDR border (Chiang Khong's vicinity), due to the Thai government's concerns over the shifting borderline (Lazarus et al. 2006). Despite fierce opposition from Thai civil society groups and villagers, discussions of the navigation improvement project, returned in late 2016 (Thermpithayapaisit 2016), and the Thai cabinet approved the proposal to develop the Lancang-Mekong river transportation and to formally establish the borderline on the Mekong River (Fawthrop 2017). This updated Lancang-Mekong Navigation Channel Improvement Project is planned to conclude in 2025. Another important example of a Thai economic development initiative is the establishment of special economic zones in border provinces in 2015.[4] Under this

[3] The Kingdom of Laos (or in short, Laos) became the Lao People's Democratic Republic (Lao PDR)
[4] A special economic zone is an area designated by the Thai government to encourage industrial and commercial activities, for example, through an establishment of an industrial park and other infrastructures.

policy, Chiang Khong is planned to become one of the key hubs for trade, tourism, and logistics (NESDB 2016).

The history of Chiang Khong from early establishment to the present-day neoliberal context highlights its complex past and ambivalent future as a border region. This historical understanding is useful for reflecting on the socio-economic dynamics that are occurring alongside the biophysical changes of the Mekong River.

4.1.3 Demographics

The region is home to diverse ethnic groups. Some have claimed to be indigenous to the area and others have migrated from Nanzhao (around modern-day Yunnan, China) and Luang Prabang (Lao PDR) kingdoms, and other areas (Roykaew et al. 2004). These diverse ethnic groups can be represented by three clusters based on their general geographic settlement patterns. These include (1) Tai Yuan or Khon Muang, Tai Lue, and Lao people who live in the lowlands (2) Khmu people who generally live near the foothills; and (3) Hmong, Yao, Chin Haw, and Akha people who reside in mountainous areas. Given this thesis' emphasis on Mekong River transformations, further descriptions of lowland people in the study area, particularly the Tai Yuan and Lao people, are provided below.

The region's largest ethnic population is *Tai Yuan* (ไทยวน) people, whose ancestors have migrated from major cities of the Lanna Kingdom, particularly from Nan Province and, to a lesser extent, Prae, Lampang, and Chiang Mai (Roykaew et al. 2004). Tai Yuan is one of the Tai ethnic groups who shares the Tai-Kadai language family (Schliesinger 2001, 193–97) and reside predominantly in modern-day upper region of northern Thailand (Wannakit and Nathalang 2011). Some Tai Yuan groups in Thailand also refer to themselves as *Khon Muang* (คนเมือง), in which *Khon* translates to "people" and *Muang* to "urbanity" or "cultivated land." This self-designation differs from other Tai Yuan people outside of northern Thailand, who only call themselves Yuan (Thubthun and Tandikul 2017). According to Charoenmuang (2003), the term reflected a response to an influx of other ethnicities into the area during the making of the Thai nation-state in the Rattanakosin Era (1782 – 1932). *Khon Muang* was initially used to indicate that Tai Yuan people of northern Thailand are indigenous to the area (Charoenmuang 2003). It later operated to

characterize the social identity of Tai Yuan and other ethnic groups that have settled amongst each other and over time came to share a similar language (i.e., *Kham Muang* or Northern Thai dialect) and some aspects of culture and traditions (Vaddhanaphuti 2006; Thubthun and Tandikul 2017). Tai Yuan people's livelihood strategies in Chiang Khong and Wiang Kaen were traditionally based on rice farming, trade, and fishing (Roykaew et al. 2004). For those living by the Mekong or its tributaries, livelihood activities generally overlap as many who rely primarily on land-based activities also fish seasonally, and those adopting fishing as their main occupation may also engage in some degree of agriculture or trade.

On the other hand, Lao people have historically migrated between the banks of the Mekong River. They established small communities in Chiang Khong and Wiang Kaen districts around a hundred years ago (Roykaew and et al. 2004; RECOFTC 2015). They maintain strong Lao culture and traditions as shown in the continued usage of Lao language within the community and the maintenance of the *Lay Hua Fai* (ไหลเฮือไฟ) or the fire boat festival, and other Lao Buddhist ceremonies. During the early settlement period, their livelihood strategies were agriculture- and resource-based, including the farming of upland rice and vegetables, fishing, and a limited reliance on animal husbandry of chickens and pigs (Roykaew et al. 2004). Their expertise in fishing is cultivated from long-term dependence on the Mekong River. Boys as young as ten years old could fish own their own, and fishing continues to play an important role in the livelihood activities of many Lao communities today (Roykaew et al. 2004).

4.2 Field Sites

The field sites, shown in Figure 2, encompassed three main areas in Chiang Khong and Wiang Kaen, namely Wiang Chiang Khong sub-district (Chiang Khong), Pak Ing Tai village (Chiang Khong), and Huay Luk village (Wiang Kaen). The study's inclusion of these sites allows for a broader understanding of how riverine changes are experienced and addressed. The first field site spans three villages of Hat Krai, Sob Som, and Wiang Don Chai. Due to the proximity of these villages to each other and how the area has grown into a small town, it was not practical to focus on the political boundaries between these villages. The sub-district lies adjacent to a highway connecting Chiang Khong to other major towns in Chiang Rai Province. With a Friendship bridge connecting to Huay-Xai, Lao PDR, and a permanent cross-border immigration office about 10 km

south of the town center (this is one of two official border crossing points in Chiang Rai), the area is considered as a transport stop-over for tourists and a trading post with much economic potential (Lamun 2013). The sub-district has a population of approximately 1,000 people, the majority of whom are Thai Yuan lowlanders (Wiang Chiang Khong Municipality 2018).[5] The urban area is characterized by residential and commercial spaces, and major economic sectors include trade and services, tourism, and agriculture – the latter of which lies outside the municipality (Wiang Chiang Khong Municipality 2018). Despite that fisheries have been a significant component of the local economy (Santasombat 2011), subsistence fishery and aquaculture are now practiced to a relatively limited extent along the Mekong River (Wiang Chiang Khong Municipality 2018). Hai Krai village is widely-known as a historical Mekong Giant Catfish catching site, but all catches have been banned since 2009 (Roykaew and et al. 2004; Hogan 2013). The species remains an important symbol for Chiang Khong, and a Mekong Giant Catfish ceremony is held every April to promote tourism. In addition to the Mekong Giant Catfish, Mekong riverweed (known locally as *kai* or *gai*) is another culturally-important river-based resource of Chiang Khong. The riverweed is widely collected along the shore of Hat Krai during the dry season, and is considered a nutritious culinary dish or snacks for local residents and tourists alike (Santasombat 2011).

In contrast to the local residents of Chiang Khong sub-district whose majority is made up of Tai Yuan people, Pak Ing Tai and Huay Luk residents are ethnic Lao. Ancestors of Pak Ing Tai residents migrated from Luang Prabang and other parts of northern Laos over a hundred years ago, and establish the village around 1917 (RECOFTC 2015; Santasombat 2011). The population of Pak Ing Tai is approximately 200 people (70 households) based on 2018 data (Department of Provincial Administration 2018). The majority of the villagers engage in land-based agriculture, producing rice and cash crops such as corn and beans, but fishing remains an important economic and social practice (RECOFTC 2015). As the village lies at the mouth of the Ing River, in which it draws its name,[6] the confluence of the Ing and Mekong rivers provides a prime fishing location. It is where fish can be found migrating up the smaller Ing River to spawn. This fishing ground is only accessible by local residents and those with strong social ties, such as relatives or members

[5] 2014 Population data imputed from those with access to public utilities
[6] *Pak* means 'mouth' and *Pak Ing* means 'mouth of the Ing'

of nearby villages.[7] The abundance of these wild catches from both the Mekong and Ing rivers historically provided substantial income for local fishers, but harvest has dramatically declined over the past decades (Santasombat 2011). Unlike the Wiang Chaing Khong sub-district, the area is less suitable for riverweed harvest and riverbank agriculture.

Figure 2. Field sites
(A) Chiang Khong Sub-District, (B) Pak Ing Tai, (C) Huay Luk
[Source: Google Maps]

Finally, Huay Luk village is in Wiang Kaen District, approximately 30 km southeast of Chiang Khong town and 7 km north of the town of Wiang Kaen. About a hundred years ago, early Huay Luk settlers had migrated from northern Laos, initially establishing a village at Kon Kam (present-day on the Thai side) and later moving south to establish Huay Luk village. The village has a population of approximately 650 people (300 households) based on 2018 data (Department of

[7] Pak Ing was one administrative unit until its separation in 2000. Pak Ing (Village No. 2) lies 1.5 km southeast of Pak Ing Tai (Village No. 16). Residents of these two villages still hold close ties, and share a fishing ground at the mouth of the Ing River.

Provincial Administration 2018). Due to its relatively large size, Huay Luk has a temporary permitted area, which allows border crossings of local residents and cross-border commerce. The village is located at a foothill with limited agricultural area. Local residents thus had significantly depended on the Mekong River for food and trade, but also farmed upland rice and other vegetables for subsistence (Roykaew and et al. 2004). With agricultural promotion and support by the Thai government over the past 30 years, the farming of pomelo and other cash crops, including rubber trees and corn, has become an important part of the local economy. Nevertheless, many local residents continue to practice subsistence fishing near the village and at their ancestral fishing ground, known as Pha Dai Rapids, about 5 km downstream.[8] Many also engage in riverweed harvesting during the dry season and forage for wild foods year-round.

[8] The rapids area is known as *Pha Dai* by Thai residents, and *Kok Luang* by Lao residents. People from both sides of the Mekong River can enjoy unrestricted access to this fishing ground.

5. Human-River Relations and Livelihood Strategies

The majority of villagers living within the Mekong River Basin have for centuries depended on the Mekong River as a source of livelihood (Santasombat 2011, 23). In addition to agriculture, riparian villagers of Chiang Khong and Wiang Kaen engage in different river-based livelihood activities including subsistence fishing, aquaculture, riverbank gardening, and foraging for aquatic plants. These practices contribute to enhancing livelihood opportunities and wellbeing through food security and income generation.

Local villagers' close relations to the Mekong River have been cultivated through daily practices (e.g., domestic use, playing), the teachings of elders, and personal observations. Many villagers who fish in the Mekong mentioned that they learned to swim and fish during their childhood by accompanying and helping their father, for example with rowing the boat. Some villagers also reminisced that before the Mekong River went through drastic changes within the past decade, young children would go down to the sandy beach or play in the river, while adults could reliably depend on the Mekong for fish and other resources. In order to explain how the knowledge-practice-belief complex encapsulated in local ecological knowledge (Berkes 2018) informs response strategies to riverine changes, this chapter first discusses river-based livelihood practices with emphasis on those relating to food production, the associated systems of resource management, and social and cultural norms – all of which shape the dynamic relationship between people and the Mekong.

5.1 Subsistence Fishing

Riparian villagers of Chiang Khong and Wiang Kaen historically relied on subsistence fishing as one of the main sources of livelihood. Fishing can be done seasonally or yearlong depending on the gear and location. The most prominent fishing activity in the area is drift gillnetting (**ไหลมอง**), whereby the fisher dismounts the gillnet from a small boat, allowing it to suspend and drift in the water (Figure 3). This type of fishing is rarely done by women as it targets larger, heavier Mekong fish compared to other methods. Furthermore, drift gillnetting requires some degree of local management given that it involves a relatively large fishing area and only one fisher can fish at a time. Accordingly, it is done within a locally-managed fishing ground, known as *luung* (**ลั้งหรือลวง**). In many places, a common management strategy of queuing up at a fish quay is enforced.

An example of such quay is shown in Figure 4. Early arrivals guarantee that the fisher can get more rounds of drift gillnetting. After each round, the fisher returns to the quay to untangle his fishing net on a makeshift bamboo structure and wait by the fishers' resting house for his next turn. Fishers pay attention to each other's catch to appraise their chances of a successful harvest. When one or more fish are caught, more fishers may participate in fishing during that period of time. Fishing may be interrupting during the wettest months (i.e., August and September) due to the difficulty in fishing in a more expansive water body and in dealing with large woody debris that come with the higher, and stronger river flows.

Figure 3. A Lao man using a drift gillnet [source: photo by author]

Figure 4. Pak Ing Tai fish quay [source: photo by author]

Access to the fishing ground varies by locality, but in general, pertains to male members of the village and others with close familial ties. It comes with the responsibility of maintaining the fish quay and fishers' resting house and participating in an annual clean up activity after the rainy season to remove logs, garbage, and other debris. As the Mekong River is considered an international common property, shared between Thai and Lao people, Thai villagers often mention that Lao fishers can access their fishing ground. Pan, a Thai fisher from Hat Krai village explained,

> "*Any Lao villager can come [to access our fishing ground]… We cannot prevent them, but they say they can help us. Most of the time it's the young people. They have the strength. When we built this resting house, the Thai side just stood there and paid for the materials, and we depended on [the Laos] to do the work… They may disqualify one another [from*

accessing the fishing ground] by saying 'this person didn't help. Don't let him come. [He should] go somewhere else.'"

From field observation, however, few Lao fishers come to the Thai side to fish and they also require an informal consent from local fishers, sometimes involving an entry payment or additional contributions to earn trust and acceptance. On the other hand, some Thai fishers, who identified as ethnically Lao, rarely cross the border to fish. While many maintain that the Mekong is an international common property, shared between the two bordering countries, and that Thai and Lao villages separated by the Mekong have "a sibling relationship," they cite the difference in the political regimes as being one of the main hindrances as Lao authorities are stricter with regards to cross-border visits.

In addition to drift gillnetting, fishers use various types of fishing gear that are appropriate for seasonal water fluctuations and fish species and behaviors. These practices are more popular among villagers who primarily rely on agriculture, and who fish as a supplementary source of food or income. Fishing traps, such as line hooks and funnel baskets (*Sai-Lun;* **ไซลั่น**, Figure 5), may be set up in the morning before going to the agricultural fields and retrieved later in the day. Villagers do not necessarily need to fish within the locally-managed fishing ground with these methods. They typically frequent the same areas their fathers had fished or find unclaimed fishing places where no other fishers have set up traps. These fishing places are often near shore, where there are large rocks or overgrown aquatic plants, or within seasonal water channels.

Women also participate in a few types of fishing, particularly those that target smaller fish or shrimps, and that do not require the use of a boat. They not only know how to use specific types of fishing gear, but have also developed the skills to make those gear from their parents, husbands, or other villagers. In Chiang Khong and Wiang Kaen, female villagers generally use a square net with a bamboo handle known as *jam* or *yor* (**จ๋ำหรือยอ**, Figure 6) at a riverside, oxbow, or shallow rocky beach to trap small fish. This is often done seasonally, during the rainy season between June to November. When the water recedes, those who continue to fish may switch to cast net fishing (**แห**) and trapping small shrimps (**ดักกุ้ง**). Female villagers do not think of themselves as fishers; they consider their role as a supportive one, primarily for household consumption. They may also sell the surplus, including processed or cooked products, at a local market for extra income. Ting, a young mother from Huay Luk, explained that:

"*Often when the water level rises, many women here would go fishing with a square net. They could catch fish themselves. Women use the square nets, not the funnel baskets [like the men]. Before [over 10 years ago] when I went to fish, I could catch 4-5 kilograms. They were small fish, about 100 baht per kilo. Now, I can't catch as many… I don't get a lot from square net fishing, only for eating, not for sale. Before, there was enough to sell.*"

Figure 5. Funnel basket trap
[source: photo by author]

Figure 6. Female villager using a yor for capturing small fish and shrimps
[source: photo by author]

Women are not expected to learn and develop fishing skills like men. According to Ting, a women's involvement in fishing also arises from personal preference as well as encouragement from parents. She pointed out that,

"*For me, I'm a woman but I like both land-based and river-based livelihood strategies. When I have time, I would go fishing…for example with using hooks, I could also do that. I learned from my father when I was a kid. I like hook fishing and using yor [square net]. When I was young, I also tried drift gillnetting, but not anymore. Not many women do like me. They don't like it but I do.*"

Subsistence fishing, as a means of livelihood for many Chiang Khong and Wiang Kaen villagers, also reflects the entwined ecological and cultural beliefs and knowledge. Certain non-living objects

that facilitate or support fishing practices are believed to embody spirits and people should pay respect to them in order to maintain good relationship or receive good luck. While many of these eco-cultural practices have been abandoned over time, some fishers continue to, for example, give thanks to their boat spirit known as *Mae Ya Nang Rua* (แม่ย่านางเรือ), after having caught a satisfactory amount of fish. This practice involves calling the spirit with a lighted incense to come and feast on an offering, which generally includes chickens and a bottle of rice whiskey. Other food offerings are also given depending on the fisher's choice. After a period of time (as assumed that the spirit has finished and left), the offering turns into a feast and is shared among the fishers. As such, the practice also provides an occasion to celebrate and tighten social bonds.

5.2 Aquaculture

Aquaculture, as shown in Figure 7, is a relatively new development in Chiang Khong, pursued by people of diverse backgrounds, including retired civil servants, marine police, and others hoping to supplement their income. There are approximately four small-scale aquaculture farms (each with approx. 20 floating cages) in Wiang Chiang Khong area, and none in Pak Ing Tai and Huay Luk. According to Poh Reap and Mae Oon, an elderly fish farmer couple, aquaculture was encouraged by a former village head of Don Wiang Chai over 10 years ago, and about 10 local villagers eventually formed a group to share information and support each other in this new endeavor. Due to the high cost of investment and production and the difficulty in rearing fish on the Mekong River, however, only Poh Reap and Mae Oon from the group remain in operation. Similar to other fish farmers interviewed, the couple did not receive much support from the local government in terms of subsidies or technical know-how. They instead invested their own money to build the floating cages on the Mekong River and relied on learning-by-doing and learning-by-mistake to become better at fish farming.

Figure 7. Small-scale aquaculture
[source: photo by author]

Small-scale fish farmers in Wiang Don Chai generally rear non-native species that have been successfully bred for aquaculture in Thailand. These fish include the Channel Catfish (*Ictalurus punctatus*), endemic to North America, and Nile Tilapia (*Oreochromis niloticus*), endemic to Africa. Juvenile fish are bought from Mae Jo fish breeding stations (under the Department of Fisheries) in Chiang Mai, and reared to the desired weight before they are sold to local markets. When asked why fish farms do not raise native species, Poh Reap and Mae Oon explained that they have tried before, but native fish, such as the Red-tail Mystus (*Hermibagrus wyckioides*), grow too slowly.[9] Overall, the economic viability of Mekong River aquaculture appears quite limited, given the high costs in establishing floating cages and in fish rearing. Compared to pond- or lake-based aquaculture, river-based aquaculture is less lucrative as fish take a long time to get to the desired weight, having to expend energy swimming against the strong river current. Notwithstanding the low profitability, those such as Tan and Gai, have cited personal enjoyment and 'personal ties' to the Mekong River as the core reasons why they continue to do aquaculture.

[9] With an exception of Gai (Hat Krai), who only raise the Red-tail Mystus fish for personal enjoyment and occasional sale.

5.3 Riverweed Harvesting

The freshwater green algae or riverweed, known as *kai* or *gai*, is economically, culturally, and ecologically important for Mekong River Basin inhabitants. These high-protein riverweeds grow in flowing water on pebbles along rocky beaches. From January to April, the Mekong recedes and the water becomes clearer as sediments get deposited from slower flows. The clearer water allows sunlight to penetrate through the characteristically turbid Mekong, creating an ideal condition for riverweed growth. Villagers from both sides of the river traditionally harvest riverweed during those drier months for household consumption and local sale (Figure 8). The harvesting ground, however, is not exclusive to members of the village, and can be accessed as a common property. When questioned about the possibility of overharvesting, the locals replied that riverweed could grow back quickly if the water remains clear and low enough for sunlight to reach the riverbed.

Figure 8. Riverweed harvest
[source: Wichai Chantawaro, 31 March 2017]

Figure 9. Riverweed products
[source: Prachachat.net, 14 March 2018]

Similar to fishing, riverweed harvesting is a gendered practice. Harvesters, mainly women, would go down to the river to collect riverweed by hand. They depend on shallow waters because those areas are more easily accessible and better for riverweed growth. These women not only possess knowledge about riverweed seasonality and ecology, but also about how to prepare it. Once collected, the riverweed is washed multiple times and can be prepared in several ways, including sun-dried and spiced or added to salads or curries (Figure 9). Mae Nam, a Hat Krai local, explained about the importance of the riverweed:

> "*The riverweed here grows on pebbles, from sand, and it is very nutritious, so we harvest them… Before around 5 or 6 a.m., we went to check the Mekong River, and many people*

were already there harvesting. People are used to eating it. From our grandfathers and grandmothers to small children. We're all used to eating it. As for me, my grandparents taught me to eat it and I'm passing this on to my grandchildren. But now, it has also become more of a business… Before [during the harvesting season], I could collect it every day, from morning, afternoon, to evening. The riverweed grows quickly when it is bright out, but if it rains, it would disappear all of a sudden. Also, all kinds of fish eat this riverweed. During a fish migration season, if villagers caught those fish, they would find riverweed in the fish's stomach."

Promoted as a cultural product, unique to the Mekong region, riverweed plays a significant role in the local economy and in women's empowerment. Some harvesters cited that a day's worth of riverweed harvest could earn them up to a thousand baht, or more than three times the daily minimum wage. It thus provides a meaningful source of income for local households, albeit for a limited time of year. Furthermore, women's earnings from riverweed sales means that they can rely more on themselves financially. Mae Mun, an elderly woman from Hat Krai, also reminisced how she came to own 20 rais of land from her riverweed sales and what her daily activities were:[10]

"I used to harvest the riverweed, and I would dry, prepare, or sell as is. Before we could clear the forest and claim it for ourselves, so that was what I did. I hired some people for 600 Baht [over 40 years ago] per rai. We cleared it with a tractor and grew vegetables there. I sold the riverweed at that time… and could save about 100 or 200 baht a day. That was quite a lot! Minimum wage at the time was about 20 baht per day. In one year, I calculated that I earned many thousand baht! In the old days, I could save money from the riverweed, made it myself, everything by hand. I would wake up at 4 a.m. to make a batch of herb-spiced riverweed, then at 6 a.m., I would go harvest more and brought them back to wash around 9 a.m. I would only get back home around 11 a.m. and then I would bring the prepared and fresh riverweed to the market to sell. If I couldn't sell everything, I would come back to dry them. If you think about it, a woman's life is hard, but [all the women in] the whole village did it. It was more about who was more diligent, but we all did it."

[10] 1 Rai = 0.16 Hectare

5.4 Riverbank Gardening

In areas where the riverbank slopes are mild, local residents also seasonally engage in riverbank gardening (Figure 10). As the Mekong recedes, it reveals the nutrient-rich soils beneath, which are highly productive for vegetable growth. The maintenance of these gardens involves relatively little care compared to those locating more inland as they get sediments and nutrient deposits from the river and the air is more humid, thus requiring less watering.

Riverbank gardens are often inherited from generation to generation, but they could be claimed by new occupants if the land is left unused. Gardening generally starts in November and may last until April or May, depending on the water levels. Commonly grown crops include different types of vegetables such as lettuce, cabbage, peanuts, chili peppers, and Thai eggplants. Family members, including children, are often enlisted to share the work between soil preparation, seeding, weeding, harvesting, and sale. As riverbank gardening is part of a broader array of the villagers' livelihood strategies, both male and female villagers may also go fishing or set up traps by the riverside to catch small fish and shrimps.

Furthermore, many generations of residents in Don Wiang Chai village grow mung bean sprouts year-round at the sandy beach of Pha Tan waterfront, as shown in Figure 11. These bucket-grown mung bean sprouts are a well-known local product due to its traditional production technique of using river sand and water drawn from the Mekong as medium for growth (Huntranee et al. 2015). In the wet season when the riverbank is flooded, mung bean growers carry up the buckets to higher grounds and continue growing mung beans using sand collected from the beach. Am, one of the last few mung bean sprout growers of Don Wiang Chai, explained his livelihood strategies:

> "*In the old days, people here, almost every households in this village grow mung bean sprouts here. Before, I helped my parents, and learned [to grow mung bean sprouts] through observations… I used to fish as well when I grew vegetables, but I didn't grow mung bean sprouts then. If I had time, I would [fish], but now I don't have time anymore [because growing the sprouts require a lot of work and attention]. In the dry season, I also grow vegetables at the beach there… we grow corn, basil, holy basil, all sorts of garden vegetables.*"

Figure 10. Dry-season riverbank gardening at Pha Tan Waterfront
[source: Chiangraifocus.com, 20 March 2016]

Figure 11. Mung bean sprouts farming
[source: photo by author]

Riverbank gardening has long been a source of sustenance and additional income for riparian villagers within the Mekong River Basin. This practice is particularly important for landless villagers as well as the elderly who have limited work prospects and do not wish to work far from home. Given the degree of reliance of riparian villagers on the Mekong River for subsistence consumption and income, drastic riverine changes would cause broad impacts to many of these river users. The next chapter discusses the perceptions and experiences of different groups around riverine changes, and their opinions on the causes of change.

5.5 Mekong River's Multiplicity of Meanings

Socioeconomic activities that link people to the Mekong have shaped the meanings of this transboundary river. To many riparian residents, the Mekong is more than a source of livelihoods for sustenance and income generation. It also bears unique social and cultural significance. As river-based livelihood activities are embedded in social relations, they also shape the social bonds within the community. Engaging in these activities often mean an opportunity to meet and socialize with other resource users, as seen in how gillnet fishers often gather at their resting house to share stories, meals, and drinks, or in how women go to fish or collect riverweed together. Furthermore, the river and its resources contribute to individual empowerment, enabling people to make independent decisions and be more in control over their lives and environment (Hennink et al. 2012). This is particularly highlighted by the less powerful individuals in society, such as women, children, and the elderly. In addition to the case of Mae Mun (Section 5.3), Nont, a part-time fisher

of Pak Ing Nua, also asserted that *"some children/adolescents would come to fish over the school holidays. If they're successful, their parents would be comfortable since they could earn at least a thousand baht. When I was young, I almost did not ask for[pocket] money from my parents."*

Everyday livelihood activities have engendered personal ties, or the sense of attachment, to the Mekong River. Some respondents cited this 'attachment' to explain why they have shifted from wage labor to being self-employed and engaging in river-based livelihood strategies. For example, Tan, a fish farmer of Don Wiang Chai who retired early from civil service, explained that *"I primarily farm fish and sometimes do drift gillnetting, but it's hard to cover the expenses of fishing. I only do it because I love it; I have the skills and the love for it. This feeling came from being attached to [the Mekong], being used to this livelihood. I saw my parents doing it, and I absorbed this feeling automatically."* The Mekong River has also been likened to a 'lifeblood,' an indispensable part of riparian communities, as it not only sustains local livelihoods and economy, but also underpins their physical, social, and cultural existence. This perception appears to be linked to the sense of 'indebtedness' to the Mekong River, and the Lao festival of *Lay Hua Fai* (ไหลเฮือไฟ) or the fire boat festival, during which people pay respect as well as ask for forgiveness from the river for any wrongdoings they may have committed.

Such ties to the Mekong are, however, contrasted by the perception that the younger generation is more disconnected from the river. Socioeconomic processes, such as infrastructure development, urbanization, and the expansion of the market economy, have been cited as partial reasons for this disconnect. According to a number of respondents (e.g., Poh Boon, Nont, Nid, Wan, and Suk), younger people are more physically distant from the river, with few pursuing the livelihood practices of their parents. The river use is also mediated by urban infrastructures of water treatment system and pipelines. Moreover, Mae Nam and Mae Nee suggested large-scale development projects are also responsible for this process of distancing as river-related practices, including recreational activities, become more difficult and dangerous. How local residents perceive and experience riverine changes are further explained in the next chapter.

6. Perceptions, Experiences, and Knowledge of River Transformations

Changes to the Mekong River's biophysical characteristics have caused cascading impacts on the people and other species over the past decades. The villagers' accounts of these transformations, formed through observations, experiences, and exchanges with different groups of actors, point to large-scale development projects as a primary source of change, but their explanations are never a simple one. They have also acknowledged that behavioral, technological, and other factors also to contribute to riverine changes. Furthermore, their local ecological knowledge about these changes and impacts is more than a product of accumulated knowledge over generations and of direct experience, but also a blend of diverse knowledge types that helps to explain their realities. How these villagers tell their stories is, thus, of particular interest for understanding the nuances of the impacts and how they frame their problems and priorities.

6.1 The Decline of Fish and Other Resources

To many villagers, the unseasonal ebb and flow of the Mekong River is an obvious indicator of a transformed river, which leads to negative ecological and ultimately socioeconomic outcomes. Local residents pointed that some days, the river could rise as much as 2-3 meters, and other days, it may fall just as much. Concerns over hydropower development were most frequently expressed. Many villagers cited that because of the dams, the river ecosystem could not function as before and fish could not migrate to their spawning grounds when the Mekong is too low. The cloudier water also appeared to affect the hatching of fish eggs or the survival of juvenile fish. Dam-related flows also complicate subsistence fisheries in at least two important ways according to the respondents. Firstly, dam releases during the rainy season to prevent overflows and dam failure cause the river to surge, making it more difficult to practice drift gillnetting. At the same time, when the dam is being refilled, the river becomes drier and small fish cannot get to their habitat in minor streams. Secondly, traditional trap-based gear become useless. When the water level rapidly increases, they may be too deep to retrieve, and when it rapidly decreases, the trap may be stranded on land.

Memories of early changes were voiced by older village members, while younger fishers highlighted more recent changes. Poh Boon, a Hat Krai village elder explained, "*These changes began many years ago, since China built [hydropower] dams. In 1996, things started to change.*

The water level fluctuates, up and down. It's not normal anymore. Usually in the dry season, the water is very clear but these days, it's cloudy." Respondents also indicated that impacts on aquatic resources became increasingly clearer within the past decade, paralleling the rise in upstream hydropower projects. To Som, a fisher in his late 30s from Pak Ing Tai village: "*We used to have many more fish. During this flood season, same as spawning season, you would normally see that we have fish tied up everywhere [by the fish quay]. Now, nothing. [Things have changed clearly] in the past 2-3 years. It happened slowly, bit by bit… Last year during the high season, we got a lot of fish for a about a week. This year, only a few days."* In addition to the decrease in the number of fish caught, the size of fish has also become smaller. Sa, a housewife from Pak Ing Tai who helps her husband sell fish, added that *"From the past 4-5 years especially, there's not enough fish to sell. No more big fish like 5-10 kg. Even when we could catch 2-3 kg ones, it's usually one or two of that a day."*

In addition to hydropower development, respondents also attributed the cause of riverine changes to the Lancang-Mekong Navigation project, an effort spearheaded by China to improve river-based trade route from the southern Chinese port of Simao, Yunnan, to Lao PDR's ancient capital of Luang Prabang. While the full project is incomplete with regards to the blasting of rapids between Thai-Lao border, sites north of Thailand have been completely cleared by 2004, allowing large ships to reach the northernmost Thai port. Oun, an elderly Pak Ing Tai fisher recounted that, *"I remember that from 2003 or 2004 onward, it was clear that the fish disappeared. I can't tell why, I don't know who to blame. Is it the rapids blastings? That's part of it."* The project has caused specific impacts to the river and aquatic resources. Some villagers explained that after those rapids and reefs have been taken out, the flow of the Mekong has become stronger, and greater river traffic upstream has led to increased trash disposal in the Mekong from commercial fleet. Others opined that the blastings destroyed the habitat of fish and other species. Mae Nam, a female villager from Hat Krai, shared her perspectives on how the navigation project has threatened aquatic life and local livelihoods:

> *"Everything is for commerce these days. They [the Chinese] wanted to blast the rapids, to trade, but us villagers have lived here for so long. Without the rapids, the rocks, how could the fish live? The river flow has also changed direction, and eroded the banks. Us riparian villagers have to live with riverbank erosion… And what do we get from this project?*

Nothing. No fish. All gone. How can they live, eat? Normally with the rocks, algae and such can grow on them and the fish can hide and eat them."

Using local knowledge to explain environmental change bears important limitations as it is spatially limited and it draws mainly from observation and ecological reasoning. Some villagers were more careful not to attribute the decrease in fishery resources to river development projects alone. Oun of Pak Ing Tai further clarified,

"*Do dams cause fish declines? That might relate to the unusual rise and fall of the river, or it could be related to the new dam [in Laos, which is currently under construction]. I haven't seen it with my own eyes, but I saw the news. We could look at this from many angles. Maybe it is because we fish year-round and because during the spawning season in July, we catch everything. We don't take a break; we catch everything. The Fisheries Department doesn't tell us not to do it. [Fish population] might fall because of that? I don't know. I didn't study it, but know it has gone down."*

This uncertainty is echoed by other villagers, who had in the past observed the illegal use of fishing gear, such as electrofishing and blast fishing (i.e., using explosives), and the worsened water quality, which has been attributed to pesticide leaching, littering, and other pollution.

In the case of riverweed availability, however, local villagers were near certain that hydropower operations are the main problem. Drastic impacts have been illuminated by Mae Tan, an elderly Hat Krai woman, *"From being able to harvest riverweed for 3-4 months, now we could only do it for less than a week this year. The bloom was very short. When they [the Chinese] released water [from dams], the riverweed disappeared, gone with the water."* Another villager from Huay Luk, Ting, echoed this issue, *"Things were still good 9 or 10 years ago, but in the past 5 years, especially, we could sometimes harvest riverweed, and sometimes not. The river rose quickly and fell quickly… we used to be able to harvest for months, but now not so much. When we noticed the bloom, the villagers could then harvest maybe a day or two before the water rose again. After another 5-6 days and the water level fell, but the riverweed was gone."* The villagers understood that the Mekong River's unseasonal flows could only be a product of dam cascades,

and with less riverweed, their river-based livelihoods as well as aquatic species that subsist on these protein-rich green algae are in jeopardy.

6.2 Transformed Riverbanks

Riverbank erosion is a natural process, which could be exacerbated by human activities, such as reservoir construction, river channel improvement for navigation, and bridge construction (Kummu et al. 2008). Ongoing riverbank erosion along the Mekong River over the past decades has prompted the Thai government to initiate riverbank reinforcement projects along the entire Mekong corridor, stretching over 330 km of the riverside (Srinetr 2018). Such project involves creating a wall of rocks and reinforced concrete along the river to prevent further erosion.

In the last ten years, these projects have been implemented in parts of Chiang Khong and Wiang Kaen, including the case study area. Large swaths of riparian forest, riverbank gardens, and fishing areas have been converted to reinforced concrete walls (Figure 12), thus displacing space of livelihood strategies. The respondents cited how the loss of natural riverbanks has transformed microecosystems along the river, degrading habitats for many species, including insects and fish. Poh Luang Prachit, Huay Luk village head explained:

> *"The benefit of riverbank protection is to prevent erosion, to prevent the loss of our territory, but I could also see the whole picture. If you think deeply about it, the problem is because of us humans. They built dams upstream. When they open and close dam gates, they cause the flow to change direction and erode our riverbanks. We might have natural erosion before but it was not this severe. And we have livelihoods that depend on riparian forests, Krai plants, rocks, sandbars. Fish thrive there, and also birds. But now, despite the concerns of our government, we don't have [natural riverbanks]. No riparian plants, no rocks along the banks. It's like we have a concrete dam, the river is just a channel. Fish don't really stay there."*

At Hat Krai village, whose name directly translates to a beach of willow-leaved water croton (*Homonoia riparia*) known locally as Krai, interviewed fishers explained that fish like to hide by Krai plants and feed on different riparian plants. They identified how the river protection project

has degraded such habitat and removed some riparian zones of Hat Krai that provide refuge for fish in the dry season. Recognizing the importance of Krai plants, some fishers also tried to grow Krai around the fishing quay, but such effort has been very limited.

Figure 12. Riverbank lined with rocks and reinforced cement
[source: photo by author]

Furthermore, riverbank protection projects have particularly impacted landless villagers and the elderly by further limiting their livelihood options. An elderly woman from Hat Krai village, Mae Mun, explained that "*Before this [riverbank reinforcement] I did riverbank gardening, growing vegetables like Thai eggplants. Below there by the riverbank. We could grow everything. Now they [Thai government] took it all. They took the land. The structures made it hard to collect riverweed, too. It's flooded. I don't know what else [livelihood strategies] to do.*"

In Wiang Don Chai, respondents, who are mung bean sprout growers, expressed concerns over the expansion of the riverbank protection project, which involves the widening of a bicycle path along the Mekong. They feared that this new development could transform the Pha Tan waterfront and sandy beach, making it unfeasible to farm along the riverbank during the summer months. Without those unique geographic characteristics, their livelihoods would be greatly impacted.

6.3 Worsened Well-Being and Greater Risks

Riverine changes and the associated ecological transformations have led to a greater economic burden and worsened well-being. While the prices of fish and other Mekong resources such as riverweed have increased significantly due to supply decreases, villagers who engage in river-based activities must bear greater economic risks.[11] Fishing has been likened to a gamble as there is little guarantee of a successful catch unlike what it was in the past. For drift gillnetting, for example, the more rounds they fish, the higher the cost of fishing. Interviewed fishers cited that each drift gillnetting trip costs approximately 20-25 baht based on gasoline usage, and this does not include other costs such as time and the depreciation of their boat and fishing gear. According to Sa, a fisher's wife who takes care of fish sales, her household income has decreased considerably because of fishery declines: "*We have been severely impacted! Usually, when we sell Mekong fish, we could earn about 10,000 or 20,000 a month [from fishing alone]. Now that's not possible. They say fish is more expensive, but we have to wait 3-4 days to get one fish of about 2-3 kg. That's about 900 Baht. And then, it takes another 3 days to catch another. No, that's not good enough. We also have to consider the cost of gasoline… for us, it's almost like half of our income disappeared.*" Local residents who engage in other river-based livelihood activities face similar problems. In the case of aquaculture, one farmer explained that fish often die when there is a sudden rise in the Mekong level, as water becomes too muddy and fish suffocate (i.e., ecological hypoxia). Recounting a time when she had to sell her fish quickly to cut losses, she said *"2-3 years ago, we used to sell fish (Channel Catfish; Ictalurus punctatus) for 150 per kg. From that we had to call every restaurant we knew and sell for 100 per kg because of the fish kill. Each fish was 2-3 kg. We just had to sell, so they didn't die for nothing. For the small ones that we could not sell, we had to just get rid of them. We also ate some."*

Women face unique challenges from the changes in the Mekong River as their household status is one of a helper, with less access, ownership, and control over assets or tools needed to make a livelihood. The lack of boat ownership and gendered fishing tools limit these women to working along the riverbanks and in shallow waters. As the Mekong river flows unseasonably, rising and falling at unpredictable times, those activities have become increasingly difficult. For

[11] Certain scaleless Mekong fish species could cost between 300 to 400 Baht per kilogram, about ten times more than the cost of farmed red tilapia.

example, only those with a boat can access river islands or shallow, offshore areas to collect riverweed. Mae Mun explained these differences in impacts on men and women:

> "*We, both men and women, used to be able to go fishing in the Mekong, but now if you want to fish, you have to have a boat, to go drift gillnetting. Otherwise, it's not really worth it. Before, people also used drift gillnets but compared to now, [a boat] is a must. You can't go on foot and use small nets anymore. Also with a scoop net for fishing fish or shrimps, women used to be able to do that. Collecting riverweed also, but now it's hard. If China wants to build more dams, not a chance [of doing those activities].*"

As a result, the limitations experienced by women, who rely on river-based activities, leads to a greater burden to earn more income from other sources to feed the household.

In addition to losing a significant part of household income, resource declines have broad implications on other aspects of well-being, including mental health, family relationships, food access, and cultural transmission. Impacts on mental health were described as something as mild as the feeling of being inconvenienced from harvest difficulties. More severe impacts include a high level of stress and constant worrying, especially with regards to river flow fluctuations. Am, a bean sprout grower of Wiang Don Chai, pointed that he and his helpers must check the water level several times a day to make sure their sprouts are not flooded. He described his daily schedule and recounted a recent flood:

> "*We have to observe in the evening, but we also don't know what tomorrow morning will look like. Will the water rise or not? We have to take a risk. Around 3 p.m., we have to go down to the beach again to see. In the morning, we also go down at 5 a.m… In the past 2-3 weeks when the water was rising, we were about to have dinner around 9 p.m. and my wife went down to check. Ohh! we found that the water was really high. All of us, my wife, my son who was visiting at the time, and I had to go down to carry our bean sprout buckets. The water rose too quickly. All three of us worked together until 10 p.m. Now, my helper [son] has left…*"

Some respondents have also expressed concerns about family relationships and the education of the younger generations as working adults would migrate to bigger cities to work, leaving their

children behind for the grandparents to take care of. While in-city migration flows are not unique to the problems of environmental changes and resource depletion, they are often related. The next chapter will discuss such response strategy in more detail.

Food access also plays a role in the overall health and well-being of local communities. Riparian villagers traditionally subsist daily on these Mekong food sources. With the decline in freshwater fish and other resources, respondents admitted to shifting their consumption pattern toward more chicken and livestock as they are more readily available and affordable. While this impact has been linked to the issue of food security as local residents lose access to essential fatty acids, vitamins, and minerals commonly found in river-based foods (e.g., Orr et al. 2012), respondents have particularly highlighted the personal and cultural aspects of well-being, and what this loss or limitation on access means to them. For example, Mekong fish are considered a local delicacy with a taste far more superior than farmed fish. Poh Boon, an elderly local explained that, "*We still buy [Mekong fish], but only once in a while. We don't have money to buy it often. Other people don't really buy it. One meal would cost over a thousand baht, and that's enough for a couple of days*." Similarly, Pan of Hat Krai clarified, "*People here who don't fish still buy them. They buy Mekong fish, and they don't want fish from other places because they are used to eating this way. They [riverine changes] also impact our cooking.*"

In addition, resource declines bring a particular concern about maintaining local traditions and transmitting memories of how their ancestors lived. Certain practices, such as *Liang Phee Lhuang* or a ceremony performed by Mekong Giant Catfish fishers to pay respect to fishing ground spirits, no longer exist in its traditional form as the locals could no longer catch them. It was however replaced by a more elaborate Mekong Giant Catfish ceremony, initiated by the local government. Such development was rather seen as a misrepresentation of the fishers' culture, as explained by Gai, a Hat Krai local who were one of the last people to capture the Mekong Giant Catfish:

> "*The worship [of spirits] used to be practiced by the fishers themselves, but now it has become a business for certain groups of people. They want an income [from it]. They bring monks to pray for a ceremony that pays respect to ghosts? Right? And to perform that in front of Hat Krai temple? The monks did it! That's crazy! The fishers are opposed to that. Monks should stay in the temple, not worship the spirits. The ceremony is essentially about*

ghosts, those who died violently. Spirits of the fishing ground, the quay, the boat. It's really terrible."

In other cases, the declines are seen as a challenge to passing on ancestral memories and local knowledge. Oun, an elderly fisher from Pak Ing, expounded that "*I still teach my sons that their father and mother are indebted to the Mekong even though we now shower with municipal water. Their grandfathers and grandmothers had depended on it [Mekong]. The river still provides us fish, but there are less of them now… [the Mekong] still nourishes us."* At the same time, respondents also expressed an understanding of the socioeconomic dynamics and the ongoing shift from subsistence livelihood to commercially viable economic activities. The ability to buy and eat Mekong fish and riverweed, however, remains a significant part of the dynamic livelihoods. This observation is reinforced by the responses of Pang, a young Sob Som woman: *"For me, I have to eat Mekong fish every year. It's seasonal. I also buy farmed fish, and most of those sold at the market are farmed. I haven't had any Mekong Giant Catfish since I got older."*

6.4 Changing River, Changing Perceptions

Like other majestic rivers of the world, the Mekong River has elicited a broad set of emotional responses from admiration, respect, to fear. Its transformation, however, has led to more negative views toward this once-familiar river. The Mekong has become less predictable and less understood by local resource users due to the stronger and more erratic flows. As Mae Mun asserted, *"It is like I don't know the Mekong anymore."* Its riverbanks and riverbeds have also been altered from the change in flow directions and the riverbank reinforcement project. Some shallow parts of the river have become deeper and there is a greater perceived danger of being swept away by the strong currents. Mae Nee added, *"We were not afraid [of the Mekong] back then because we know the water, where it's shallow. We know how far to walk to, but now we're afraid of misstepping. There was a slope far toward that wall (pointing out), but the Mekong has become scary these days."* This fear thus reinforces younger people's disconnectedness from the Mekong River, as evidenced in an account of Pang, a 25-year-old female merchant from Sob Som:

"I do almost nothing relating to the Mekong. When they built the riverbank reinforcement and the footpath, livelihoods also changed. The elderly have difficulties coming down to catch fish. I used to play by the Mekong when I was young. There used to be a sandy beach here, but it has become very deep now. Personally, I'm not afraid because I had played here before. Well, maybe a little afraid because of the deep water. My grandmother and other old women always say, 'don't play in the river.'"

7. Response to Riverine Changes

7.1 Individual-Oriented Responses

Strategies to address environmental changes at the individual level range from immediate actions to cope with everyday struggles to cognitive and behavioral adjustments oriented toward longer-term livelihood security. Local residents in Chiang Khong and Wiang Kaen, who continue to engage in river-based livelihood practices, have carried out a mix of strategies that combine existing sources of knowledge with new ones to determine an appropriate course of action.

7.1.1 Coping and Adjusting to the New Reality

Findings suggest that mental preparation and creative ways of gauging about riverine changes underpin many individual response processes. The planning for hardships, including a modification of expectation about successful harvests and what one needs to live on, were cited as an important strategy when resources become scarce. Such strategy has also been referred to as "*living sufficiently,*" or living within one's means. How local residents perceive, think, and judge their course of action have also been adapted to the new reality of a transformed Mekong River. Respondents cited several strategies to better detect sudden changes and take actions to limit potential harm. These include more frequent direct observations of the river, broadening their sources of information about sudden riverine changes (i.e., using traditional and social media in addition to direct observations), or capitalizing on their social network to find out when the river may rise or fall. Given a monitoring station several kilometers upstream, Chiang Khong and Wiang Kaen residents, who are well-connected, may be able to learn of, and prepare for the sudden riverine changes despite the lack formal notification system. Some respondents also cited observing other villagers and their successes as another way to gauge when they should engage in the relatively riskier river-based activity. For example, successful catches often indicate that a school of fish may be migrating by, and fishing during that period is worthwhile.

The practices of river-based livelihood continually adapt to the changing river regimes and the available technology. In the case of fishing practices, which require technical skill and knowledge of gear usage, fishers would adjust the size of the gillnet and weight of lead parts daily, or change to other types of gear to match the water conditions. They would also closely observe

and imitate the techniques of those who have a greater success. According to Oun, a Pak Ing elderly fisher, *"We adjust almost every day [when we go drift gillnetting]. We used to have one layer of net with a mesh size of 18 cm. Now, we can't only rely on that. We might add another layer of 9 cm, and another 7 cm on top of that. If we can't capture one, another [smaller fish] might get caught. When we could drift gillnet, we could also be angling. If we can't catch any, we would find other [livelihood] opportunities."* Poh Luang Prachit, Pak Ing Tai village head, further explained that the use of 3-layered gillnets in his village began around 2007 when the fishers observed a serious decline in fish population.

Findings further indicate that the strategy of using destructive and illegal gear, such as electrofishing and blast fishing (i.e., using explosives), have almost disappeared as resources dwindle. Citing the long-term impacts of using these tools, such as fish infertility, the fishers interviewed claimed to no longer take part in such illegal activity. The practice is also deemed as unfair, putting further pressure on the resources available. A few cases of illegal usage still exist as indicated by elderly fishers. However, most responses claimed villagers from Lao PDR continue the widespread use of such destructive gear.

7.1.2 Diversifying and Reprioritizing Efforts

Resource users diversify and reprioritize their efforts in order to manage the risk associated with river-based livelihood activities. Livelihood diversification is not a new strategy for responding to riverine changes, due to the seasonality of many subsistence practices (e.g., riverweed harvest, riverbank gardening). However, Mekong River transformations have made river-based activities economically riskier, further complicating the shift between different livelihood practices. Specific diversification and reprioritization strategy varies from case to case, but it generally involves a combination of selling labor as a farm worker, a construction worker, or a truck driver, or selling foraged foods (e.g., bamboo shoots) or other products at a local market. These contractual works generally pay at the daily minimum wage of 300 baht, but the certainty of earning an income is often chosen over the preferred river-based subsistence practices. As Som, a male fisher from Pak Ing, explained, "*If there's a contract job available, I would do that. Working on a plantation or in an orchard, something like that to supplement [my income]. I also do vegetable gardening to supplement. If it was like before, when we had plenty of fish, we wouldn't have to find all those jobs. Only fishing would be enough."* Similarly, Sa, a female villager from

Pak Ing who helps her husband sell fish, described the different types of work she does to make a living, *"If someone wants to hire me [for contract work], I would go. Sometimes it's to cut grass in the fields. When there's not a lot of fish, I look for things to sell. My mother also goes to the market to sell her sewn clothes. We'd go to the weekly market, and if we had fish, we would sell them, too."*

Local residents also shift their efforts to take advantage of the seasonality and new opportunities. The flexibility provided by agriculture and contractual work means that they can strategically choose when and how long they are engaged in river-based activities. This includes intensively engaging in river-based activities only during the peak season (e.g., fishing in July and August, riverweed harvesting in April or May), and returning to other land-based activities for the rest of the year. Many villagers with land ownership have shifted toward growing cash crops, such as tobacco, corn, and rubber, but river-based activities remain a part of their livelihood. According to Wan and Suk of Huak Luk, they both own some land and have shifted from growing corn to pomelo trees. "*Growing corn is tiring as they are annual crops, but Pomelo trees can live more than 10 years. We don't need to grow again and again. Plant it once, cut the grass, put in fertilizer, spray pesticides, harvest. It's a cycle like that, so there's time to fish. [When the fish catch is low], I would do more contract work, do other things to supplement. There're a lot of jobs, but it's all up to the person whether he/she wants to do it,"* they took turns explaining the situation. Moreover, Nid, a female villager from Huay Luk, shared how her family has shifted priorities. *"My husband has some land. We grow rubber trees there, but we don't have to take care of it so much now because they're over 10 years old. When it rains, we would stop harvesting rubber, and when we have time, we find other work. Right now, our main livelihood strategy is tending our rubber plantation, followed by other agricultural work, pomelo plantation. After that, we find contract work. We also grow our own pomelo trees. Fishing is much less important now. It was in the second place before."*

7.1.3 Leveraging Social Networks for Resource Access

Resource declines have prompted a greater exclusionary control of access to the fishing grounds. Given the decentralized form of managing the fishing ground, the strategy to limit competition is commonly done on a personal basis. Pan, a Hat Krai fisher, highlighted how things have changed, "*Those from another village, who used to assist us during a Mekong Giant Catfish hunt, had the*

right to access [our fishing ground at Hat Krai]. We talked and agreed on that, and we considered ourselves friends. But these days, even my closest friends cannot come. My friends! There are too little fish, too many people."

Few villagers, however, are still able to take advantage of their familial or social connections to gain access to the declining resources and find better opportunities. Kan, a 30-year-old male from Lao PDR, spoke of how he came to Huay Luk,

> *"I mostly come to Thailand to work. There's also work on the Lao side, but I came to live here with my mother's relative because his/her children moved out. In Lao, there's construction work, building roads. If you compared the wages, the Lao wage is less. It's about 200 baht a day if it's a major [intensive] work, but it's 300 in Thailand, and could be more if it's major. When I first came to live with my relative, he/she introduced me to Brother Krit (pseudonym). He taught me how to use a drift gillnet… It's been 3 years now. I fish with him in the first year and did it myself in the past 2 years."*

Another resident from Lao PDR, Ming, is able to fish at both Pak Ing and Huay Luk fishing grounds after cultivating friendship and trust with local fishers for many years. He revealed that he was not completely welcome at first, but by demonstrating his generosity and geniality (e.g., contributing labor for the upkeep of the fishing ground as well as money to social gatherings), other fishers came to accept him. Such access allows him to move around between different fishing grounds, including one of his village, to seek the best opportunities available. He would strategically fish at the southerly-located Huay Luk during the earlier parts of the fish upstream migration season, and relocate to Pak Ing Tai or his home village when the Mekong level rises, making it difficult to successfully capture fish at Huay Luk. His case is, however, very unique as no other fishers observed fish with a drift gillnet at multiple locations.

7.1.4 Shifting Livelihoods and Finding New Opportunities

In addition to the strategies to sustain river-based livelihoods discussed above, local residents have opted for other individual-level strategies that indicate a shift away from a reliance on the Mekong River. These strategies, however, have different implications on human-river relations. For local residents who maintain a personal tie to the Mekong River and its resources, but have chosen other

livelihoods or occupations, river-based livelihood practices have turned into recreational activities. Gai, an engineer for the Chiang Khong municipality, has been fishing for over 30 years, and is one of a few younger fishers (aging less than 40) who possesses the tools and skills to hunt the endangered Giant Mekong Catfish. In addition to fishing, he has a floating raft where he raises freshwater fish in mesh cages. According to Gai,

> "*You need capital [to invest in aquaculture]. My investment was almost 300,000 baht. Who's going to throw away that much money. They'd have to be passionate about it. Fishing these days is no longer about making money, but more about personal liking. Farming these fish is also a liking, so that I can eat them. I also sell if someone wants to buy, but now they're more for personal consumption… People here adapt by not taking up fishing as a main livelihood strategy… It has rather about personal preference. It's within us. It's here since we were young, this liking for fishing.*"

Local residents who claimed to fish recreationally have expressed how they are pursuing their personal passion or liking. For Pan, an elderly fisher and a former president of the Giant Mekong Catfish Fisher's Club of Hat Krai, the Mekong's unseasonal flows and other changes have transformed how fishers fish. He suggested that at Hat Krai, fishing has become less of a means to secure basic necessities, but rather an activity old fishers do "for fun." By re-thinking what fishing means, these fishers modify their relationship with the Mekong and fishing ground—a relationship that emphasizes the benefits of recreation and socialization in place of subsistence.

Finally, in a bid to address long-term changes, both environmentally and socioeconomically, and to find better life opportunities, many local residents of Chiang Khong and Wiang Kaen referred to formal education as a way to ensure a better livelihood, and would encourage their sons and daughters to study and find work in the cities. The younger generation working out-of-town are expected to send back remittances, thus providing an informal source of social security where the livelihood security is lacking. This livelihood shift, particularly from river-based strategies, pertains to both young women and men of Chiang Khong and Wiang Kaen. The following account, told by Oun, an elderly fisher of Pak Ing, is illustrative of a response strategy informed by a perception that environmental changes have diminished economic opportunities and security associated with the Mekong River.

"[The number of fishers] have decreased. [Those who are around are] the same people. But as the head of the household, we have to plan, that we can't let our children follow our footsteps. We need to provide them with a higher level of education. If our stomachs are not full? That doesn't matter. Fishing no longer provides stability. I also think that, and have scolded my younger child (about 20 years old) that 'if you like fishing, go study fishery sciences [at the university]. Don't come and fish like me.' We know that we have problems now… Today I only caught one fish. I'll give it to my two grandchildren."

7.2 Collective-Oriented Responses

Local ecological knowledge (LEK) further contributes to the strategic and often political responses by impacted communities in Chiang Khong and Wiang Kaen. Through working collectively and engaging with the broader social and political networks, local villagers are able to enhance their capacity to affect change and achieve a desired outcome (Ireland and Thomalla 2011). Findings show that impacted communities have engaged in three approaches to collectively respond to Mekong transformations, namely (1) organizing as a collective; (2) becoming enlisted in conservation; and (3) engaging in Jao Baan Research and political action. The first strategy reflects an improvement in the capacity to deal with a new environmental reality, while the last two strategies combine attempts to access external support and to develop proactive measures to both limit current impacts and avoid future threats.

7.2.1 Organizing as a Collective

Collective response is fostered through social relations and shared experiences and challenges. In contrast to fishing and aquaculture activities, which have had limited collective organization,[12] the female-dominated riverweed harvesting activities have drawn sufficient support from local villagers to establish the Kai Production Local Enterprise Collective (**กลุ่มวิสาหกิจชุมชนสาหร่ายน้ำจืดไก**). Founded in 1999 to improve alternative income generation and expand the channels to

[12] with an exception of Giant Mekong Catfish Fisher's Club of Hat Krai, which was dissolved in 2009.

promote and sell locally processed riverweed, the collective is made up of interested Hat Krai women, whose livelihoods rely on riverweed harvesting in addition to working as housewives or farmers. Despite the initial focus on promoting the cultural importance and health benefits of their riverweed resources (Sonbali and Jaidee 2014), impacts from riverine changes, including a limited harvesting window and harvest declines, have prompted the collective to make changes to their operations. As it was able to obtain processing machines funded through a government program, the collective could shift their operations to produce other products, such as dried longan (tropical fruit) and beef jerky when the riverweed harvest falls short. Furthermore, members' contributions help to provide sufficient support for group members (e.g., micro-credit lending) during difficult times.

Additionally, the collective has sought support from research institutions to enhance their local ecological knowledge in riverweed harvest, processing, and marketing. According to Mae Nee, an elderly Hat Krai native and a member of Kai Local Enterprise Group, local villagers have for generations known that riverweed are healthful, but support from Chiang Mai University research team in helping to determine its nutritional value has allowed them to make a stronger claim about the riverweed's health benefits. The shorter harvest period and the associated decline in riverweed harvest have prompted the group to seek partnerships and ways to elongate the shelf life of processed riverweed. More recently, local villagers have also innovated ways to make riverweed chips, cookies, and cakes to sell to tourists. Through the local enterprise group, these women are able to work collectively and expand their access to external support to cope with and adapt to the changing livelihood conditions.

7.2.2 Becoming Enlisted in Conservation

In the earlier sections, responses have centered around the villagers' own struggles and ability to mobilize existing resources – knowledge, skills, and social relations. The observed strategic and political responses, on the other hand, demonstrate how the villagers have supported or engaged in initiatives that contribute to local empowerment and resistance against large-scale river development. These initiatives were greatly influenced by a local conservation group, known as *Rak Chiang Khong* [Conserve Chiang Khong] or more formally the Mekong-Lanna Natural Resources and Culture Conservation Network, which is made up of a loosely organized network

of conservationists and activists.[13] Seeking to reconcile the linkages between history, ecology, culture in community development (coined as the history-ecology-culture guiding principle), the group's work relating to the Mekong River aims to raise awareness and reconnect people to their local history and culture, strengthen a network of resource users and environmental groups, and drive the struggles against river development projects that undermine the locals' ability to access and use natural resources (Niwat Roykaew, personal communication, 21 August 2018).

The formation of fish conservation zone in Chiang Khong and Wiang Kaen exemplifies the collective and strategic efforts of villagers to resist the impacts of riverine changes brought about primarily by the hegemonic process of river development, and to mobilize their local ecological knowledge (LEK) to support the broader conservation movement. Aiming to protect fish resources from further decline and raise awareness of the ongoing river development, conservation zones encompass critical protection sites, which are typically at the mouth of a river, seasonal channels, deep pools, or where there are extensive submerged rocks providing fish refuge. Currently, there are two conservation zones in the study area, at Pak Ing Tai and Huay Luk, both established in 2004.[14] The former consists of a permanent 200-meter no fishing area at the mouth of the Pak Ing River connecting to the Mekong. The location is considered as *the best fishing area* by local fishers as it is where migratory fish enter the Ing River to reach their spawning grounds. Fishing of any kind is restricted year-round and any violations would result in a fine, enforced by the village committee. Conservation management, guided by the Rak Chiang Khong's history-ecology-culture principle, also involves an annual event, *Seub Chata Mae Nam* [Elongating the Life of the River], which reproduces a Buddhist alms giving ceremony involving the release of fish into the Mekong River. According to the village head of Pak Ing Tai, the conservation zone establishment process faced initial resistance from the fishers and took several years before reaching an agreement in 2004. Benefits of participation were communicated broadly, which include access to external support from the Rak Chiang Khong and community partners as well as local government agencies. Contributions range from an initial offering of two cows, to transfers and releases of endemic fish, and an enrollment in a mobile fish breeding program. The village

[13] The group is not a grassroots organization as key members are not local villagers themselves but rather teachers, businessmen, and artists, who share concerns over the development trajectories of Chiang Khong (and more broadly the Mekong) communities and environments.
[14] Multiple fish conservation zones were established by various groups of actors, including the WWF, but only two remain in the study area.

also became enlisted in the conservation network and gained strategic ties to participate at the Ing Watershed People's Assembly (IWPA), a community-based platform established in 2013 to facilitate Ing watershed management decision-making.

Some local fishers, however, remained skeptical about the long-term benefits of conservation. Som, a local fisher of Pak Ing, shared that the municipality's funding for the *Sueb Chata Mae Nam* ceremony has been inconsistent, and fish releases are typically larval Java barb or similar species that are suited for aquaculture, which do not thrive in the Mekong River's strong currents. Others such as Oun felt that the established conservation zone is insufficient to limit fish population declines, but new rules for the fishing ground and fishing season would be more effective.

Fish conservation zone in Huay Luk also emerged around the same time as that of Pak Ing. Spanning about 300 meters long and 15 meters wide, the zone lies on the Mekong River adjacent to the Huay Luk village waterfront. According to the village head, Poh Luang Thong Suk, the idea to establish the conservation zone and collaborate with the Rak Chiang Khong group resulted from the riverine changes and ongoing decline in fish catch at the village's ancestral fishing ground, 5 km downstream. By enlisting the villagers to engage in conservation, fishers could fish nearby and save on their boating fuel costs. Other villagers could also contribute to conservation by feeding the fish in the conservation zone. Poh Luang Thong Suk, the Huay Luk village head, explained that it started as an experiment to see whether the villagers could establish a fish habitat, and to encourage fishers to fish nearby. Results have been very positive as wild fish could be seen coming up for food, and many villagers would feed the fish and help monitor against fishing violations. Fishers also benefit from the released fish that stray out of the conservation zone.

Conservation practices and the reproduced Buddhist ceremony of making merits and releasing fish to the river highlight the use of local ecological knowledge (LEK) to render the conservation zone sacrosanct. Fishing in the conservation zone is seen as immoral and is believed to lead to negative consequences. Underlying this belief is the Buddhist principle of karma, or the cause and consequences of one's action. Krit, a local fisher, explained *"I agree [with conservation]. To preserve [the Mekong] for our children and grandchildren. When we release the fish, we also have monks praying, and we make merits to the fish. If people try to catch them, they would fear the karma and such. The monks already pray and make merit."* While direct benefits of conservation to local fishery may vary by location, the villages involved were able to

gain access to conservation funding and technical support and participate in the broader conservation movement. The benefit of gaining more respect from outsiders was also cited as the fish conservation model has been taken and adopted elsewhere.

7.2.3 Engaging in Jao Baan Research and Political Action

Paralleling the process of establishing Mekong River fish conservation zones was an explicit effort to engage in the politics of knowledge. *Tai Baan Research*, directly translated to "villagers' research," emerged as a mechanism to build a multi-scale network of resource users, NGOs, and others, and create space for participating and influencing decisions around large-scale river development. The research approach particularly aims at giving local villagers greater control and ownership over the production of environmental knowledge, which has long been dominated by scientists and academics in policy making (Myint 2016). Developed in 2000 during a struggle against the construction of Pak Mun Dam in northeastern Thailand, Tai Baan Research was applied to the case of Chiang Khong and Wiang Kaen, and renamed *Jao Baan Research* to reflect the local dialect.[15] Its research methodology falls within the Participatory Action Research (PAR) framework, which "seeks to democratize research processes through the inclusion of local stakeholders as co-researchers and actively contribute to democratic social transformation" (Scurrah 2013). Instead of referring to resource users as participants, the methodology underscores them as "villager researchers," and put them at the center of developing research agenda, collecting and interpreting the data, and contributing to resource management decision-making (Sretthachua 2006).

Jao Baan Research can be characterized as a process of knowledge hybridization that combines local ecological knowledge (LEK) with social science methodology to lend more credibility and validity to villagers' experiences and knowledge of environmental phenomena.[16] Villager researchers play the central role as producers of knowledge and participate in workshops to systematically collect and organize knowledge, and review what are collectively known. Research participation is based on subject knowledge of the local ecology and livelihood strategies (e.g., subsistence fishing, riverbank gardening) as well as personal enthusiasm in engaging in

[15] The word *Tai Baan* is based on a Thai-Isan dialect, whereas *Jao Baan* is based on Kham Muang or northern Thai dialect.
[16] These methods include field surveys, group discussions, key informant interviews and photo documentation.

community-based research, rather than an attempt to capture the broadest representation of the Mekong riparian community. These villager researchers are, thus, of the older generation with years of practical experience in the topic of interest. Furthermore, Jao Baan Research includes considerable external involvement by "research assistants" (i.e., student volunteers and NGO workers), who facilitate group discussions and translate knowledge into written texts and maps. These assistants can also acquire a deeper understanding of the culturally encoded local knowledge (Scurrah 2013). According to Dr. Chainarong Sretthachua of Mahasarakam University, the training of villager researchers in gathering empirical information and the support provided by research assistants have helped overcome some limitations of PAR as conventionally practiced in Thailand (i.e., too narrowly focused) (personal communication, September 19, 2018). He underscored that the methodology's three key components — villagers as producers of knowledge; academics/scientists as supporters in developing of the conceptual framework; and NGO workers as mobilizers of exchanges and negotiations — can elevate local knowledge for use in policy making.

In practice, Jao Baan research in Chiang Khong and Wiang Kaen involved 146 villager researchers from 13 Mekong riparian villages (Jao Baan Research 2004), including the study area of this master's thesis. It was spearheaded by the Living River Siam Association (formerly SEARIN) and Rak Chiang Khong Group, and spanned from August 2003 to June 2004. Research efforts focused on classifying complex river ecosystems, identifying important aquatic habitats, ascertaining the diversity and availability of fish and plant species, and describing how these resources are accessed and used by the local community (Jao Baan Research 2006). The interpretation of results within the context of local experience and knowledge allowed for cultural and spiritual explanations of environmental phenomena in addition to biophysical ones (Scurrah 2013). Furthermore, the research paid attention to the roles of women as well as the economic, social, and cultural significance of natural resources in the local context (Jao Baan Research 2006), thus taking a holistic approach in understanding the complex relations between the social and biophysical worlds.

The hybridization and mobilization of local environmental knowledge (LEK) under Jao Baan Research were both political and strategic. Findings were submitted to key State and human rights agencies for comparison against the Environment Impact Assessment of the Mekong-Lancang Navigation Channel Improvement Project produced by a consultancy company

(Sretthachua 2006). Maps, such as in Figure 13, were also used to highlight local ecological knowledge and lay claims over the cultural significance of the Mekong ecosystems. Furthermore, concerns over the impacts of river development and ties established through conservation and research collaboration have created opportunities for the Rak Chiang Khong Conservation Group to rally local residents to object these river development projects. While many of the earlier Jao Baan villager researchers were no longer available for an interview, a number of villagers interviewed (at least 10 out of 27) admitted to attending or supporting these protests, including one in Figure 14.[17] Mae Tan, an elderly female resident of Hat Krai, mentioned the time she joined a demonstration group at the Government House to object the channel improvement project several years ago. Despite feeling that the influence of villagers remains limited, she continues to support these political initiatives in hope that voices from the ground can be used to negotiate with the Chinese state, for example, to modify dam operations and reduce downstream impacts.

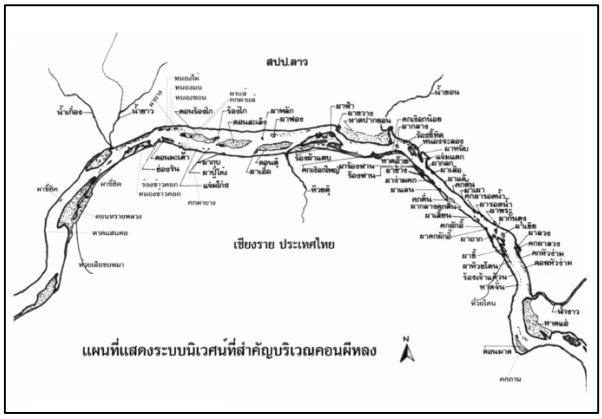


Figure 13. Ecosystem map of Kon Pi Long [Source: Jao Baan Research, 2004]

Figure 14. Protest against Mekong-Lancang Project [source: Transborder News, 28 April 2017]

Jao Baan Research has opened opportunities for local people to voice their concerns and access external support. Strong protests against the navigation channelization project have prompted Chinese project developer to organize several meetings and public hearing forums for Chiang Khong and Wiang Kaen riparian communities. For example, about 200 villagers attended a public hearing forum, held in September 2017, to share their local ecological knowledge and concerns

[17] Interview questions did not explicitly ask about the political involvement. This minimum number reflects those who verbally admitted to supporting the protests, but other respondents who did not mention it may have lent support as well.

over existing and potential impacts (Transborder News 2017). Several of these hearings have led to an open acknowledgement by Chinese authorities about transboundary impacts and concerns (Rujivanarom 2017). Furthermore, village leadership has shown to be vital in mobilizing local ecological knowledge in strategic and political ways: to have their concerns and demands listened to, and to access funding and support for local initiatives. Poh Luang Thong Suk, the village head of Huay Luk, explained how Jao Baan Research has been mobilized to benefit his village:

> *"We became aware and thought that we needed to study and collect data [about riverine changes and impacts]. Often it is at the level of village leaders, village committee members, who have [leadership] roles since they were young. We did many activities, from participating in conference meetings or hearings, to going to different provinces… I am part of a team and we would be the ones talking [in meetings]. There are 2-3 of us…Each of us only attended school until Grade Four, but we fought [with our knowledge and data] to convey the problems to other stakeholders. Those people all have a doctorate degree… We have listened to these experts and professors, and we contributed our realities [to the conversation] …I think this is how people see the significance of our struggles. Sometimes, we could also get support, like when we proposed for funding. It was a UN (United Nations) program, I think for buying a fertilizer making machine, and we were successful with that."*

The process of negotiation is still ongoing, with Mekong riparian communities and a network of environmental groups continuing to push for more involvement in research and decision making. The Thai Minister of Foreign Affairs, Don Pramudwinai, has indicated that Chinese authorities are considering other logistical alternatives and may terminate the Mekong Navigation Channel Improvement Project (Matichon Online 2019), but a more recent meeting of the Joint Committee on Coordination of Commercial Navigation (JCCCN) has suggested that the project is still in progress (Transborder News 2019). It may not be possible to determine the extent to which Jao Baan Research and the mobilization of local ecological knowledge would influence decision-making, but these efforts have already created new spaces for negotiation and collaboration.

8. Discussion

8.1 Local Ecological Knowledge and the Struggle for Personal Agency

A close examination of the multi-scalar nature of response processes, from the individual to the collective level, has shown how the hybridization and mobilization of local environmental knowledge (LEK) contribute to the agency to cope with, adapt to, take advantage of, as well as resist against, the ongoing transformation of the Mekong River and its ecosystems. Sections 7.1.1 through 7.1.3 highlight individual responses to riverine changes based on human expertise and knowledge of social-ecological practices. Applying Lister's agency typology, these responses contain some elements of 'getting by,' which is also synonymous with the act of coping to survive in adverse circumstances (Lister 2004, 133). Having roots in the psychological sciences, coping refers to the more immediate and reactive response made autonomously by impacted individuals or groups (Reser and Swim 2011; Alemayehu and Bewket 2017). At the same time, coping or 'getting by' is not entirely passive as existing resources and know-hows must be mobilized to manage hardships.

Resource users also adjust their behavior and enhance their capacities to deal with the transformed environment in the longer term. These strategies more closely reflect the process of adaptation, which stresses the notion of long-term livelihood security (Deb and Haque 2017)—one which Lister's typology fails to adequately represent. Here, adaptation is seen a deliberate and conscious process that emerges from the responses to a complex assemblage of more than ecological changes, but also the underlying socio-economic conditions and other stimuli (e.g., science, policy) (Head 2010). This adaptation process also involves the blending of local ecological knowledge (LEK), inherited and/or gained through direct experience, with other forms of knowledge (e.g., technological knowledge emerged externally, or social knowledge about gaining trust and building social capital), to enhance one's capacities, competence, or skills in dealing with the complex assemblage of anthropogenic environmental changes. Such blending may occur through the exercise of social resourcefulness to access new information (beyond direct observation), or of technical resourcefulness to adjust or adopt new techniques or tools (e.g., three-layered gillnets) to secure a livelihood. In this sense, such form of agency can be referred to as 'getting better at' rather than simply 'getting by.' These findings are consistent with studies on the

role of local knowledge and 'autonomous' (i.e., unplanned) responses to climate change, which highlight resource users/producers' innovativeness in adapting to changeable and marginal environments (Naess 2013).

LEK-informed adaptive strategies, however, do not necessarily lead to normatively better outcomes at the broader social-ecological level. Aside from the use of illegal or destructive gear, the decision to adapt and continue practicing river-based livelihoods in the context of declining aquatic resources would increase competition with other resource users and may put further pressure on the degraded ecosystems. Such action can be reinterpreted as 'maladaptive' as the benefits of river-based livelihoods are accrued to some (who are more socially/technically resourceful) at the expense of the others (Barnett and O'Neill 2010). The conceptual separation between adaptive and maladaptive response is not as straightforward as one may think as it is contingent on the spatial and temporal scales and how a successful outcome is defined (e.g., Jacobson et al. 2019; Work et al. 2018). However, it is beyond the scope of this study to determine the extent to which river-based livelihoods themselves contribute to resource declines, and thus whether their autonomous responses are adaptive or maladaptive is open to question.

The shift away from river-based livelihoods, as described in Section 7.1.4, further reflects an adaptive strategy, and is marked by the 'getting out' form of agency. In addition to environmental changes, other complex and multi-faceted dynamics motivate this shift. These include the expansion of market-based mode of production and consumption, which enlists more people to participate in the market through wage labor, and the rise of western formal education system (Aswani, Lemahieu, and Sauer 2018). While these processes have often been linked to the devaluation and erosion of indigenous and local ecological knowledge (Reyes-García et al. 2005; Reyes-García et al. 2007; Voeks and Leony 2004; Godoy et al. 2005), local integration into the market economy does not always undermine local ecological knowledge system (Kodirekkala 2015). Seeing any forms of knowledge as "dynamic, hybrid, and heterogeneous" (Harrison, Rybråten, and Aas 2018) helps to unveil how some pieces of LEK may disappear under market integration as they lose their practicality or no longer fit within the hybrid worldview (e.g., certain animist elements). Other parts of it, however, may become hybridized to create new knowledge (Gómez-Baggethun, Corbera, and Reyes-García 2013). Economic activities themselves may also spur interest in LEK learning and acquisition (Guest 2002). Indeed, the shift from subsistence to recreational fishing can contribute to the co-production of the knowledge about local ecology, the

use and access of aquatic resources, and the meaning of resource-related places and practices. Furthermore, Gómez-Baggethun and Reyes-García (2013, 646) argue that the emphasis should not be on the preservation of a specific unit of knowledge, but rather on "the ability to generate, transform, transmit, and apply knowledge" as this capacity or agency "enables actions and adjustments in response to current and future changes." In the context of the Mekong River, the strategy to move away from river-based livelihood practices entirely, such as to find better economic activities in the cities, would likely result in a decline in LEK retention and transmission. More importantly, it may undermine the collective agency to use place-based strategies to contend with anthropogenic riverine changes. Such concern is frequently expressed by elderly villagers and village leaders:

> *"Younger people don't really stay home [in the village]. As they grow up, they go study elsewhere. They don't really have ties [to the river]. Part of it is because they can't enter the Mekong to play or do things like before… now the Mekong is scary, so they don't know how to conserve it. They don't know the value of the river. The world has changed, and our lives have changed. People only use tap water [which is from the river] and they don't know its value, where the Mekong originates, how it flows, when the season comes… oh! I feel pity for the fishing grounds. [The younger generation] don't care about it anymore."*
> *— Mae Nam, female, Hat Krai*

The ambivalent ways in which human agency works is further demonstrated by the response to organize as a collective (Section 7.2.1). This strategy reflects the agency of 'getting better at' through 'getting organized' as it relies on collective action to access external resources and to engage in river-based livelihood practices more effectively. According to Ireland and Thomalla (2011), collective action contributes to the building and strengthening of networks that serve as communication channels for new knowledge production, the improvement of the economic resources of members in the collective, the creation of space to discuss and solve problems collectively, and the empowerment of the local people to request for government funding or services. The case of the Kai Production Local Enterprise Collective particularly highlights how social networks have enhanced local ecological knowledge and adaptive capacity. The networks created through the collective helped to attract important resources needed to adapt to the shortened

window of harvest as well as to improve market competitiveness (e.g., processing machines, marketing of nutritional values). However, as shared interest and values play an important role in enabling collective action (Rauschmayer et al. 2018; Meinzen-Dick, Di Gregorio, and McCarthy 2004), the limitation of the group, made up only of elderly female villagers, to recruit new members means that its long-term viability is under question. This collective response, thus, appears to lack the agency to adapt to the transformed Mekong conditions in the longer term.

8.2 Local Ecological Knowledge and the Exercise of Political Agency

In contrast, fish conservation activities and the Jao Baan Research (Section 7.2.2 and 7.2.3) have a strategic and political emphasis that reflects a nested agency of 'getting organized' at the village level and 'getting involved' in the broader environmental movement. While new networks may provide resource users with access to technical and financial support, these responses do not rely on direct livelihood benefits, but rather on reworking the top-down decision-making process of transboundary river management into a more inclusive one. Toward this effort, local ecological knowledge become interwoven with locally rooted ethnic identities to create a political space for local empowerment and resistance against anthropogenic riverine changes. These place-based strategies enact a politics from below, which are also "implicated in networks and relationships that stretch beyond the local" (Rigg 2007, 175).

This resonates with Escobar's (2001) triple localizing strategy aiming at defending local cultures and ecologies. Firstly, these response strategies operate with a place-based emphasis on local models of nature and cultural practices. Secondly, they draw on trans-local strategy to actively and creatively engage with other movements (e.g., environmental, human rights) (Escobar 2001). However, instead of focusing on the linkages of identity, territory, and culture as Escobar theorizes, the conservation zones and Jao Baan Research more explicitly link issues of knowledge, ecology, and culture to mobilize resistance across the local, regional, national and transnational levels. Place-based activities of conservation and research indeed contribute to a larger political movement, which among others include lawsuits against Mekong hydropower construction by the Thai People's Network in Eight Mekong Provinces,' and a complaint with the Finnish government filed by 15 civil society groups from seven countries against hydropower developer's alleged violations of responsible business standards and the OECD's guidelines on sustainable development, environmental protection, and human rights (Hensengerth 2015). Furthermore,

through engaging in conservation initiatives and other political activities, the villagers could be seen as participating in the process of 'scale jumping,' whereby alliances are created to escape the repressive scale fixes (i.e., the local) and to allow political claims made at one geographical level to expand to another (Smith 2000, 1993; Swyngedouw 2000). Social-ecological problems experienced by local residents of Chiang Khong and Wiang Kaen are nothing but local in the context of transboundary river development, and they are using their political networks to elevate their problems and demands to the regional and international levels.

8.3 Important Considerations in Local Ecological Knowledge Mobilization

The mobilization of local ecological knowledge (LEK) across the individual and collective levels has contributed to various forms of agency in responding to the complex milieus of the Mekong River transformation. However, there are a few important considerations worth noting. The first corresponds to how the *personal* (i.e., livelihood focused) and the *political* (i.e., power structure focused) dimensions of agency relate and perform empirically. These dimensions are theoretically co-constituting; to engage in political actions requires a sense of personal agency that one can act, but acting politically can also enhance the capacity to act at the personal/livelihood level (Lister 2004). Findings based on the case study, nevertheless, suggest that this co-constitution is rather limited. While many resource users, who are 'getting by' or 'getting better at' by mobilizing their own local knowledge and other resources, have shown support for conservation strategies and political protests, village leadership plays a much bigger role in implementing conservation activities, seeking external support, and volunteering and enlisting others to partake in political action. This reflects the paradox of empowerment—a basic contradiction that empowerment is supposed to a be bottom-up process created through the exercise of agency, but in practice, it takes place through interventions (e.g., from the Rak Chiang Khong Group), which carry their own objectives and interests (Wilson 2008, 86). At the same time, the strategic and political activities surrounding conservation, particularly in Pak Ing Tai village, have provided little benefits toward local fishers' livelihoods beyond access to local government funding and technical support, thus their contributions to personal agency is limited at best.

The use of LEK as a political tool such as through Jao Baan Research has tendencies to romanticize what resource users know and how they relate to their ecologies. While the production

of experts or 'villager researchers' capable of contributing to environmental management and decision making can be empowering, it downplays how resource users do not necessarily act as stewards of the environment and may also contribute to local environmental problems. For example, Jao Baan Research (2004) selectively describes the diversity of 'traditional' fishing gear, leaving out the widespread use of electrofishing and dynamiting, which are currently deemed illegal. Given the dynamism and hybridity of LEK and how it can incorporate new knowledge and technology originated beyond the local, those illegal gear are as 'traditional' as others that have been developed and adopted from elsewhere. Furthermore, LEK projects can limit the agency of minority groups within the community as existing local power imbalances are reproduced through the emphasis on traditions and stereotyped subsistence livelihoods. The issue of gender is a prominent one. As river-based livelihood practices are highly gendered, villager researchers in Jao Baan Research in Chiang Khong and Wiang Kaen were mostly men (Jao Baan Research 2004, 2006), whose participation and input shape certain understanding about Mekong livelihoods and local interests and desires. While attempts have been made to include women's perspectives in later iterations of Tai Baan Research (e.g., women's network in the Ing River Basin), there remains challenges in an attempt to advance a political project that can capture the messiness of a social reality. As the process of producing experts shape identity and knowledge (Lamb 2018), those engaged in it, particularly under the call for empowerment, necessarily reflect on what LEK mobilization both expose and hide, and to whose benefit, and whose expense.

8.4 Human-River Relationship Transformed?

As the Mekong River goes through rapid transformation from large-scale development projects, its relations to local residents of Chiang Khong and Wiang Kaen have also been reshaped. This is not to suggest that anthropogenic environmental change is the only source of livelihood shifts; socioeconomic dynamics, including urbanization, market integration, expansion of irrigated agriculture have all contributed to livelihood transitions in many places (Bouahom, Douangsavanh, and Rigg 2004; Scoones 2009). However, impacts from riverine changes appear to have sped up the process of shifting away from river-based livelihoods, as seen by the loss of access to riverbank gardening or the re-prioritization of livelihood efforts toward land-based activities. Such shift, especially in the younger generation has been linked to a sense of disconnect and the process of being physically (and potentially emotionally) distanced from the Mekong River. While this

empirical finding is limited by the study's methodology, it can be partially explained by the concept of place attachment, which suggests that people develop bonds with places that are meaningful to them (Scannell and Gifford 2010). The level of engagements in river-based activities thus play an important role in developing place attachment. The process of detachment, or indifference towards nature and nonhuman entities (Muradian and Pascual 2018), may on the other hand result from the low, or the lack of, place attachment.

By contrast, the expression of place attachment, as shown in a reference to the Mekong River as a 'lifeblood' (Section 5.5), suggests an enduring relationship in the face of riverine transformations. Those who have developed a deeper bond with the Mekong River and river-based livelihoods, thus, use LEK to cope with and adapt to riverine changes. Their strategies, in effect, reflect an attempt to resist against the process of detachment, from a place that bears significant social and cultural meanings to them. Previous research on the link between place attachment and oppositional responses (Vorkinn and Riese 2001; Devine-Wright and Howes 2010) also help to explain why political responses against large-scale river development, as found in this study, take place.

The use of LEK to drive political struggles also links to the fostering of a specific form of human-river relationship. While local resource users are not necessarily stewards of the river, the establishment of fish conservation zones and the socially instituted norms around conservation have likely reinforced that sense of stewardship in the resource users themselves, despite that their initial objectives may have been influenced by strategic and political reasons. Nevertheless, how local resource users relate to the river and its resources is highly complex. This study has characterized such relations primarily from the perspective of socioeconomic or livelihood activities, and to a more limited extent, their associated customs and cultural norms. It is thus limited in its conceptual framework and methodology to uncover the complexities of identity, subjectivity, and values that also frame human-nature relations. However, the findings suggest that many local resource users are actively resisting the reconfiguration of human-river relationship as they are responding to riverine transformations, particularly the decline in the Mekong's capacity to support aquatic life and human livelihoods.

9. Conclusions

Electricity-generating dams and riverine trading routes are transforming the Mekong River into an engine of poverty alleviation and economic development. These benefits are, however, complicated by the impacts on riparian communities, aquatic species, and others that depend on riverine ecosystems (World Commission on Dams 2000). In seeking to understand the multi-levelled interconnectedness of social-ecological processes as well as local villagers' multidimensional responses to riverine changes, this study investigates the usage and mobilization of local ecological knowledge (LEK) to mediate the reconfiguration of human-river relationship. The following subsections offer concluding points for this research, by summarizing research findings and providing critical reflections on research methodology. Finally, the chapter concludes with suggestions for future research.

9.1 Summary of Findings

How do impacted groups relate to the Mekong River and its ecosystems?

Many riparian villagers of Chiang Khong and Wian Kaen depend on the Mekong River as a source of livelihood. Key river-based livelihood activities include subsistence fishing, aquaculture, foraging of aquatic resources, and riverbank gardening. These practices are structured by systems of resource management as well as social and cultural norms that shape the dynamic human-river relationship. Gender roles, for example, limit women's participation in river-based practices to those that do not require the use of a boat and large gear. At the same time, they are more involved in related activities—processing aquatic products and selling them in local markets. Beyond a source of livelihood, the Mekong River bears unique social and cultural significance as a place that shapes social bonds within the community and contributes to individual empowerment. Everyday livelihood practices have also engendered personal ties, or the sense of attachment, to the Mekong. To some, the river represents a lifeblood that sustains local livelihood and economy and underpins their physical, social, and cultural existence. Recognizing the significance of the Mekong River, Thai-Lao communities continue to practice the *Lay Hua Fai* or fire boat festival to pay respect to the river spirit and ask for forgiveness of any wrongdoings. Nevertheless, these

strong ties are contrasted by the perception that younger generations of people are disconnected from the Mekong as river use changes and is increasingly mediated by urban infrastructures.

How are riverine changes perceived, experienced, and distributed along the axes of gender and livelihood-related uses of the river?

Local resource users have demonstrated their complex understanding of the Mekong River ecologies and the political, social, and economic dynamics surrounding anthropogenic environmental change. Large-scale development projects have been cited as a primary source of riverine transformations, leading to the decline of fish and other aquatic resources as well as greater economic burden and worsened well-being. They also prompted riverbank reinforcement projects, which further limited the livelihood options of landless villagers and the elderly engaging in riverbank gardening and fishing. While both men and women share similar understandings on riverine transformations and endure income losses, their gendered practices result in different specific experiences of impacts. Fishers, who are mostly men, bear greater economic risks as they spend more time and money in fuel costs in hope of catching the highly priced Mekong fish. On the other hand, women face unique challenges as they have less access, ownership, and control over assets or tools to make a livelihood. Limited to working along the river bank or in shallow waters, they experience greater difficulty in riverweed harvesting and fishing with small gear as the river rises and falls at unpredictable times. In addition to livelihood and economic impacts, riverine transformations and resource declines have broad implications on different aspects of well-being, including mental health, family relationships, food access, and cultural transmission. They have ultimately led to more negative views toward the once-familiar Mekong and reinforces the process of disconnectedness between riparian communities and their majestic river.

How is LEK employed and mobilized to respond to riverine changes? To what objective(s)?

Despite their worsened well-being and increased economic risks associated with river-based livelihood practices, local resource users have devised a broad set of responses to sustain their local livelihoods as well as to contest against top-down development, deemed as the primary contributor of Mekong River transformation. This study particularly highlights local ecological knowledge (LEK) as a source of agency and potential empowerment for local resource users, who have been marginalized by the process of development. The process of LEK hybridization

underpins diverse strategies to cope and adapt to environmental change, including an adjustment to the new environmental reality, risk assessments, diversification and re-prioritization of their activities, the use of social networks to obtain resource access, and the coordination of efforts to access external support. These strategies reflect the personal agency (i.e., 'getting by,' 'getting better at,' and 'getting organized') to secure one's livelihoods and mitigate the impacts from Mekong River transformation. However, LEK-informed activities do not always lead to sustainable, socially-just, nor normatively better outcomes (Murdoch and Clark 1994; Hauck and Koessler (2004), cited in Antweiler 2012). Autonomous strategies, for example, can be maladaptive at the broader social-ecological level if they contribute to further resource depletion.

Given the risks and impacts of riverine changes on well-being, not all resource users choose to continue participating in river-based livelihood activities. The circumstances surrounding this 'getting out' form of agency, however, have different implications on the use, maintenance, and transmission of LEK. The shift of reliance in river-based livelihood activity, from a subsistence to recreational one, contrasts with the complete shift from river-based activity. The latter would likely result in LEK devaluation and erosion as pointed out by village elders, thus undermining the agency to contend with anthropogenic environmental change through LEK mobilization.

LEK also contributes to the exercise of political agency through place-based strategies of conservation and the Jao Baan Research. Local resource users fortify their capacity to manage fishery resources through 'getting organized' at the village level, as well as by 'getting involved' in the broader environmental movement. Under Jao Baan Research, the demonstration of local geophysical features, biological resources, and local livelihoods in written texts and maps enable the tacit ecological knowledge of local people to 'perform' beyond its everyday meanings and uses (Barron et al. 2015). LEK thus transforms into a political tool, mobilized by a multi-scale network of resource users, NGOs, and others to negotiate the direction of river basin management.

How does local ecological knowledge (LEK) mediate the reconfiguration of human-river relationship in the context of anthropogenic riverine transformations?

All in all, what this thesis has achieved is in combining social and political considerations of responses to environmental change to offer a nuanced understanding of LEK and its linkages with human agency. Practical applications of LEK to secure local livelihoods can be viewed as resistance against new arrangements of human-river relationship, whereby riparian communities

become detached from their riverine resource base. While the process of detachment, or indifference towards nature and nonhuman entities (Muradian and Pascual 2018), might already be occurring under the current technological and urbanization trends (Atran and Medin 2014, 333), resource declines and the loss of resource access appear to have accelerated this process. Beyond the practical aspects, the political use of LEK highlights the struggles to contest the power imbalances in river management decision-making, and to reshape human-river relations as one of stewardship. In doing so, it also risks simplifying or romanticizing how local resource users relate to the river.

9.2 Critical Reflections on Research Methodology

The research objectives and questions were developed out of an empirical curiosity about social-ecological changes from large-scale development projects and the implications of responses to those changes. By situating local ecological knowledge (LEK) at the core and complementing it with the concept of agency, the conceptual framework facilitates new understandings of responses to anthropogenic environmental change beyond the frames of resilience thinking and takes into consideration the political and socioeconomic dynamics that are also at play. It highlights the knowledge-practice-belief complex that results from intimate interactions between humans and their environments. Accordingly, river-based livelihood strategies come to the fore as the basis of interactions that foster knowledge development and transmission. This emphasis is useful for demonstrating local people's struggles and capabilities to address impacts in their own ways according to their own wishes and limitations. It however downplays other groups of people who are not engaged in food production practices, but are still impacted by river development projects such as boat operators or others who consume products from the Mekong. The framework is also limited in problematizing human-river relationship and probing into the agency of the non-human world, which facilitates a deeper examination of how human-nature relations are co-constituted.

Regarding data collection methods, the use of mixed methods, qualitative approach encompassing participant observation, semi-structured interviews, and document research has been extremely beneficial in extending the scope of collected data, ensuring validity and reliability, and enriching findings. Differences in interview responses, for example regarding fishing seasonality, were checked with available documents to confirm the general trustworthiness of information. The combination of sampling methods was also helpful in broadening the range of

responses and in extending on certain social networks, but as I was also developing my research during fieldwork, I had conducted more interviews than needed and more time could have been spent on participant observation or examining documents.

Additionally, my positionality and the media attention on Mekong River development have influenced the data collection process, resulting in different advantages and disadvantages. My position as a master's student from Switzerland was perceived favorably and helped establish field relations. Some respondents shared that they were willing to speak with me to "help" with my studies and research. However, my field sites, as recommended by the Rak Chiang Khong Group upon my initial arrival to the field, have already attracted quite a lot of media and research attention and some of my respondents' expectations and answers were likely influenced by journalists or other researchers. My previous experience in both conducting and participating in quantitative empirical research has also led to some level of uneasiness when I conducted my interviews. In those quantitative research settings, participants would receive financial compensation for their time and input, but these monetary incentives can be controversial and problematic in qualitative research. Despite the decision to not offer financial compensation (as it would complicate my relations to the respondents), I still felt obligated to reciprocate for their assistance and time. My response to this uneasiness was to offer in-kind benefits (e.g., fruits and soda or juice drinks) in some cases and to be careful with the interview time. In a few cases, I may have been too early to wrap up an interview and not probe enough, thus affecting the quality of the data collected. This is also coupled with other challenges of conducting interviews, such as finding an appropriate time and place (often done at the respondents' home or the fish quay) and balancing targeted and open-ended questions.

Using qualitative content analysis (QCA) to guide coding and interpretations proved to be very useful as it facilitated an extraction of specific structures from the materials, particularly in identifying different dimensions and forms of agencies and the different layers of LEK. The approach was sufficiently flexible and helped in identifying themes or patterns that my conceptual framework and hence my interview questions did not adequately cover, such as meanings of the river and personal ties or disconnectedness. It remains possible that I had misunderstood or misinterpreted some of my collected data. To limit misrepresentations, I used edited transcripts rather than paraphrases to back up my interpretations. However, this choice likely affected the communicative effectiveness of the message being conveyed.

The quality of qualitative research cannot be assessed simply by applying classical criteria of objectivity, reliability, and validity (Steinke 2004). Throughout this research, I have applied what Patton (2002) proposed as the social construction and constructivist criteria for improving the quality and credibility of qualitative research, including acknowledging my positionality and subjectivity, triangulation of sources, and addressing the trustworthiness through careful checking and reflections, being transparent about the methods applied, and following systematic analytical techniques. I also acknowledge that the quality of this thesis could be further enhanced by discussing my findings more with others (e.g., peer debriefing) and actively seeking negative cases to find alternate explanations.

9.3 Future Research Directions

As this master's thesis relies on a holistic approach to capture the complex relationships between LEK usage and agency in the context of riverine transformation, future research that examines the dynamics of LEK transmission and retention, and how it relates to the agency to defend local environmental resources, would be worthwhile. Due to concerns that the younger generation would be indifferent toward Mekong River transformations, some efforts have already been taken to integrate local history and LEK learning into formal education (Thairath 2016). Correspondingly, future research might investigate how institutionalized LEK learning contributes to the production of new subjectivities and influence decisions to engage in political struggles against large-scale development. As institutionalized learning greatly differs from its informal counterpart, the research could also examine the challenges and possibilities of enhancing LEK adoption by young local people.

Additionally, a more policy-oriented research, that engages researchers, impacted communities, and governmental actors, could be a constructive one (Thornton and Scheer 2012), particularly to establish appropriate mitigation measures and to avoid interventions that undermine local livelihoods. Studies of LEK have already spurred a number of collaborative efforts to improve the understanding and management of the ecosystem (e.g., Turvey et al. 2014; Bender et al. 2014). Future research could, for example, incorporate LEK to enhance the design of riverbank reinforcement projects or develop conservation approaches beyond fish conservation zones. Caution must, however, be taken to prevent the co-option of LEK and local struggles to extend

certain claims (e.g., Forsyth 2003; Briggs 2013), or serve certain political objectives (e.g., Chalmers and Fabricius 2007; Nadasdy 1999).

References

Adamson, P.T. 2009. "An Assessment of the Hydrology at Proposed Dam Sites on the Mainstream of the Mekong Upstream of Vientiane." Report for the Ministry of Energy & Mines, Department of Electricity, Laos.

Agrawal, Arun. 1995. "Dismantling the Divide Between Indigenous and Scientific Knowledge." *Development and Change* 26 (3): 413–39. https://doi.org/10.1111/j.1467-7660.1995.tb00560.x.

Ahearn, Laura M. 2001. "Language and Agency." *Annual Review of Anthropology* 30 (1): 109–37. https://doi.org/10.1146/annurev.anthro.30.1.109.

Alemayehu, Arragaw, and Woldeamlak Bewket. 2017. "Smallholder Farmers' Coping and Adaptation Strategies to Climate Change and Variability in the Central Highlands of Ethiopia." *Local Environment* 22 (7): 825–39. https://doi.org/10.1080/13549839.2017.1290058.

Antweiler, Christoph. 1998. "Local Knowledge and Local Knowing. An Anthropological Analysis of Contested 'Cultural Products' in the Context of Development." *Anthropos* 93 (4/6): 469–94.

———. 2012. "Urban environmental knowledge and citizens' science." In *Environmental Uncertainty and Local Knowledge: Southeast Asia as a Laboratory of Global Ecological Change*, edited by Christoph Antweiler and Anna-Katharina Hornidge, 55–91. Wetzlar, Germany: Majuskel Medienproduktion GmbH. http://public.eblib.com/choice/publicfullrecord.aspx.

Aswani, Shankar, Anne Lemahieu, and Warwick H. H. Sauer. 2018. "Global Trends of Local Ecological Knowledge and Future Implications." Edited by Andrés Viña. *PLOS ONE* 13 (4): e0195440. https://doi.org/10.1371/journal.pone.0195440.

Atran, Scott, and Douglas L Medin. 2014. *Native Mind and the Cultural Construction of Nature*. Cambridge: MIT Press.

Baird, Ian G. 2006. "Probarbus Jullieni AndProbarbus Labeamajor: The Management and Conservation of Two of the Largest Fish Species in the Mekong River in Southern Laos." *Aquatic Conservation: Marine and Freshwater Ecosystems* 16 (5): 517–32. https://doi.org/10.1002/aqc.763.

Baran, Eric, and Ian G. Baird. 2003. "Approaches and Tools for Sustainable Management of Fish Resources in the Mekong River Basin." In *Biodiversity Management and Sustainable Development*, edited by M. Cao, K. Woods, H. Hu, and L. Li, 78–87. Kunming, China: China Forestry Publishing House. http://ifredi-cambodia.org/wp-content/uploads/2004/01/Baran%20Baird%202003%20%20Mekong%20fisheries%20tools.pdf.

Baran, Eric, Groupe consultatif pour la recherche agricole internationale, Research program on water, land, and ecosystems, Eric Guerin, Joshua Nasielski, and Worldfish Center. 2015. *Fish, Sediment, and Dams in the Mekong*. Penang, Malaysia: WorldFish: CGIAR Research program on water, land and ecosystems.

Baran, Eric, Teemu Jantunen, Chiew Kieok Chong, A.E. Neiland, and C. Béné. 2008. "Values of Inland Fisheries in the Mekong River Basin." In *Tropical River Fisheries Valuation: Background Papers to a Global Synthesis*, 227–89. The WorldFish Center Studies and Reviews 1836. Penang, Malaysia: The WorldFish Center. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.549.4136&rep=rep1&type=pdf.

Baran, Eric, and Chris Myschowoda. 2008. "Have Fish Catches Been Declining in the Mekong River Basin?" In *Modern Myths of the Mekong: A Critical Review of Water and Development Concepts, Principles and Policies*, edited by Matti Kummu, Marko Keskinen, and Olli Varis,

55–64. Helsinki: Helsinki University of Technology. Water and Development Research Group.

Barlow, Chris, Eric Baran, Ashley S. Halls, and Mrigesh Kshatriya. 2008. "How Much of the Mekong Fish Catch Is at Risk from Mainstream Dam Development?" *Catch and Culture* 14 (3): 16–21.

Barnett, Jon, and Saffron O'Neill. 2010. "Maladaptation." *Global Environmental Change* 20 (2): 211–13. https://doi.org/10.1016/j.gloenvcha.2009.11.004.

Barron, Elizabeth S., Chris Sthultz, Dale Hurley, and Anne Pringle. 2015. "Names Matter: Interdisciplinary Research on Taxonomy and Nomenclature for Ecosystem Management." *Progress in Physical Geography: Earth and Environment* 39 (5): 640–60. https://doi.org/10.1177/0309133315589706.

Baxter, Jamie. 2016. "Case Studies in Qualitative Research." In *Qualitative Research Methods in Human Geography*, edited by Iain Hay, Fourth edition, 130–46. Don Mills, Ontario: Oxford University Press.

Beilfuss, R., and T. Triet. 2014. "A Scoping Study on Climate Change and Hydropower in the Mekong River Basin: A Synthesis of Research." Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. https://www.giz.de/en/downloads/giz2014-en-study-climate-change-hydropower-mekong.pdf.

Bender, Mariana G., Gustavo R. Machado, Paulo José de Azevedo Silva, Sergio R. Floeter, Cassiano Monteiro-Netto, Osmar J. Luiz, and Carlos E. L. Ferreira. 2014. "Local Ecological Knowledge and Scientific Data Reveal Overexploitation by Multigear Artisanal Fisheries in the Southwestern Atlantic." Edited by Konstantinos I. Stergiou. *PLoS ONE* 9 (10): e110332. https://doi.org/10.1371/journal.pone.0110332.

Berkes, Fikret. 1988. "Environmental Philosophy of the Chisasibi Cree People of James Bay." In *Traditional Knowledge and Renewable Resource Management in Northern Regions*, edited by M.M.R. Freeman and L.N. Carbyn, 7–21. Occasional Publication 23. Edmonton, Canada: Boreal Institute for Northern Studies.

———. 2018. *Sacred Ecology*. 4th ed. New York: Routledge. http://ebookcentral.proquest.com/lib/ualberta/detail.action?docID=5015644.

Berkes, Fikret, Johan Colding, and Carl Folke. 2000. "Rediscovery of Traditional Ecological Knowledge as Adaptive Management." *Ecological Applications* 10 (5): 1251–62. https://doi.org/10.1890/1051-0761(2000)010[1251:ROTEKA]2.0.CO;2.

Berkes, Fikret, and Dyanna Jolly. 2001. "Adapting to Climate Change: Social-Ecological Resilience in a Canadian Western Arctic Community." *Conservation Ecology* 5 (2): 18 [online].

Binkley, Marian. 2000. "'Getting by' in Tough Times." *Women's Studies International Forum* 23 (3): 323–32. https://doi.org/10.1016/S0277-5395(00)00090-X.

Blanco, Julien, and Stéphanie M. Carrière. 2016. "Sharing Local Ecological Knowledge as a Human Adaptation Strategy to Arid Environments: Evidence from an Ethnobotany Survey in Morocco." *Journal of Arid Environments* 127 (April): 30–43. https://doi.org/10.1016/j.jaridenv.2015.10.021.

Board, Jack, and Prichayada Promchertchoo. 2016. "Power Struggle: Damming the Mekong." *Channel NewsAsia*, November 2016. https://www.channelnewsasia.com/news/damming-the-mekong.

Bouahom, Bounthong, Linkham Douangsavanh, and Jonathan Rigg. 2004. "Building Sustainable Livelihoods in Laos: Untangling Farm from Non-Farm, Progress from Distress." *Geoforum* 35 (5): 607–19. https://doi.org/10.1016/j.geoforum.2004.02.002.

Bourdieu, Pierre. 1977. *Outline of a Theory of Practice*. 25. printing. Cambridge Studies in Social and Cultural Anthropology 16. Cambridge: Cambridge Univ. Press.

https://monoskop.org/images/7/71/Pierre_Bourdieu_Outline_of_a_Theory_of_Practice_Cambridge_Studies_in_Social_and_Cultural_Anthropology_1977.pdf.
Bowen, Glenn A. 2009. "Document Analysis as a Qualitative Research Method." *Qualitative Research Journal* 9 (2): 27–40. https://doi.org/10.3316/QRJ0902027.
Briggs, John. 2013. "Indigenous Knowledge: A False Dawn for Development Theory and Practice?" *Progress in Development Studies* 13 (3): 231–43. https://doi.org/10.1177/1464993413486549.
Browne, Kath. 2005. "Snowball Sampling: Using Social Networks to Research Non-heterosexual Women." *International Journal of Social Research Methodology* 8 (1): 47–60. https://doi.org/10.1080/1364557032000081663.
Canvin, Krysia, Anneli Marttila, Bo Burstrom, and Margaret Whitehead. 2009. "Tales of the Unexpected? Hidden Resilience in Poor Households in Britain." *Social Science & Medicine* 69 (2): 238–45. https://doi.org/10.1016/j.socscimed.2009.05.009.
Carminati, Lara. 2018. "Generalizability in Qualitative Research: A Tale of Two Traditions." *Qualitative Health Research* 28 (13): 2094–2101. https://doi.org/10.1177/1049732318788379.
Chalmers, Nigel, and Christo Fabricius. 2007. "Expert and Generalist Local Knowledge about Land-Cover Change on South Africa's Wild Coast: Can Local Ecological Knowledge Add Value to Science?" *Ecology and Society* 12 (1): 10 [online].
Charoenmuang, Tanet. 2003. *คนเมือง [Khon Muang]*. Chiang Mai, Thailand: Department of Sociology, Chiang Mai University.
Cho, Ji Young, and Eun-Hee Lee. 2014. "Reducing Confusion about Grounded Theory and Qualitative Content Analysis: Similarities and Differences." *The Qualitative Report* 19 (32): 1–20.
Cook, Carly N., Grant Wardell-Johnson, R. W. Carter, and Marc Hockings. 2014. "How Accurate Is the Local Ecological Knowledge of Protected Area Practitioners?" *Ecology and Society* 19 (2). https://doi.org/10.5751/ES-06341-190232.
Cope, Meghan. 2010. "A History of Qualitative Research in Human Geography." In *The SAGE Handbok of Qualitative Research in Human Geography*, edited by Dydia Delyser, Stuart Aitken, Mike Crang, Steve Herbert, and Linda McDowell, 25–45. London: England: SAGE.
Cote, Muriel, and Andrea J. Nightingale. 2012. "Resilience Thinking Meets Social Theory: Situating Social Change in Socio-Ecological Systems (SES) Research." *Progress in Human Geography* 36 (4): 475–89. https://doi.org/10.1177/0309132511425708.
Coulthard, S. 2008. "Adapting to Environmental Change in Artisanal Fisheries—Insights from a South Indian Lagoon." *Global Environmental Change* 18 (3): 479–89. https://doi.org/10.1016/j.gloenvcha.2008.04.003.
Coulthard, Sarah. 2012. "Can We Be Both Resilient and Well, and What Choices Do People Have? Incorporating Agency into the Resilience Debate from a Fisheries Perspective." *Ecology and Society* 17 (1). https://doi.org/10.5751/ES-04483-170104.
Coulthard, Sarah, and Easkey Britton. 2015. "Waving or Drowning: An Exploration of Adaptive Strategies Amongst Fishing Households and Implications for Wellbeing Outcomes: An Exploration of Adaptation." *Sociologia Ruralis* 55 (3): 275–90. https://doi.org/10.1111/soru.12093.
Creswell, John W. 2013. *Qualitative Inquiry and Research Design: Choosing among Five Approaches*. 3rd ed. Los Angeles: SAGE Publications.
Darby, Stephen E., Julian Leyland, Matti Kummu, Timo A. Räsänen, and Hannu Lauri. 2013. "Decoding the Drivers of Bank Erosion on the Mekong River: The Roles of the Asian Monsoon, Tropical Storms, and Snowmelt: CLIMATE FLUCTUATIONS AND MEKONG

RIVER BANK EROSION." *Water Resources Research* 49 (4): 2146–63. https://doi.org/10.1002/wrcr.20205.
Davidson-Hunt, Iain, and Fikret Berkes. 2003. "Learning as You Journey: Anishinaabe Perception of Social-Ecological Environments and Adaptive Learning." *Conservation Biology* 8 (1): 5 [online].
Deb, Apurba Krishna, and C. Emdad Haque. 2017. "Multi-Dimensional Coping and Adaptation Strategies of Small-Scale Fishing Communities of Bangladesh to Climate Change Induced Stressors." *International Journal of Climate Change Strategies and Management* 9 (4): 446–68. https://doi.org/10.1108/IJCCSM-06-2016-0078.
Department of Provincial Administration. 2018. "Statistical Report of Population and Households (2018)." 2018. http://stat.bora.dopa.go.th/stat/statnew/statTDD/views/showProvinceData.php.
Devine-Wright, Patrick, and Yuko Howes. 2010. "Disruption to Place Attachment and the Protection of Restorative Environments: A Wind Energy Case Study." *Journal of Environmental Psychology* 30 (3): 271–80. https://doi.org/10.1016/j.jenvp.2010.01.008.
Dyck, Isabel. 2001. "Qualitative Methods in Geography." In *International Encyclopedia of the Social & Behavioral Sciences*, edited by Neil J. Smelser and Paul B. Baltes, 1st ed. Amsterdam ; New York: Elsevier.
Ellen, R. F., Peter Parkes, and Alan Bicker, eds. 2000. *Indigenous Environmental Knowledge and Its Transformations: Critical Anthropological Perspectives*. Studies in Environmental Anthropology, v. 5. Amsterdam: Harwood Academic.
Ellis, Frank. 2000. *Rural Livelihoods and Diversity in Developing Countries*. Oxford ; New York, NY: Oxford University Press.
Escobar, Arturo. 2001. "Culture Sits in Places: Reflections on Globalism and Subaltern Strategies of Localization." *Political Geography* 20 (2): 139–74. https://doi.org/10.1016/S0962-6298(00)00064-0.
Fabinyi, Michael, Louisa Evans, and Simon J. Foale. 2014. "Social-Ecological Systems, Social Diversity, and Power: Insights from Anthropology and Political Ecology." *Ecology and Society* 19 (4). https://doi.org/10.5751/ES-07029-190428.
Fawthrop, Tom. 2017. "Blasting the Mekong." *China Dialogue*, 2017. https://www.chinadialogue.net/article/show/single/en/9606-Blasting-the-Mekong.
Fernández-Llamazares, Álvaro, Isabel Díaz-Reviriego, Ana C. Luz, Mar Cabeza, Aili Pyhälä, and Victoria Reyes-García. 2015. "Rapid Ecosystem Change Challenges the Adaptive Capacity of Local Environmental Knowledge." *Global Environmental Change* 31 (March): 272–84. https://doi.org/10.1016/j.gloenvcha.2015.02.001.
FishBase. n.d. "Pangasianodon Gigas: Mekong Giant Catfish." https://www.fishbase.de/summary/6192.
Folke, Carl. 2006. "Resilience: The Emergence of a Perspective for Social–Ecological Systems Analyses." *Global Environmental Change* 16 (3): 253–67. https://doi.org/10.1016/j.gloenvcha.2006.04.002.
Forsyth, Tim. 2003. *Critical Political Ecology: The Politics of Environmental Science*. London ; New York: Routledge.
Frenken, Karen, ed. 2012. "Mekong River Basin." In *Irrigation in Southern and Eastern Asia in Figures: Aquastat Survey, 2011*, 143–58. FAO Water Reports 37. Rome: Food and Agriculture of the United Nations.
Friend, R.M., Robert Arthur, and Marko Keskinen. 2009. "Songs of the Doomed: The Continuing Neglect of Capture Fisheries in Hydropower Development in the Mekong." In *Contested Waterscapes in the Mekong Region: Hydropower, Livelihoods and Governance*, edited by François Molle, Tira Foran, and Mira Käkönen, 307–32. London: England: Earthscan.

Gausset, Quentin, Justin Kenrick, and Robert Gibb. 2011. “Indigeneity and Autochthony: A Couple of False Twins?: INDIGENEITY AND AUTOCHTHONY.” *Social Anthropology* 19 (2): 135–42. https://doi.org/10.1111/j.1469-8676.2011.00144.x.

Gentles, Stephen J., Cathy Charles, Jenny Ploeg, and K. Ann McKibbon. 2015. “Sampling in Qualitative Research: Insights from an Overview of the Methods Literature.” *The Qualitative Report* 20 (11): 1777–89.

Gentles, Stephen J., and Silvia L. Vilches. 2017. “Calling for a Shared Understanding of Sampling Terminology in Qualitative Research: Proposed Clarifications Derived From Critical Analysis of a Methods Overview by McCrae and Purssell.” *International Journal of Qualitative Methods* 16 (1): 160940691772567. https://doi.org/10.1177/1609406917725678.

Giddens, Anthony. 1979. *Central Problems in Social Theory: Action, Structure, and Contradiction in Social Analysis*. Berkeley: University of California Press.

———. 1986. *The Constitution of Society: Outline of the Theory of Structuration*. 1. paperback ed. Berkeley: Univ. of California Press.

Gilchrist, Grant, Mark Mallory, and Flemming Merkel. 2005. “Can Local Ecological Knowledge Contribute to Wildlife Management? Case Studies of Migratory Birds.” *Ecology and Society* 10 (1): 20 [online].

Glasenapp, Markus von, and Thomas F. Thornton. 2011. “Traditional Ecological Knowledge of Swiss Alpine Farmers and Their Resilience to Socioecological Change.” *Human Ecology* 39 (6): 769–81. https://doi.org/10.1007/s10745-011-9427-6.

Godoy, Ricardo, Victoria Reyes-García, Elizabeth Byron, William R. Leonard, and Vincent Vadez. 2005. “The Effect of Market Economies on the Well-Being of Indigeneous Peoples and on Their Use of Renewable Natural Resources.” *Annual Review of Anthropology* 34 (1): 121–38. https://doi.org/10.1146/annurev.anthro.34.081804.120412.

Gómez-Baggethun, Erik, Esteve Corbera, and Victoria Reyes-García. 2013. “Traditional Ecological Knowledge and Global Environmental Change: Research Findings and Policy Implications.” *Ecology and Society* 18 (4). https://doi.org/10.5751/ES-06288-180472.

Gómez-Baggethun, Erik, and Victoria Reyes-García. 2013. “Reinterpreting Change in Traditional Ecological Knowledge.” *Human Ecology* 41 (4): 643–47. https://doi.org/10.1007/s10745-013-9577-9.

Gómez-Baggethun, Erik, Victoria Reyes-García, Per Olsson, and Carlos Montes. 2012. “Traditional Ecological Knowledge and Community Resilience to Environmental Extremes: A Case Study in Doñana, SW Spain.” *Global Environmental Change* 22 (3): 640–50. https://doi.org/10.1016/j.gloenvcha.2012.02.005.

Goss, Frederick. 2006. “From Boundary to Border: A Case Study of the Making of the Southern Thai-Lao Border.” Coursework. Chulalongkorn University.

Guest, Greg. 2002. “Market Integration and the Distribution of Ecological Knowledge within an Ecuadorian Fishing Community.” *Journal of Ecological Anthropology* 6 (1): 38–49. https://doi.org/10.5038/2162-4593.6.1.3.

Gunderson, Lance H, and C. S Holling. 2012. *Panarchy: Understanding Transformations in Human and Natural Systems*. United States: Island Press : Made available through hoopla. https://www.hoopladigital.com/title/11456581.

Harrison, Hannah L., Stine Rybråten, and Øystein Aas. 2018. “Hatching Knowledge: A Case Study on the Hybridization of Local Ecological Knowledge and Scientific Knowledge in Small-Scale Atlantic Salmon (Salmo Salar) Cultivation in Norway.” *Human Ecology* 46 (4): 449–59. https://doi.org/10.1007/s10745-018-0001-3.

Head, Lesley. 2010. “Cultural Ecology: Adaptation - Retrofitting a Concept?” *Progress in Human Geography* 34 (2): 234–42. https://doi.org/10.1177/0309132509338978.

Hennink, Monique, Ndunge Kiiti, Mara Pillinger, and Ravi Jayakaran. 2012. "Defining Empowerment: Perspectives from International Development Organisations." *Development in Practice* 22 (2): 202–15. https://doi.org/10.1080/09614524.2012.640987.

Hensengerth, Oliver. 2015. "Where Is the Power? Transnational Networks, Authority and the Dispute over the Xayaburi Dam on the Lower Mekong Mainstream." *Water International* 40 (5–6): 911–28. https://doi.org/10.1080/02508060.2015.1088334.

Hilborn, R., J. M. Orensanz, and A. M. Parma. 2005. "Institutions, Incentives and the Future of Fisheries." *Philosophical Transactions of the Royal Society B: Biological Sciences* 360 (1453): 47–57. https://doi.org/10.1098/rstb.2004.1569.

Hirsch, Philip. 2011. "China and the Cascading Geopolitics of Lower Mekong Dams." *The Asia-Pacific Journal* 9 (20): 1–5.

Hogan, Zeb. 2013. "A Mekong Giant: Current Status, Threats, and Preliminary Conservation Measures for the Critically Endangered Mekong Giant Catfish." Reno, US: WWF. http://awsassets.panda.org/downloads/mgc_report_june2013.pdf.

Hopping, Kelly A., Ciren Yangzong, and Julia A. Klein. 2016. "Local Knowledge Production, Transmission, and the Importance of Village Leaders in a Network of Tibetan Pastoralists Coping with Environmental Change." *Ecology and Society* 21 (1). https://doi.org/10.5751/ES-08009-210125.

Hortle, K.G. 2009. "Fishes of the Mekong: How Many Species Are There?" *Catch and Culture* 15 (2): 4–12.

Houde, Nicolas. 2007. "The Six Faces of Traditional Ecological Knowledge: Challenges and Opportunities for Canadian Co-Management Arrangement." *Ecology and Society* 12 (2): 34 [online].

Hsieh, Hsiu-Fang, and Sarah E. Shannon. 2005. "Three Approaches to Qualitative Content Analysis." *Qualitative Health Research* 15 (9): 1277–88. https://doi.org/10.1177/1049732305276687.

Huntranee, Jutathip, Nonthpavit Sirichan, Narumon Ratanasuwan, and Lalida Pingkasun. 2015. "ถั่วงอกริมโขงจากคนเชียงของ [Riverbank mung bean sprouts from Chiang Khong locals]." *Ang Kaew*, 2015. http://www.imekong.org/2016/01/beansprout_chaingkhong/.

Ibert, Oliver. 2007. "Towards a Geography of Knowledge Creation: The Ambivalences between 'Knowledge as an Object' and 'Knowing in Practice.'" *Regional Studies* 41 (1): 103–14. https://doi.org/10.1080/00343400601120346.

Iniesta-Arandia, Irene, David García del Amo, Ana Paula García-Nieto, Concepción Piñeiro, Carlos Montes, and Berta Martín-López. 2015. "Factors Influencing Local Ecological Knowledge Maintenance in Mediterranean Watersheds: Insights for Environmental Policies." *AMBIO* 44 (4): 285–96. https://doi.org/10.1007/s13280-014-0556-1.

Ireland, Philip, and Frank Thomalla. 2011. "The Role of Collective Action in Enhancing Communities' Adaptive Capacity to Environmental Risk: An Exploration of Two Case Studies from Asia." *PLoS Currents* 3 (October): RRN1279. https://doi.org/10.1371/currents.RRN1279.

Jacobson, Chris, Stacy Crevello, Chanthan Chea, and Ben Jarihani. 2019. "When Is Migration a Maladaptive Response to Climate Change?" *Regional Environmental Change* 19 (1): 101–12. https://doi.org/10.1007/s10113-018-1387-6.

Jao Baan Research. 2004. *The Mekong River: River of Livelihoods and Culture*. Chiang Rai, Thailand: Southeast Asia Rivers Network (SEARIN).

———. 2006. *Local Knowledge of Mekong River Fish [ความรู้ท้องถิ่นเรื่องพันธุ์ปลาแม่น้ำโขง]*. Edited by Niwat Roykaew, Jirasak Intayot, Chainarong Sretthachua, Somkiat Kuenchiangsa, Sayan Kamnung,

Sumatr Pulayao, Pianporn Deetes, Chantra Jaikummee, and Anchalee Kaewwiset. Chiang Khong, Thailand: Living River Siam-SEARIN and Chiang Khong Conservation Group.
Johnsen, Jahn, Bjørn Hersoug, and Ann-Magnhild Solås. 2014. "The Creation of Coastal Space – How Local Ecological Knowledge Becomes Relevant." *Maritime Studies* 13 (1): 2. https://doi.org/10.1186/2212-9790-13-2.
Jorgensen, Danny L. 2015. "Participant Observation." In *Emerging Trends in the Social and Behavioral Sciences*, edited by Robert A Scott and Stephan M Kosslyn, 1–15. Hoboken, NJ, USA: John Wiley & Sons, Inc. https://doi.org/10.1002/9781118900772.etrds0247.
Kearns, Robin A. 2016. "Placing Observation in the Research Toolkit." In *Qualitative Research Methods in Human Geography*, edited by Iain Hay, Fourth edition, 313–33. Don Mills, Ontario: Oxford University Press.
Keay, John. 2005. "The Mekong Exploration Commission, 1866–68: Anglo-French Rivalry in South East Asia*." *Asian Affairs* 36 (3): 289–312. https://doi.org/10.1080/03068370500276266.
Keskinen, M., S. Chinvanno, M. Kummu, P. Nuorteva, A. Snidvongs, O. Varis, and K. Västilä. 2010. "Climate Change and Water Resources in the Lower Mekong River Basin: Putting Adaptation into the Context." *Journal of Water and Climate Change* 1 (2): 103–17. https://doi.org/10.2166/wcc.2010.009.
Kodirekkala, Koteswara Rao. 2015. "External Intervention, Local Environment, and Knowledge Erosion: A Forest-Based Community of South India." *Culture, Agriculture, Food and Environment* 37 (2): 124–29. https://doi.org/10.1111/cuag.12059.
Kracauer, S. 1952. "The Challenge of Qualitative Content Analysis." *Public Opinion Quarterly* 16: 631–42.
Kuenzer, Claudia, Ian Campbell, Marthe Roch, Patrick Leinenkugel, Vo Quoc Tuan, and Stefan Dech. 2013. "Understanding the Impact of Hydropower Developments in the Context of Upstream–Downstream Relations in the Mekong River Basin." *Sustainability Science* 8 (4): 565–84. https://doi.org/10.1007/s11625-012-0195-z.
Kull, Christian, and Haripriya Rangan. 2016. "Political Ecology and Resilience: Competing Interdisciplinarities?" In *Interdisciplinarités Entre Natures et Sociétés Colloque de Cerisy*, edited by Bernard Hubert and Nicole Mathieu, 71–87. Brussels: P.I.E. Peter Lang. https://serval.unil.ch/notice/serval:BIB_7DF835D4FA13.
Kummu, Matti, X.X. Lu, Akchousanh Rasphone, Juha Sarkkula, and Jorma Koponen. 2008. "Riverbank Changes along the Mekong River: Remote Sensing Detection in the Vientiane–Nong Khai Area." *Quaternary International* 186 (1): 100–112. https://doi.org/10.1016/j.quaint.2007.10.015.
Kummu, Matti, and Olli Varis. 2007. "Sediment-Related Impacts Due to Upstream Reservoir Trapping, the Lower Mekong River." *Geomorphology* 85 (3–4): 275–93. https://doi.org/10.1016/j.geomorph.2006.03.024.
Kura, Yumiko, Olivier Joffre, Benoit Laplante, and Bounthong Sengvilaykham. 2017. "Coping with Resettlement: A Livelihood Adaptation Analysis in the Mekong River Basin." *Land Use Policy* 60 (January): 139–49. https://doi.org/10.1016/j.landusepol.2016.10.017.
Lamb, Vanessa. 2018. "Who Knows the River? Gender, Expertise, and the Politics of Local Ecological Knowledge Production of the Salween River, Thai-Myanmar Border." *Gender, Place & Culture*, August, 1–16. https://doi.org/10.1080/0966369X.2018.1481018.
Lamun, Nopparat. 2013. "Chiang Khong: One City, Two Models [เชียงของ หนึ่งเมืองสองแบบ]." Rak Chiang Khong.
Lazarus, Kate, Pierre Dubeau, Channa Bambaradeniya, Richard Friend, and Latsamay Sylavong. 2006. *An Uncertain Future: Biodiversity and Livelihoods along the Mekong River in*

Northern Lao PDR. Vientiane, Lao PDR: World Conservation Union, Lao PDR Country Office.

Lewis, Jane. 2003. "Design Issues." In *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, edited by Jane Ritchie and Jane Lewis, 47–76. London ; Thousand Oaks, Calif: Sage Publications.

Liermann, Catherine Reidy, Christer Nilsson, James Robertson, and Rebecca Y. Ng. 2012. "Implications of Dam Obstruction for Global Freshwater Fish Diversity." *BioScience* 62 (6): 539–48. https://doi.org/10.1525/bio.2012.62.6.5.

Lister, Ruth. 1997. *Citizenship: Feminist Perspectives*. Washington Square, N.Y: New York University Press.

———. 2004. *Poverty*. Key Concepts. Cambridge, UK ; Malden, MA: Polity.

———. 2015. "'To Count for Nothing': Poverty beyond the Statistics." *Journal of the British Academy* 3: 139–65. https://doi.org/10.5871/jba/003.139.

Liu, Kuan-Ting, Kuo-Hsin Tseng, C. Shum, Chian-Yi Liu, Chung-Yen Kuo, Ganming Liu, Yuanyuan Jia, and Kun Shang. 2016. "Assessment of the Impact of Reservoirs in the Upper Mekong River Using Satellite Radar Altimetry and Remote Sensing Imageries." *Remote Sensing* 8 (5): 367. https://doi.org/10.3390/rs8050367.

Long, Norman, and Ann Long, eds. 1992. *Battlefields of Knowledge: The Interlocking of Theory and Practice in Social Research and Development*. London ; New York: Routledge.

Lorenz, Edward. 2001. "Models of Cognition, the Contextualization of Knowledge and Organizational Theory." *Journal of Management and Governance* 5 (3–4): 307–30.

Lu, X. X., and R. Y. Siew. 2006. "Water Discharge and Sediment Flux Changes over the Past Decades in the Lower Mekong River: Possible Impacts of the Chinese Dams." *Hydrology and Earth System Sciences* 10 (2): 181–95. https://doi.org/10.5194/hess-10-181-2006.

Lune, Howard, and Bruce L. Berg. 2017. *Qualitative Research Methods for the Social Sciences*. Ninth edition. Books a La Carte. Boston: Pearson.

Manh, N. V., N. V. Dung, N. N. Hung, B. Merz, and H. Apel. 2014. "Large-Scale Suspended Sediment Transport and Sediment Deposition in the Mekong Delta." *Hydrology and Earth System Sciences* 18 (8): 3033–53. https://doi.org/10.5194/hess-18-3033-2014.

Manh, Nguyen Van, Nguyen Viet Dung, Nguyen Nghia Hung, Matti Kummu, Bruno Merz, and Heiko Apel. 2015. "Future Sediment Dynamics in the Mekong Delta Floodplains: Impacts of Hydropower Development, Climate Change and Sea Level Rise." *Global and Planetary Change* 127 (April): 22–33. https://doi.org/10.1016/j.gloplacha.2015.01.001.

Matichon Online. 2017. "ชาวบ้านห้วยลึกห่วงสร้างเขื่อนลาว-ระเบิดแก่งแม่น้ำโขงกระทบชุมชน [Huay Luk villages concerned over Lao dam construction and Mekong rapids blasting impacting community]." *Matichon Online*, March 2017. https://www.matichon.co.th/region/news_496330.

———. 2019. "ด่วน!! ดอนเผย 'จีน' ยกเลิกระเบิด เกาะแก่งแม่น้ำโขง [Urgent! Don reveals China terminating Mekong rapids blasting]." *Matichon Online*, March 9, 2019. https://www.matichon.co.th/foreign/news_1397464.

Maxwell, Joseph Alex. 2012. "What Is Realism, and Why Should Qualitative Researchers Care?" In *A Realist Approach for Qualitative Research*, 3–14. Thousand Oaks: SAGE Publications. https://www.sagepub.com/sites/default/files/upm-binaries/44131_1.pdf.

Mayring, Philipp. 2000. "Qualitative Content Analysis." *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* 1 (2): Art. 20.

———. 2014. "Qualitative Content Analysis: Theoretical Foundation, Basic Procedures and Software Solution." http://nbn-resolving.de/urn:nbn:de:0168-ssoar-395173.

McLaughlin, Paul, and Thomas Dietz. 2008. "Structure, Agency and Environment: Toward an Integrated Perspective on Vulnerability." *Global Environmental Change* 18 (1): 99–111. https://doi.org/10.1016/j.gloenvcha.2007.05.003.

McMillen, Heather, Tamara Ticktin, and Hannah Kihalani Springer. 2017. "The Future Is behind Us: Traditional Ecological Knowledge and Resilience over Time on Hawai'i Island." *Regional Environmental Change* 17 (2): 579–92. https://doi.org/10.1007/s10113-016-1032-1.

Meinzen-Dick, Ruth, Monica Di Gregorio, and Nancy McCarthy. 2004. "Methods for Studying Collective Action in Rural Development." 33. CAPRi WORKING PAPER. Washington, D.C., United States: International Food Policy Research Institute. http://ebrary.ifpri.org/utils/getfile/collection/p15738coll2/id/125175/filename/125176.pdf.

Mekong River Commission (MRC). 2009. "The Flow of the Mekong." 2. MRC Management Information Booklet Series. Mekong River Commission. http://www.mrcmekong.org/assets/Publications/report-management-develop/MRC-IM-No2-the-flow-of-the-mekong.pdf.

Mekong River Commission Secretariat (MRC). 2010. "State of the Basin Report 2010." http://www.mrcmekong.org/assets/Publications/basin-reports/MRC-SOB-report-2010full-report.pdf.

Mittermeier, R.A., W.R. Turner, F.W. Larsen, T.M. Brooks, and C. Gascon. 2011. "Global Biodiversity Conservation: The Critical Role of Hotspots." In *Biodiversity Hotspots: Distribution and Protection of Conservation Priority Areas*, edited by Frank E. Zachos and Jan Christian Habel, 3–22. Berlin, Heidelberg: Springer Berlin Heidelberg. https://doi.org/10.1007/978-3-642-20992-5.

MRC. 2010. "Impacts of Climate Change and Development on Mekong Flow Regimes First Assessment - 2009." 29. Mekong River Commission. http://www.mrcmekong.org/assets/Publications/technical/tech-No29-impact-of-climate-change.pdf.

Muradian, Roldan, and Unai Pascual. 2018. "A Typology of Elementary Forms of Human-Nature Relations: A Contribution to the Valuation Debate." *Current Opinion in Environmental Sustainability* 35 (December): 8–14. https://doi.org/10.1016/j.cosust.2018.10.014.

Murdoch, Jonathan, and Judy Clark. 1994. "Sustainable Knowledge." *Geoforum* 25 (2): 115–32. https://doi.org/10.1016/0016-7185(94)90010-8.

Myint, Tun. 2016. "Citizen Science in a Democracy: The Case of Thai Baan Research." In *Tocqueville Lecture Series*. Minnesota, USA: Carleton College. https://ostromworkshop.indiana.edu/pdf/seriespapers/2016F_Tocq/Myint%20paper.pdf.

Nadasdy, Paul. 1999. "The Politics of TEK: Power and the 'Integration' of Knowledge." *Arctic Anthropology* 36 (1/2): 1–18.

Naess, Lars Otto. 2013. "The Role of Local Knowledge in Adaptation to Climate Change: Role of Local Knowledge in Adaptation." *Wiley Interdisciplinary Reviews: Climate Change* 4 (2): 99–106. https://doi.org/10.1002/wcc.204.

Nightingale, Andrea J. 2014. "Nature-Society." In *The SAGE Handbook of Human Geography*, edited by Roger Lee, Noel Castree, Rob Kitchin, Victoria Lawson, Anssi Paasi, Chris Philo, Sarah Radcliffe, Susan M. Roberts, and Charles W.J. Withers, 1:120–47. Los Angeles: SAGE reference.

Office of the National Economic and Social Development Board. 2016. "Thailand's Special Economic Zones."

Olsson, Per, and Carl Folke. 2001. "Local Ecological Knowledge and Institutional Dynamics for Ecosystem Management: A Study of Lake Racken Watershed, Sweden." *Ecosystems* 4 (2): 85–104. https://doi.org/10.1007/s100210000061.

O'Neill, Phillip, and Pauline M. McGuirk. 2014. "Qualitative Methods in Socio-Spatial Research." In *Handbook of Research Methods and Applications in Spatially Integrated Social Science*, edited by R.J. Stimson, 177–91. Cheltenham, United Kingdom: Edward Elgar Publishing.

Ormston, Rachel, Liz Spencer, Matt Barnard, and Dawn Snape. 2014. "The Foundations of Qualitative Research." In *Qualitative Research Practice: A Guide for Social Science Students and Researchers*, edited by Jane Ritchie and Jane Lewis, 2nd. ed. London: SAGE.

Orr, Stuart, Jamie Pittock, Ashok Chapagain, and David Dumaresq. 2012. "Dams on the Mekong River: Lost Fish Protein and the Implications for Land and Water Resources." *Global Environmental Change* 22 (4): 925–32. https://doi.org/10.1016/j.gloenvcha.2012.06.002.

Patton, M. 1990. "Purposeful Sampling." In *Qualitative Research and Evaluation Methods*, 2nd ed., 169–86. Beverly Hills, CA: Sage.

Patton, Michael Quinn. 1999. "Enhancing the Quality and Credibility of Qualitative Analysis." *Health Services Research* 35 (5): 1189–1208.

———. 2002. *Qualitative Research and Evaluation Methods*. 3 ed. Thousand Oaks, Calif: Sage Publications.

Peterson, Garry. 2000. "Political Ecology and Ecological Resilience: An Integration of Human and Ecological Dynamics." *Ecological Economics* 35 (3): 323–36. https://doi.org/10.1016/S0921-8009(00)00217-2.

Pokaew, Prachayaporn. 2018. "ไก สาหร่ายแห่งแม่น้ำโขง จ.เชียงราย [Gai, riverweed of the Mekong River, Chiang Rai Province]." Chiang Khong, Thailand: ThaiPBS. https://youtu.be/4gOzdnZIyIk.

Ramos, Seafha C., Tanya M. Shenk, and Kristen M. Leong. 2016. "Introduction to Traditional Ecological Knowledge in Wildlife Conservation." Natural Resource 1291. National Park Service, U.S. Department of Interior.

Räsänen, Timo A., Paradis Someth, Hannu Lauri, Jorma Koponen, Juha Sarkkula, and Matti Kummu. 2017. "Observed River Discharge Changes Due to Hydropower Operations in the Upper Mekong Basin." *Journal of Hydrology* 545: 28–41. https://doi.org/10.1016/j.jhydrol.2016.12.023.

Ratner, Blake D., Björn Åsgård, and Edward H. Allison. 2014. "Fishing for Justice: Human Rights, Development, and Fisheries Sector Reform." *Global Environmental Change* 27 (July): 120–30. https://doi.org/10.1016/j.gloenvcha.2014.05.006.

Rauschmayer, Felix, Christine Polzin, Mirijam Mock, and Ines Omann. 2018. "Examining Collective Action Through the Capability Approach: The Example of Community Currencies." *Journal of Human Development and Capabilities* 19 (3): 345–64. https://doi.org/10.1080/19452829.2017.1415870.

Raymond, Christopher M., Ioan Fazey, Mark S. Reed, Lindsay C. Stringer, Guy M. Robinson, and Anna C. Evely. 2010. "Integrating Local and Scientific Knowledge for Environmental Management." *Journal of Environmental Management* 91 (8): 1766–77. https://doi.org/10.1016/j.jenvman.2010.03.023.

RECOFTC. 2015. "ข้อมูลบริบทชุมชนบ้านปากอิงใต้ [Pak Ing Tai Community Context]." 2015. https://archive.recoftc.org/project/%E0%B9%82%E0%B8%84%E0%B8%A3%E0%B8%87%E0%B8%81%E0%B8%B2%E0%B8%A3%E0%B8%AD%E0%B8%99%E0%B8%B8%E0%B8%A3%E0%B8%B1%E0%B8%81%E0%B8%A9%E0%B9%8C%E0%B8%A5%E0%B8%B8%E0%B9%88%E0%B8%A1%E0%B8%99%E0%B9%89%E0%B8%B3%E0%B8%AD%E0%B8%B4%E0%B8%87/basic-page/%E0%B8%9A%E0%B9%89%E0%B8%B2%E0%B8%99%E0%B8%9B%E0%B8%B2%E0%B8%81%E0%B8%AD%E0%B8%B4%E0%B8%87%E0%B9%83%E0%B8%95%E0%B9%89.

Reser, Joseph P., and Janet K. Swim. 2011. "Adapting to and Coping with the Threat and Impacts of Climate Change." *American Psychologist* 66 (4): 277–89. https://doi.org/10.1037/a0023412.

Reyes-García, Victoria, Vincent Vadez, Elizabeth Byron, Lilian Apaza, William R. Leonard, Eddy Perez, and David Wilkie. 2005. "Market Economy and the Loss of Folk Knowledge of Plant Uses: Estimates from the Tsimane' of the Bolivian Amazon." *Current Anthropology* 46 (4): 651–56. https://doi.org/10.1086/432777.

Reyes-García, Victoria, Vincent Vadez, Tomás Huanca, William R. Leonard, and Thomas McDade. 2007. "Economic Development and Local Ecological Knowledge: A Deadlock? Quantitative Research from a Native Amazonian Society." *Human Ecology* 35 (3): 371–77. https://doi.org/10.1007/s10745-006-9069-2.

Rigg, Jonathan. 2007. *An Everyday Geography of the Global South*. London ; New York: Routledge.

Rist, Lucy, R. Uma Shaanker, E.J. Milner-Gulland, and Jaboury Ghazoul. 2010. "The Use of Traditional Ecological Knowledge in Forest Management: An Example from India." *Ecology and Society* 15 (1): 3 [online].

Robbins, Paul. 2012. *Political Ecology: A Critical Introduction*. Chichester, West Sussex: Wiley-Blackwell.

Roykaew, Niwat, and et al. 2004. *เชียงของ เวียงแก่น: พัฒนาการของสังคมชายขอบจากอดีตสู่การเปลี่ยนแปลงทางเศรษฐกิจการเมืองในอนุภูมิภาคลุ่มน้ำโขง [Chiang Khong-Wiang Kaen: the development of a marginal society from the past to the political and economic change in the Mekong River Subregion]*. Bangkok, Thailand: The Thailand Research Fund.

Ruddle, Kenneth, and Anthony Davis. 2013. "Local Ecological Knowledge (LEK) in Interdisciplinary Research and Application: A Critical Review." *Asian Fisheries Science* 26: 79–100.

Rujivanarom, Pratch. 2017. "China 'ready to Amend' Mekong Plan." *The Nation*, December 20, 2017. http://www.nationmultimedia.com/detail/national/30334368.

Santasombat, Yos. 2011. *The River of Life: Changing Ecosystems of the Mekong Region*. Chiang Mai: Mekong Press.

Scannell, Leila, and Robert Gifford. 2010. "Defining Place Attachment: A Tripartite Organizing Framework." *Journal of Environmental Psychology* 30 (1): 1–10. https://doi.org/10.1016/j.jenvp.2009.09.006.

Schliesinger, Joachim. 2001. *Tai Groups of Thailand: Profile of the Existing Groups*. Tai Groups of Thailand, Joachim Schliesinger ; Vol. 2. Bangkok: White Lotus Press.

Scoones, Ian. 2009. "Livelihoods Perspectives and Rural Development." *The Journal of Peasant Studies* 36 (1): 171–96. https://doi.org/10.1080/03066150902820503.

Scurrah, Natalie. 2013. "'Countering Hegemony' and 'Institutional Integration': Two Approaches to Using Tai Baan Research Fr Local Knowledge Advocacy." In *Governing the Mekong: Engaging in the Politics of Knowledge*, edited by Rajesh Daniel, Louis Lebel, and Kanokwan Manorom. M-POWER Book Series on Water Governance in the Mekong Region, no. 4. Petaling Jaya: Strategic Information and Research Development Centre.

Simpson, Leanne. 2005. "Traditional Ecological Knowledge among Aboriginal Peoples in Canada." In *The Encyclopedia of Religion and Nature*, edited by Bron Raymond Taylor, Jeffrey Kaplan, Laura Hobgood-Oster, Adrian J. Ivakhiv, and Michael York, 1649–51. London ; New York: Thoemmes Continuum.

Sivongxay, Amphone, Romy Greiner, and Stephen T. Garnett. 2017. "Livelihood Impacts of Hydropower Projects on Downstream Communities in Central Laos and Mitigation Measures." *Water Resources and Rural Development* 9 (June): 46–55. https://doi.org/10.1016/j.wrr.2017.03.001.

Smith, N. 1993. “Homeless/Global: Scaling Places.” In *Mapping the Futures: Local Cultures, Global Change*, edited by Jon Bird, B. Curtis, T. Putnam, G. Robertson, and L. Tickner, 87–119. Futures, New Perspectives for Cultural Analysis. London, United Kingdom: Routledge.

———. 2000. “Scale.” In *The Dictionary of Human Geography*, edited by R.J. Johnston, D. Gregory, G. Pratt, and M. Watts, 4th ed., 724–27. Oxford, United Kingdom: Blackwell Publishing Ltd.

Sonbali, Jedsada, and Suree Jaidee. 2014. “การรวบรวมองค์ความรู้ด้านศิลปวัฒนธรรมและภูมิปัญญาท้องถิ่นล้านนา “เอตทัคคตา ครูภูมิปัญญาท้องถิ่น" [The Collection of Knowledge of Arts, Culture, and Lanna Local Wisdom: ‘Etatakta, local wisdom teacher’].” Chiang Rai Rajabhat University. http://ctc.crru.ac.th/wp-content/uploads/2016/03/krumwisahakitchumchon.pdf.

Sretthachua, Chainarong. 2006. “The Concept of Tai Baan Research (Villagers’ Research): Local Wisdom for Resources Management.” IUCN, TEI, IWMI, and M-POWER. https://portals.iucn.org/library/sites/library/files/documents/2007-067.pdf.

Srinetr, Vithet. 2018. “Cumulative Impacts of Hydropower Cascade Dams on Hydrology, Environment, Ecosystem, and Livelihood: Lessons Learnt from A Mekong Mainstream Transboundary Study.” Expert Training Workshop presented at the Expert Training Workshop: Cumulative Impact Assessment on Lower Mekong Regional Water and Energy Infrastructure Development and Planning in Chiang Rai, Mae Fah Luang University, Chiang Rai, Thailand, August 20.

Stehr, Nico. 2001. “A World Made of Knowledge.” *Society* 39 (1): 89–92. https://doi.org/10.1007/BF02712625.

St.John, Ronald Bruce. 1998. *The Land Boundaries of Indochina : Cambodia, Laos and Vietnam*. Edited by Clive H Schofield. 6th ed. Vol. 2. Boundary and Territory Briefing. Durham, U.K.: International Boundaries Research Unit, University of Durham.

Swyngedouw, Erik. 2000. “Authoritarian Governance, Power, and the Politics of Rescaling.” *Environment and Planning D: Society and Space* 18 (1): 63–76. https://doi.org/10.1068/d9s.

Szalontai, Balázs. 2011. “From Battlefield into Marketplace: The End of the Cold War in Indochina, 1985-1989.” In *The End of the Cold War and the Third World: New Perspectives on Regional Conflict*, edited by Artemy M Kalinovskij and Sergey Radchenko, 155–72. London; New York: Routledge.

Taylor, David. 1998. “Social Identity and Social Policy: Engagements with Postmodern Theory.” *Journal of Social Policy* 27 (3): 329–50. https://doi.org/10.1017/S0047279498005315.

———. 2011. “Wellbeing and Welfare: A Psychosocial Analysis of Being Well and Doing Well Enough.” *Journal of Social Policy* 40 (04): 777–94. https://doi.org/10.1017/S0047279411000249.

Thairath. 2016. “โฮงเฮียนแม่น้ำของ ภูมิคุ้มกันแม่น้ำโขง [Hong Hian Mae Nam Khong: Mekong River Immunity].” *Thairath News*, January 2016. https://www.thairath.co.th/content/558164.

Thermpithayapaisit, Akom. For cabinet consideration. 2016. “ขอความเห็นชอบแผนพัฒนาการเดินเรือระหว่างประเทศในแม่น้ำล้านช้าง-แม่น้ำโขง ค.ศ. 2015-2025 และดำเนินงานเบื้องต้นโครงการปรับปรุงร่องน้ำทางเดินเรือในแม่น้ำล้างช้าง-แม่น้ำโขง,” November 2016. http://www.cabinet.soc.go.th/doc_image/2559/9932254344.pdf.

Thompson, Christian. 2008. “First Contact in the Greater Mekong: New Species Discoveries.” WWF-Great Mekong Program. http://awsassets.panda.org/downloads/first_contact_final_report.pdf.

Thornton, Thomas F., and Adela Maciejewski Scheer. 2012. “Collaborative Engagement of Local and Traditional Knowledge and Science in Marine Environments: A Review.” *Ecology and Society* 17 (3). https://doi.org/10.5751/ES-04714-170308.

Thubthun, Narathip, and Chinasak Tandikul. 2017. “A review of studies on Tai Yuan ethnicity.” *มนุษยศาสตร์ สังคมศาสตร์* 34 (2): 245–72.

Tilt, Bryan, Yvonne Braun, and Daming He. 2009. “Social Impacts of Large Dam Projects: A Comparison of International Case Studies and Implications for Best Practice.” *Journal of Environmental Management* 90 (July): S249–57. https://doi.org/10.1016/j.jenvman.2008.07.030.

Transborder News. 2017. “Concerns over Rapids Blastings Impacting Ya Mon Relics-the Center of Faith of the Mekong Riparian People.” *Transborder News*, September 24, 2017. http://transbordernews.in.th/home/?p=17721.

———. 2019. “กรมเจ้าท่าทำพิลึก-เดินหน้าโครงการระเบิดแก่งแม่น้ำโขงสวนทางข้อตกลงรมว.ตป.ไทย-จีนที่ให้ยุติ [Thai Merine Department Giving Strange Signs--Moving Ahead with Mekong Rapids Blasting Project Despite Agreement for Termination between Thai-Chinese Foreign Ministers],” March 29, 2019. http://transbordernews.in.th/home/?p=22849.

Tuck, Patrick J. N. 1995. *The French Wolf and the Siamese Lamb: The French Threat to Siamese Independence, 1858-1907*. 1st ed. Studies in Southeast Asian History 1. Bangkok ; Cheney: White Lotus.

Turner, Matthew D. 2014. “Political Ecology I: An Alliance with Resilience?” *Progress in Human Geography* 38 (4): 616–23. https://doi.org/10.1177/0309132513502770.

Turvey, Samuel T., Cristina Fernández-Secades, Jose M. Nuñez-Miño, Tom Hart, Pedro Martinez, Jorge L. Brocca, and Richard P. Young. 2014. “Is Local Ecological Knowledge a Useful Conservation Tool for Small Mammals in a Caribbean Multicultural Landscape?” *Biological Conservation* 169 (January): 189–97. https://doi.org/10.1016/j.biocon.2013.11.018.

Usher, Peter J. 2000. “Traditional Ecological Knowledge in Environmental Assessment and Management.” *Arctic* 53 (2): 183–93.

Vaddhanaphuti, Chayan. 2006. “คนเมือง: ตัวตนการผลิตซ้ำสร้างใหม่และพื้นที่ทางสังคมของคนเมือง [Kon Mueang: the reproduction of identity and social space of Kon Mueang].” In *อยู่ชายขอบ มองลอดความรู้: รวมบทความเนื่องในวาระครบรอบ 60 ปี ฉลาดชาย รมิตานนท์ [Being on the margin, looking in through knowledge: an anthology for the 60th anniversary Chaladchai Ramitanont]*, edited by Anand Kanchanapan, 34–73. Bangkok, Thailand: Matichon.

Voeks, Robert A., and Angela Leony. 2004. “Forgetting the Forest: Assessing Medicinal Plant Erosion in Eastern Brazil.” *Economic Botany* 58 (sp1): S294–306. https://doi.org/10.1663/0013-0001(2004)58[S294:FTFAMP]2.0.CO;2.

Vogt, Nathan, Miguel Pinedo-Vasquez, Eduardo S. Brondízio, Fernando G. Rabelo, Katia Fernandes, Oriana Almeida, Sergio Riveiro, Peter J. Deadman, and Yue Dou. 2016. “Local Ecological Knowledge and Incremental Adaptation to Changing Flood Patterns in the Amazon Delta.” *Sustainability Science* 11 (4): 611–23. https://doi.org/10.1007/s11625-015-0352-2.

Vorkinn, Marit, and Hanne Riese. 2001. “Environmental Concern in a Local Context: The Significance of Place Attachment.” *Environment and Behavior* 33 (2): 249–63. https://doi.org/10.1177/00139160121972972.

Vörösmarty, C. J., P. B. McIntyre, M. O. Gessner, D. Dudgeon, A. Prusevich, P. Green, S. Glidden, et al. 2010. “Global Threats to Human Water Security and River Biodiversity.” *Nature* 467 (7315): 555–61. https://doi.org/10.1038/nature09440.

Vu, D. T., T. Yamada, and H. Ishidaira. 2018. “Assessing the Impact of Sea Level Rise Due to Climate Change on Seawater Intrusion in Mekong Delta, Vietnam.” *Water Science and Technology* 77 (6): 1632–39. https://doi.org/10.2166/wst.2018.038.

Wannakit, Nittaya, and Siraporn Nathalang. 2011. “Dynamics of Power of Space in the Tai-Yuan Chao Luang Kham Daeng Spirit Cult.” *MANUSYA: Journal of Humanities* Special issue (19): 87–104.

Whitehead, Alfred North. 1929. *Process and Reality: An Essay in Cosmology*. Gifford Lectures. New York: Macmillan.

Wiang Chiang Khong Municipality. 2018. “Four-Year Local Development Plan (2018-2021): Wiang Chiang Khong Municipality [แผนพัฒนาท้องถิ่น 4 ปี (พ.ศ. 2561-2564) เทศบาลตำบลเวียงเชียงของ.” http://www.wckmunic.org/pdf/%E0%B9%81%E0%B8%9C%E0%B8%99%E0%B8%9E%E0%B8%B1%E0%B8%92%E0%B8%99%E0%B8%B2%E0%B8%97%E0%B9%89%E0%B8%AD%E0%B8%87%E0%B8%96%E0%B8%B4%E0%B9%88%E0%B8%99.pdf.

Williams, Fiona, and Harriet Churchill. 2006. “Empowering Parents in Sure Start Local Programmes.” NESS/2006/FR/08. London: England: National Evaluation of Sure Start (NESS) Institute for the Study of Children, Families and Social Issues, Birkbeck, University of London. http://www.ness.bbk.ac.uk/implementation/documents/1385.pdf.

Wilson, Kalpana. 2008. “Reclaiming ‘Agency’, Reasserting Resistance.” *Institute of Development Studies Bulletin* 39 (6): 83–91.

Witzel, Andreas. 2000. “The Problem-Based Interview.” *Forum Qualitative Sozialforschung / Forum: Qualitative Social Research* 1 (1). http://www.qualitative-research.net/index.php/fqs/article/view/1132/2521.

Witzel, Andreas, and Herwig Reiter. 2012. *The Problem-Centred Interview: Principles and Practice*. London: SAGE.

WLE. 2016. “Dataset on the Dams of the Irrawaddy, Mekong, Red, and Salween River Basins.” CGIAR Research Program on Water, Land, and Ecosystems - Greater Mekong. https://wle-mekong.cgiar.org/changes/our-research/state-of-knowledge-series/.

Work, Courtney, Vannrith Rong, Danik Song, and Arnim Scheidel. 2018. “Maladaptation and Development as Usual? Investigating Climate Change Mitigation and Adaptation Projects in Cambodia.” *Climate Policy*, October, 1–16. https://doi.org/10.1080/14693062.2018.1527677.

World Commission on Dams. 2000. “Dams and Development: A New Framework for Decision-Making.”

Yin, Robert K. 2014. *Case Study Research: Design and Methods*. Fifth edition. Los Angeles: SAGE.

Zarfl, Christiane, Alexander E. Lumsdon, Jürgen Berlekamp, Laura Tydecks, and Klement Tockner. 2015. “A Global Boom in Hydropower Dam Construction.” *Aquatic Sciences* 77 (1): 161–70. https://doi.org/10.1007/s00027-014-0377-0.

Ziv, G., E. Baran, S. Nam, I. Rodrigues-Iturbe, and S.A. Levin. 2012. “Trading-off Fish Biodiversity, Food Security, and Hydropower in the Mekong River Basin.” *Proceedings of National Academy of Sciences of the United States of America (PNAS)* 109 (15): 5609–14. https://doi.org/10.1073/pnas.1201423109.

Appendices

Appendix A. Interview Guide

For resource users

Introduce master's thesis project and interviewer. Assure respondent that their names will be pseudonymized. Ask if possible to record (when appropriate).

Relations to the Mekong and its ecosystems

1. In what ways is the Mekong important for you? [encourage narrative and understand practical knowledge]
    a. Probe about livelihood activities: fishing, foraging, river bank agriculture
    b. Cultural relations like ceremonies?
    c. Other interactions?
    d. How does seasonality play into this relationship?
2. How did you come to take part in these livelihood activities?
    a. By heritage? membership of certain village? Or economic opportunity? Other?
    b. Passing down of roles and knowledge?
3. How would you describe what the Mekong means to you?
    a. Probe sources of these meanings
    b. Meanings attributed to fish and other aspects of the Mekong ecosystem?

Ecological change and impacts over time

4. What are some key ecological problems relating to the Mekong River?
    a. Explain physical and biological impacts
    b. Perceived causes of problem
5. How has the 'problem' changed over the last decade?
    a. Probe if different perspectives exist about what the problem is
6. How has this problem impacted your livelihoods?
    a. Extent/severity of impacts
    b. Probe differences between different gender and livelihood activities
    c. Impacts beyond livelihood? (e.g., cultural practices)

Local Ecological Knowledge and Response

7. Given the 'problems' mentioned, what have you done to respond to it?
    a. Cope, adapt, get-by?
    b. Individually, household level, collectively?
    c. How does local ecological knowledge play into response strategies?
    d. Probe different responses between different gender, ethnicity, uses of river
8. What else have been done by others (government, NGOs, or other institutions) to address the 'problem'?
    a. How are villagers involved in addressing the problem alongside these institutions?
9. How successful are current response strategies (locally and regionally)?

a. What more can be done, perhaps collectively?
b. Does knowledge translate into participation in collective action? Why or why not?
c. Contesting with the source of the 'problem'?

10. What have you learned about the Mekong and its ecosystem as you are experiencing this 'problem'?
    a. New knowledge formed? Integrating other types of knowledges?
    b. Is this learning shared? [contributing to institutional memory] Or is it contributing to a knowledge trap? [potentially undermining community solidarity]

Perception of future risks or threats

11. What are your fears about the future of the Mekong and your livelihoods?
    a. Economics, physical, cultural impacts and risks
    b. Probe connection between existing problem and perceived future problem
12. What would you do if the problem worsens?

For conservation practitioners

History, problem identification, and strategies

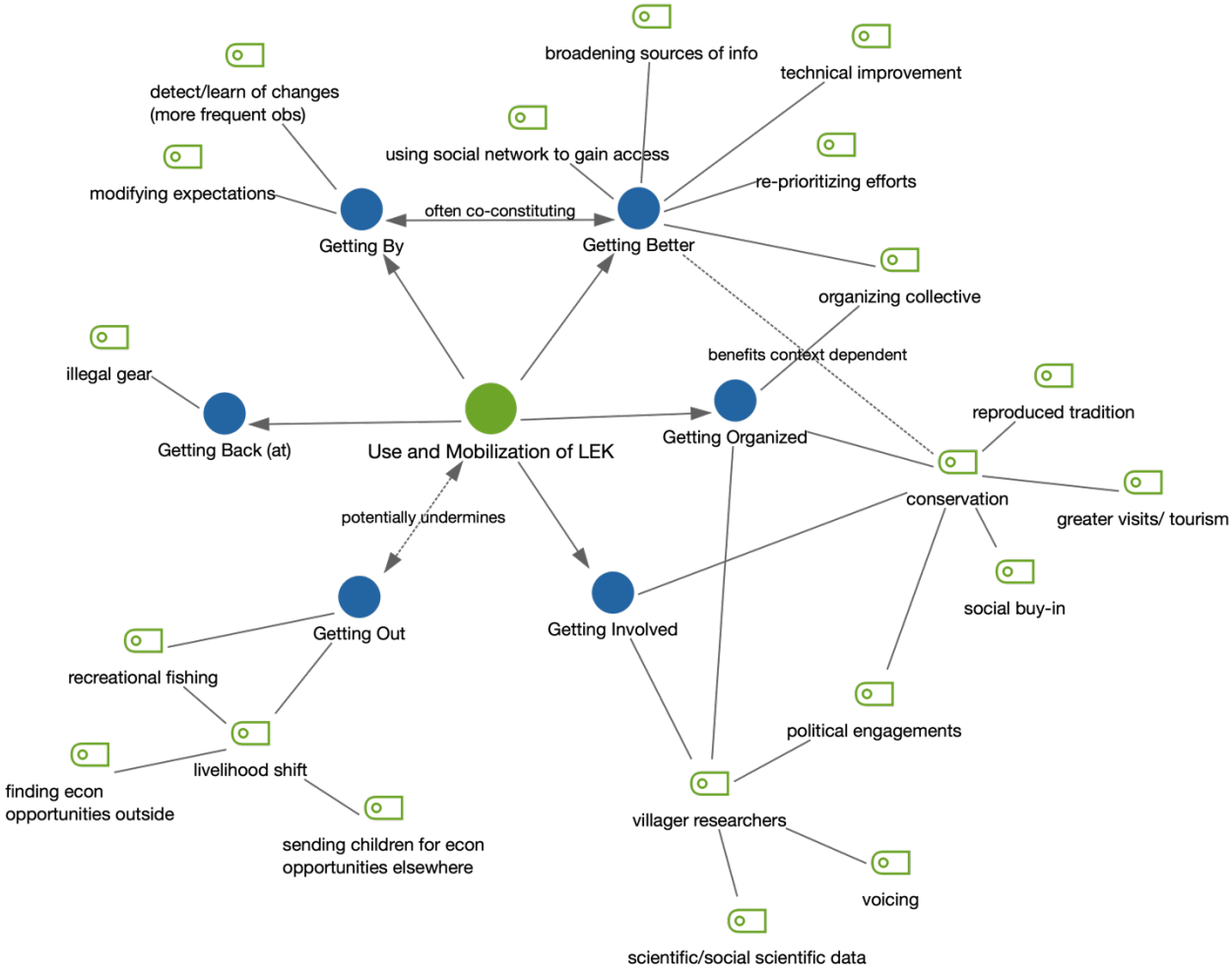
1. What is the history of your organization? What kind of work do you do?
    a. Perspectives on Mekong ecological problems and impacts
    b. How has the problem changed over time?
    c. Probe about the landscape of conservation work, networks, etc.
2. What are your strategies in addressing the problem?
    a. Probe different dimensions of strategies
    b. How might LEK play into it?
3. How involved are local villagers in these strategies? What roles do they play?
4. How have those strategies improved the problem?

For government/district officials

Problem identification and strategies

1. Regarding changes to the Mekong and impacts on local livelihoods, what do you think are the key problems?
    a. Perspectives on Mekong ecological problems and impacts
    b. How has the problem changed over time?
2. What are being done to address the problem? How have various governmental agencies helped?
    a. Probe different dimensions of strategies
    b. How might LEK play into it?
3. How involved are local villagers in these government-led strategies, if any? What roles do they play?
4. How have those strategies improved the problem?

Appendix B. Coding Map



Appendix C. List of Respondents

No.	Name	Place/Association	Gender	Age
1	Mae Nee	Hat Krai	Female	70+
2	Mae Tan	Hat Krai	Female	70+
3	Mae Nam	Hat Krai	Female	60+
4	Poh Boon	Hat Krai	Male	70+
5	Gai	Hat Krai	Male	30+
6	Pan	Hat Krai	Male	50+
7	Mae Mun	Hat Krai	Male	68
8	Kan	Sob Som	Female	50+
9	Pang	Sob Som	Female	25
10	Poh Reap and Mae Oon	Wiang Don Chai	Male Female	60+
11	Am	Wiang Don Chai	Male	50+
12	Tan	Wiang Don Chai	Male	50+
13	Subdistrict Headman	Wiang Subdistrict	Male	50+
14	Nid	Huay Luk	Female	37
15	Ting	Huay Luk	Female	41
16	Yao	Huay Luk	Female	39
17	Krit	Huay Luk	Male	52
18	Poh Chai	Huay Luk	Male	68
19	Wan and Suk	Huay Luk	Male	30+
20	Thongsuk Intawongs (Poh Luang Thongsuk)	Huay Luk Village Head	Male	54
21	Mai	Pak Ing	Male	40+
22	Oun	Pak Ing	Male	50+
23	Nont	Pak Ing Nua	Male	30+
24	Sa	Pak Ing Tai	Female	50+
25	Som	Pak Ing Tai	Male	30+
26	Prachit Chanpeng (Poh Luang Prachit)	Pak Ing Tai Village Head	Male	50+
27	Tae	Pak Ing Tai	Male	60+
28	Kan	Lao PDR	Male	30
29	Ming	Lao PDR	Male	40
30	Niwat Roykaew (Kru Tee)	Rak Chiang Khong	Male	
31	Teerapong Pomun	Living River Siam Association	Male	
32	Dr. Chayan Vaddhanaphuti	Chiang Mai University	Male	
33	Dr. Chainarong Sretthachau	Mahasarakam University	Male	

Appendix D. Personal Declaration

I hereby declare that the submitted thesis is the result of my own independent work. All external sources are explicitly acknowledged in the thesis.

Rapichan Phurisamban

Zürich, 29 April 2019