Bridging the Links:

Indigenous and Local Knowledge and Social-Ecological Resilience in Northwest Panay Island, Philippines

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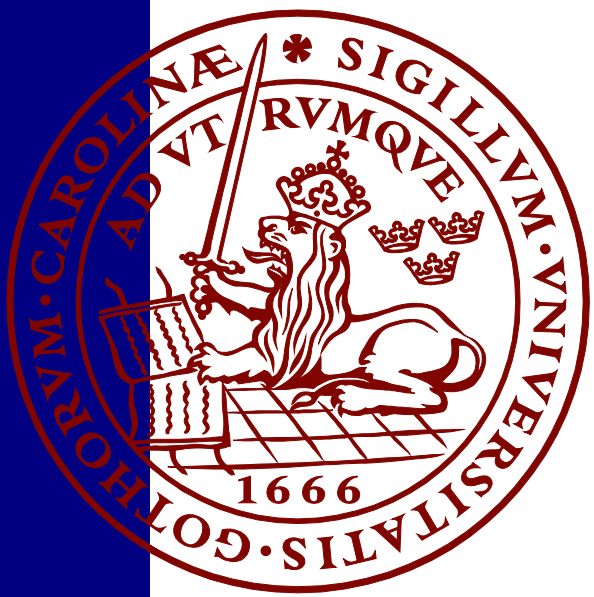

LUCSUS
Lund University Centre for Sustainability Studies

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Abstract:

This study examined how Indigenous and local knowledge (ILK) contributes to social-ecological resilience in Northwest Panay Island, Philippines through two subsistence livelihoods: *Bariw* (screw palm) harvesting/weaving and freshwater shrimp fishing in Libertad, Antique in Northwest Panay Island, Philippines. Using a qualitative research approach involving participant observations, key informant interviews, focus group discussions, and co-produced ecological calendars across three communities, the study explored how ecological knowledge, customary resource management practices, institutions, and local worldviews shape adaptive ecosystem management. Findings show that ILK is embedded in daily livelihood practices through intergenerational learning, social memory, taboos, and communal norms that regulate resource use and reinforce stewardship. However, these adaptive capacities are increasingly challenged by market integration, environmental degradation, climate variability, and formal institutional policies that influence access to previously held customary areas. The study highlights that ILK in this context remains dynamic and adaptive but is contingent on supportive institutional arrangements and continued fostering of human-nature relationships.

Keywords: knowledge systems, institutional arrangements, livelihoods, ecosystem management, social-ecological resilience

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Paagi sa panulatën ngaya, ginabalik ko ang kinaangdan sa mga gapanag-iya, sa urihing tubô, kag sa andang dunâ nga kinaiyahan.

(Through this written work, I return this Knowledge to its Owners, their Inheritors, and to their Natural Endowment.)

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Key acronyms and abbreviations

ILK	Indigenous and Local Knowledge
SES	Social-Ecological Systems
NPPNP	Northwest Panay Peninsula Natural Park
IAD	Institutional Analysis and Development Framework
DENR	Philippine Department of Environment & Natural Resources
IPs	Indigenous Peoples
POs	Participant Observations
KIIs	Key Informant Interviews
FGDs	Focus Group Discussions

1 Introduction

1.1 Introduction

Indigenous and local knowledge (ILK) represents the connections that integrate humans and nature. This relationship is rooted in enduring interactions between communities and their specific environments, as demonstrated through livelihoods, ecosystem management practices, cultural identity, and daily engagement with place (Brondízio et al., 2021; Krause et al., 2020). Rather than conceptualizing humans and nature as distinct domains (Berkes & Folke, 2002), ILK highlights their mutual constitution and deep interwovenness within social-ecological systems. Ecosystems and human communities continuously influence one another through processes of use, adaptation, learning, and stewardship across generations (Olsson et al., 2004).

ILK systems have increasingly been affected by various external pressures, such as colonization and its enduring structures (Krause et al., 2020; Sangha et al., 2026), market integration (Godoy et al., 2005; Hoque et al., 2017), and the standardization of formal education (Reyes-García et al., 2013). These factors have contributed to the marginalization and erosion of knowledge systems rooted in local contexts (Gómez-Baggethun, 2022). The ongoing loss of biocultural diversity, including languages (Chiblow & Meighan, 2022), identities, and customary practices that support knowledge transmission further intensifies these transformations (Aswani et al., 2018). As ecosystems undergo environmental degradation and global change, the weakening of ILK also erodes the adaptive capacities of resource-dependent communities (Reyes-García et al., 2013). This process creates a feedback loop in which ecological degradation undermines livelihoods and human well-being (Adger, 2000; Widiono et al., 2024), while the loss of ILK results in the disappearance of knowledge systems necessary to understand ecosystem processes, further diminishing communities' capacity to respond to environmental changes (McCarter et al., 2014; Pearson et al., 2023).

Growing concerns about environmental crises and social-ecological changes have renewed attention to ILK in academic and policy arenas (Díaz et al., 2015; Gómez-Baggethun & Reyes-García, 2013). Recent interest in ILK has arisen in part from the recognition that rigid disciplinary approaches to environmental issues often fail to capture the complexity of human-environment interactions (Gómez-Baggethun, 2022). This renewed focus positions ILK as a dynamic, adaptive, and resilient knowledge system capable of responding to uncertainty and external change (Berkes et al., 2000).

However, characterizing ILK solely as adaptive and resilient can overlook the broader institutional, political, and economic factors that influence both its adaptability and its erosion (Gómez-Baggethun et al., 2013). Shifts in environmental, social, and economic conditions continually affect how knowledge is practiced, transmitted, transformed, or lost (Aswani et al., 2018). Analyzing these dynamics requires attention to the institutions that mediate human-environment interactions. These institutional arrangements are defined as "enduring regularities of human action in situations structured by rules, norms, and shared strategies, as well as by the physical world" (Crawford & Ostrom, 1995, p. 582). These arrangements shape daily decision-making, regulate access, influence livelihood practices, and determine how communities respond to environmental variability and change. Thus, institutions both enable and constrain adaptive capacities within social-ecological systems (Folke et al., 2005).

Despite increasing recognition of ILK in sustainability and resilience studies, important gaps remain in understanding how these knowledge systems persist and adapt within local social-ecological systems under changing institutional and environmental conditions. There are still limited empirical studies on how ILK is continuously negotiated, transformed, and reproduced through livelihoods, institutional arrangements, and their responses to social-ecological change at the local scale (Reyes-Garcia et al., 2024). Understanding these dynamics is important to understanding the conditions under which ILK continues to sustain human-nature relationships within rapidly changing social-ecological systems.

Within this context, local livelihoods offer valuable insights into the relationships among ILK, institutions, and ecosystem management. Livelihoods are best examples of accumulated ecological knowledge and social memory, as they are rooted in long-term interactions with specific environments (Uddin et al., 2021). To examine these dynamics, this study focuses on two livelihoods in the Municipality of Libertad, Antique, located in Northwest Panay Island, Central Philippines: (i) *Bariw* (screw palm) harvesting and weaving, collectively referred to this study as *Bariw* use, and (ii) freshwater shrimp fishing. Through these livelihoods, I aim to understand how ILK contributes to adaptive ecosystem management, interacts with current institutional arrangements, and is shaped by changing social and environmental conditions. In doing so, my study seeks to understand the conditions under which ILK continues to support human-nature relationships reflected in livelihood practices and adaptive forms of resource management. This will be addressed through the following research questions:

- **RQ1**: How does Indigenous and Local Knowledge (ILK) contribute to adaptive management in the communities?
- **RQ2**: How do formal institutions interact in shaping and changing ILK over time?
- **RQ3**: To what extent is ILK embedded in social-ecological resilience principles under the current institutional arrangements?

1.2 Theoretical underpinnings and conceptual framework

1.2.1 Defining indigenous and local knowledge

Indigenous and Local Knowledge refers to knowledge systems characterized by their long-term interactions between communities and their environments. It emerges from repeated practices, observations, and experiences and is reinforced through institutions, belief systems, livelihoods, and worldviews that guide how communities relate to their surrounding ecosystems (Berkes et al., 2000; Díaz et al., 2015). In the literature, ILK is often referred to as "traditional ecological knowledge" or "indigenous ecological knowledge." However, I adopt the broader, more inclusive definition of ILK by Diaz et al. (2015), which recognizes ILK as an accumulated body of knowledge held by traditional and non-traditional societies that influences their interactions with and management of the living and non-living beings of their local biosphere (Hernández-Vélez et al., 2026).

ILK evolves through adaptive processes and is transmitted through observations and cultural processes about the relationships between living beings, including human beings, and the environment (Berkes, 2017). It is an attribute of societies with long historical continuity in applying this knowledge to resources and in the evolution of their management practices over generations (Berkes et al., 2000). ILK is often viewed as a knowledge-practice-belief complex (Figure 1), which moves away from cataloging knowledge as information and rather views it as a dynamic, interlinked system with fluid levels that evolve through social and cultural transmission (Berkes, 2017).

Understanding local management of natural resources, such as plants and wildlife within ILK, diverges from fixed management knowledge, such as that in business or in academia (Berkes, 2004, pp. 622–623). Instead, land and resource management reflect the application of ecological knowledge embedded in communities, including their knowledge of resource dynamics, classification, change, and

transformation (Altieri, 2004; Aswani et al., 2018). Such knowledge is continually applied, particularly in local livelihoods, and is reproduced using practices, customary regulations, norms, and social learning processes that regulate and reinforce stewardship among communities (Brondizio & Tourneau, 2016). This understanding of human-nature interconnections has attained renewed importance and appeal, particularly in academic and policy discussions on sustainability, resilience, and climate adaptation (Gómez-Baggethun, 2022). Increased attention has been given to ILK's contributions to ecosystem stewardship, livelihoods, environmental governance, and the capacity to cope with environmental and social changes (Gómez-Baggethun, 2022; McElwee et al., 2020; Turreira-García, 2025).

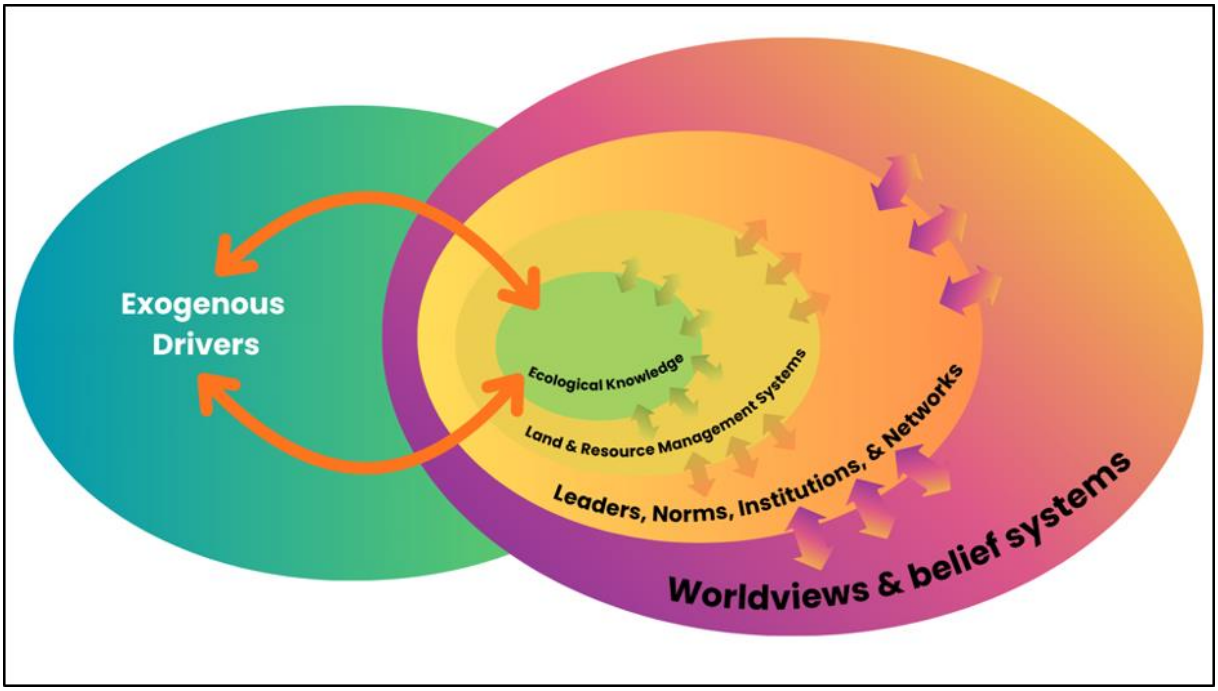

Figure 1. ILK complex coupling with exogenous drivers

Note. This is an adapted conceptual illustration of ILK as a knowledge-practice-belief (KBP) complex used in thematic coding. It shows the overarching theme and its subthemes at different levels. The arrows indicate that these levels are not distinct, but rather, they feed each other through reinforcing mechanisms. Exogenous drivers are categorized as a separate ellipsis because they do not necessarily characterize ILK dynamics, but rather, shape all of them. The KBP framework is adapted from Berkes (1999). Illustration by the author.

However, these same characteristics have also led toward interpretations of ILK in ecosystem management that risk oversimplification, particularly when ILK is extracted and organized in ways that disregard the processes through which it was generated, negotiated, and transmitted (Briggs, 2013). These views may obscure the wider social, political, and economic processes that shape resource management outcomes, while also risking the assimilation of ILK into dominant scientific or institutional frameworks that overlook its contextual, dynamic, and culturally embedded nature (Gómez-Baggethun, 2022). Tengö et al. (2014) argue that scientific knowledge and ILK should not be validated against one another through a single universal framework; instead, each knowledge system must be understood and validated within its own epistemological context. In this sense, scientific knowledge and ILK can be viewed as co-constitutive and equally valid systems that offer separate yet complementary perspectives on environmental assessment and governance. Institutions play a critical function in shaping how these knowledge systems interact and reinforce one another, which may explain both the persistence and the decline of ILK across different contexts.

1.2.2 Institutional arrangements: What structures decisions

Institutions, as means through which societies interact and organize, influence all aspects of relationships between people and nature across diverse scales (Díaz et al., 2015, pp. 3–5). They encompass both formal and informal interactions that shape decision-making, role allocation, and the exercise of power (Ostrom, 1990). These dynamics are reflected in collectively accepted rules, norms, and strategies that structure human interactions, particularly by creating incentives for behavior in recurring situations (Crawford & Ostrom, 1995). Collectively, institutions establish governance systems that combine diverse sources of power within society and, depending on context, determine how individuals' access, control, and benefit from natural resources (Díaz et al., 2015). Institutions, therefore, not only regulate behavior but also proactively shape interactions among individuals, communities, and their environments.

Institutions shape social behavior throughout both physical and social contexts (Polski & Ostrom, 1999). Indigenous and Local Knowledge (ILK) and institutions are thus interconnected, sustained by social mechanisms (Berkes et al., 2000). Communities with long histories of environmental interaction produce, maintain, and transmit knowledge through institutional practices, while institutions simultaneously reinforce and legitimize these knowledge systems.

The case of Indigenous rice farming systems in the Northern Philippines clearly illustrates this dynamic. The practice of *Alluyon*, or a communal labor system, organizes communities during the intensive seasonal periods. Community members follow shared farming calendars and assist families with agricultural labor, especially when the required labor exceeds the group's original capacity. The host families are expected to provide food to the laborers, and participation by younger generations is encouraged, creating opportunities for knowledge transmission and instilling reciprocity (Paing et al., 2022). This repeated practice institutionalizes cooperation as a social norm, embedding ecological knowledge in their livelihoods and social interactions. This also shows how institutional arrangements may operate through informal rules (rules-in-use), which include socially accepted, mostly unwritten and practiced norms in daily life or formal rules (rules-in-form) those that are written and codified (Yeboah-Assiamah et al., 2017).

Given that ILK encompasses layers of decision-making in various contexts, the Institutional Analysis and Development (IAD) Framework is particularly suited to describing the social mechanisms that interact with ILK in ecosystem management contexts (Dong et al., 2009). As ILK reveals community relationships and interactions with nature (Dudgeon & Berkes, 2003), it is best studied through the framework's exogenous variables, such as biophysical conditions, rules-in-use, and community attributes that influence interactions, negotiations, and outcomes (Polski & Ostrom, 1999).

1.2.3 Social-Ecological Systems and Resilience

Growing recognition of complex social-ecological changes has challenged approaches that treat ecological systems and humans as separate entities (Berkes & Folke, 2002). Empirical studies have enhanced understanding of how communities self-organize and sustain themselves through grounded knowledge and interactions with their environment (Galappaththi et al., 2025; Silva-Ávila et al., 2025).

This shift emerged from the recognition that rigid disciplinary approaches constrained integrated understandings of human-nature relationships (Gómez-Baggethun, 2022), eventually evolving into the concept of Social-Ecological System (SES) suggesting the division between social and natural systems is artificial and arbitrary (Berkes & Folke, 2002) that people and nature are interconnected, which together form dynamic and complex adaptive systems having strong linkages and feedback mechanisms and have thresholds and tipping points (Biggs et al., 2021, pp. 5–7).

Within SES literature, humans and nature are understood as mutually fundamental rather than separate domains. Human behavior, livelihoods, and institutions both shape and are shaped by their local ecological conditions (Chan et al., 2016). Ecosystems offer material and non-material benefits that sustain livelihoods and cultural practices, while communities, in turn, simultaneously influence ecological processes over time through their resource use and management practices (Pecl et al., 2017; Sangha et al., 2026).

This perspective is particularly relevant for understanding ILK as it stems directly from long-term interactions between communities and environments. ILK is reflected in the communities' continued livelihood practices through their continuous observation of ecological variability, interpretation of feedbacks, and adjustments to ecosystem conditions (Lauer & Aswani, 2010). This adaptive character aligns closely with social-ecological resilience. Resilience is defined as the "capacity of a system to absorb disturbances and reorganize while undergoing change to still retain the same function, structure, and feedbacks." (Folke et al., 2010, p. 3).

At the local level, social-ecological resilience is shown in community interactions with the environment, particularly through customary management practices and associated rules-in-use, including informal institutions and norms. Social networks, collaborative efforts, and institutional frameworks support the application and preservation of accumulated knowledge (Olsson et al., 2004). For instance, this is shown in a case study of rice terrace SESs in Northern Philippines, where resilience of ecosystem services is evident in the continuation of rice cultivation and is reinforced by biocultural diversity and cultural practices that are synchronous with cropping season and pest control (Castonguay et al., 2016). Consequently, this also highlights the importance of social learning in the generation and transmission of ILK, as it emerges from collective learning processes in response to ecological changes. This process develops into social memory and incorporates practices that maintain ecological memory, which then defines an adaptive local SES (Nykvist & Von Heland, 2014; Tran et al., 2022).

By examining how ILK contributes to adaptive management, how institutional arrangements shape and transform ILK, and how resilience principles are embedded in current institutional arrangements, my study aims to understand the conditions under which ILK continues to support human-nature relationships in these focal communities in Northwest Panay.

2 Methodology

2.1 Overview

I employed a qualitative research design. The empirical materials are composed of the following main sources: (1) participant observation, (2) key informant interviews, (3) focus group discussions, and (4) co-production of ecological calendars. The knowledge-practice-belief (KBP) complex, conceptualized by Berkes (1999), guided my data collection and helped me to analyze how ILK is expressed in the two livelihoods, while the Institutional Analysis and Development (IAD) Framework, specifically its exogenous variables (biophysical conditions, rules-in-use, and community attributes), informed both my interview questions and analysis of how institutional arrangements shape and are being shaped by ILK.

2.2 Literature review

A semi-systematic literature review of relevant case studies and methodologies was conducted to ensure the study´s alignment with the theoretical and empirical underpinnings of the current knowledge pool on Indigenous and Local Knowledge, social-ecological systems, resilience, and other information relevant to the study´s context. Sources included Scopus, Google Scholar, the Lund University Library, and additional online gray literature. The search strings employed are listed in Table 1.

Table 1. String keywords and databases used for literature review

Databases	Searching string and terms
SCOPUS	(“adaptive ecosystem management" AND “indigenous ecological knowledge”) OR (“ecosystem management” AND “traditional ecological knowledge”)
	(“traditional ecological knowledge”) OR (“indigenous and local knowledge) AND (resource fluctuations))
	(“institutions” AND “ecosystem management”)
	(“ecosystems” AND “human well-being”) OR (“indigenous knowledge” OR “traditional knowledge”)
	(“biophysical conditions” AND “resource units” AND ”adaptive capacity”)
	(“institutional analysis” AND “ecosystem management” AND “indigenous ecological knowledge”)
	(“community attributes” AND “institutional arrangements”)
	(“ecological calendar” AND “traditional ecological knowledge”)
	(“social-ecological systems” AND “resilience”) OR “social-ecological resilience”)
	(“indigenous and ecological knowledge” AND “resilience”)

	(“indigenous and local knowledge” AND “erosion” OR “persistence”)
	(“indigenous ecological knowledge” AND “social memory”) OR “traditional ecological knowledge” AND social memory”)
Google Scholar	Ostrom AND institutional analysis
	Thematic analysis AND methodology
LU Library Databases	Institutional analysis and development framework
	Thematic analysis AND methodology
	Social-ecological resilience
	Adaptive ecosystems management
Web search	Thematic analysis AND methodology
	Indigenous ecological knowledge and practices in the Philippines
	Mariit, Mari-it, Panay Island
	Northwest Panay, Libertad, Antique, Philippines

2.3 The communities

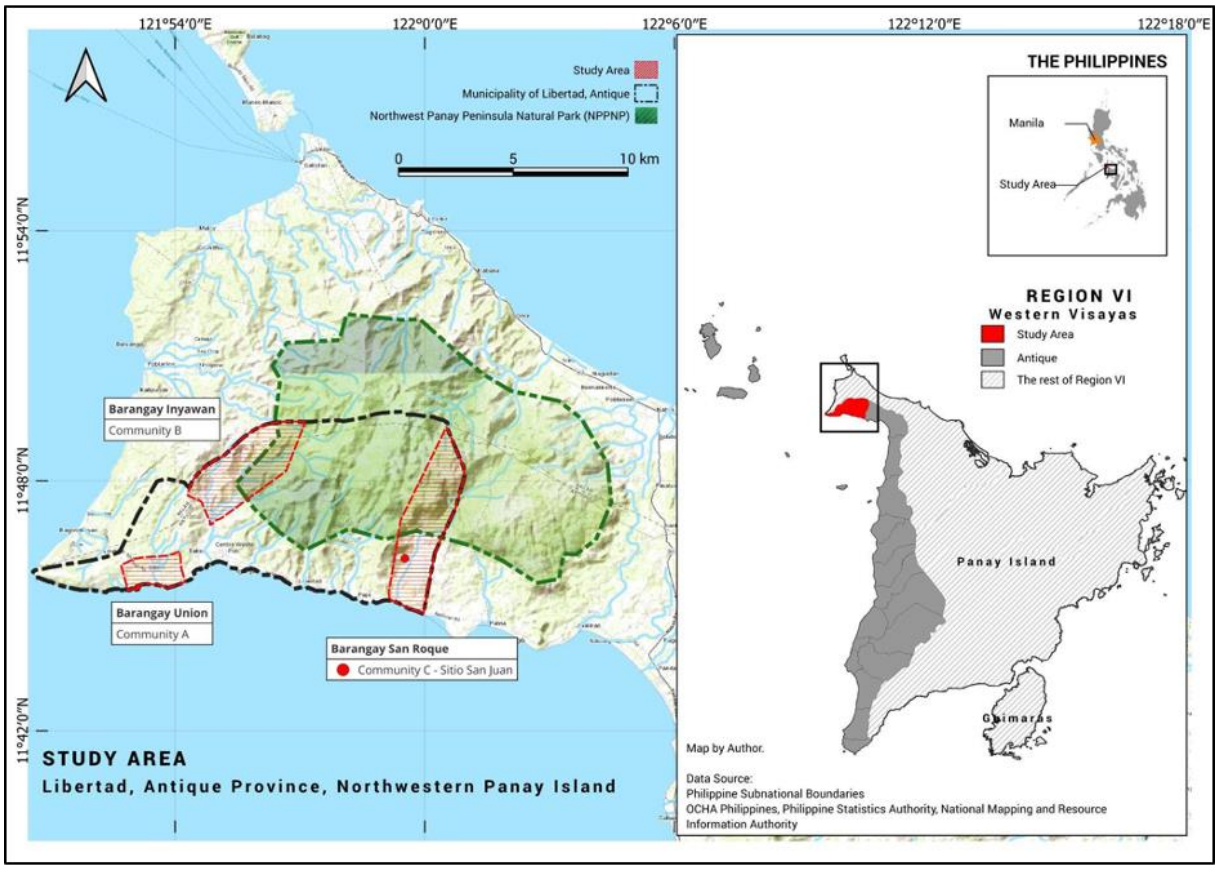

Figure 2. Map of Northwest Panay Island, The Philippines.

The map highlighted in red shows the three study areas, Barangay Union, Barangay Inyawan, and Sitio San Juan in Barangay San Roque in the Municipality of Libertad, Antique Province. Meanwhile, the Northwest Panay Peninsula Natural Park is demarcated in green. Map by the author.

Libertad in Antique Province is a fourth-class municipality located at 11°46' N and 121° 55´E in Northwest Panay Island. It has a population of 17,507 (*Libertad, Antique Profile*, 2026). The Barangay communities selected for the study were selected based on their active livelihoods associated with natural resource use in proximity to the Northwest Panay Peninsula Natural Park (NPPNP) as shown in Figure 2. Barangay is the lowest government administrative unit in the Philippines, and sitios are territorial enclaves within the barangay that were established for organizational purposes and without administrative functions (Porio & Roque-Sarmiento, 2019). The predominantly spoken language is Kinaray-a, a recognized Philippine regional language (Casalan & Dita, 2022) with a specific dialect close to Pandananon (Rentillo, 2025). Filipino (Tagalog) and English are used as lingua franca and working languages.

The following barangays: Barangay Union (Community A), Barangay Inyawan (Community B), and Sitio San Juan (Community C) were labeled for analytical and organizational purposes of the study. The Indigenous Peoples in the communities were also present, namely the Ati and the Panay Bukidnon. Barangay Union is a mixed subsistence community with an active traditional weaving association/group. The main livelihood in the area is traditional mat weaving and sea fishing. Likewise, Barangay Inyawan is a mixed subsistence community located between two intersecting rivers. The main livelihood is agricultural (notably rice) farming, but the community still tends to have traditional mat weaving and shrimp fishing as other livelihoods. Sitio San Juan is a hinterland community located approximately closer to NPPNP. Shrimp fishing is one of their main subsistence livelihoods.

Because the technical requirements of the Protected Area Management Board (PAMB), which is administered by the Philippine Department of Environment & Natural Resources (DENR), take a long time to meet, I focused instead on communities and their resource areas outside the demarcated protected area. The local Barangay offices and the municipal government were informed of all visits in advance. A local guide accompanied all field visits in each community, and a hired project assistant assisted with interview note-taking and coordination with local authorities.

2.4 Identification of KII/FGD Participants

Research participants were selected using a combination of purposive and snowball sampling methods. 48 participants were involved in the study, including 19 *Bariw* users, and 27 shrimp fishers. Two were interviewed as representatives from the Barangay council, although they claimed to be former shrimp fishers. Criteria for invitation included participants who depend on or have depended on either *Bariw* use practices or freshwater shrimp fishing, or both, and have lived in the community for at least 10 years. Participants under 18 years old were not considered because of the additional ethical and legal layers for participation, which would not be optimal for the fieldwork's limited time. Key Informant Interviews (KIIs) involved one-on-one conversations while Focus Group Discussions (FGDs) involved group discussions or small group interviews, often involving only 2-3 people. During this process, I did not distinguish between nonindigenous and Indigenous community members since their self-identification of community membership was arbitrary, and the traditional belief systems and practices in the communities, based on my own observations, were closely related, so it did not require a necessary rigid distinction for the context of this study. Nevertheless, I acknowledged their self-identification as an Indigenous Peoples (IPs) in sharing their demographic information. This decision is further elaborated in my positionality statement in Appendix C.

2.5 Data co-production process

Table 2 provides an overview of the 42 field visits we conducted between January to March 2026 across the communities. The primary aim of the field visits was to immerse myself in the communities, observe the livelihood activities, familiarize with the context of the resource system or the ecosystem, and help co-identify factors that influence the provision and production of the goods and services that support their livelihoods. I combined Participant Observations (POs) with informal community immersion visits and transect walks, specifically involving observations on livelihood demonstrations, visiting livelihood activity sites, and natural conversations with participants. POs were conducted before any semi-structured interviews, with significant time devoted to them. This approach was designed to facilitate deeper immersion in the community's social relations, attitudes, and behavior in a local area (Jorgensen, 2020). Questions during POs were about the local ecological knowledge and observing their demonstration of resource management practices and systems; these are documented in Appendix D.

KII questions were adapted from Ostrom's IAD typology in rules-in-use, to understand the rules, practices, and informal rules, norms, and taboos they follow in their livelihoods and resource management. FGD questions inquired about their experiences with their livelihoods, ecological knowledge, beliefs, norms, and resource-use practices. These questions can be found in Appendix B. All interviews, including the community workshops for the ecological calendar, were informal, natural conversations in Kinaray-a, accompanied by a community guide and the project assistant, to avoid any researcher-influence on participants' responses (Hammersley & Atkinson, 2019).

All questions were posed verbally in Kinaray-a. Prior consent was obtained from the participants to digitally record and note taking of personal information, such as age and formal educational attainments, and all key conversations. The data was manually transcribed and was stored in a shared Word document, accessible only to me and the project assistant. For data protection and confidentiality, all research participants were assigned an identification code. Unintelligible parts were discarded due to audio disturbances or overlapping voices during FGDs and KIIs. The project assistant and I are both fluent in the language used by the participants. An English version of the printed consent form can be found in Appendix A.

Table 2. Number of field visits per community (January-March 2026)

	Participants Observations (POs)	**Key Informant Interviews (KIIs)**	**Focus Group Discussions (FGDs)**
Community A	5	7	4
Community B	2	10	2
Community C	1	7	4
TOTAL	**8**	**24**	**10**

2.6 Co-production of Ecological Livelihood Calendars

An approach to better illustrate a community's close observations of nature and their livelihood is to co-produce an ecological calendar. Ecological calendars are knowledge systems that illustrate social memory of context-specific relationships over time, reflecting communities' ability to respond to seasonal and environmental changes (Cochran et al., 2016; Kassam & Bernardo, 2022).

We co-produced two ecological calendars in Barangay Inyawan and Sitio San Juan. Participants who identified as direct resource users were invited to participate in the workshop, and verbal consent was obtained. Two separate sessions addressed two distinct livelihood groups. Calendar months were labeled using Spanish loanwords and English. Participants described observed weather patterns, livelihood activities, and ecosystem changes for each season. Illustration materials were provided, and both the project assistant and I guided the participants throughout the process.

2.7 Data Processing and Analysis

A process of abductive thematic analysis was applied. Thematic coding involves identifying, reviewing, and analyzing patterns and themes within the qualitative data (Braun & Clarke, 2013). Data from participant observations, key informant interviews, and focus group discussions were transcribed from their original language (Kinaray-a). All qualitative data were anonymized and were assigned labels based on field visit date (month, day), activity (PO, KII, or FGD), and participant codes, a database was created using Google Sheets, accessible only by me and the project assistant. A thorough familiarization process followed, using recorded audio to verify transcription accuracy and ensure contextual integrity. Abductive coding approach was then used, involving iteratively reviewing between qualitative data and existing theory to develop or refine conceptual frameworks (Vila-Henninger et al., 2022). Codes were generated separately for the two livelihoods under the study. Coding criteria and analytical memos were co-developed with the project assistant to guide the process.

The dataset underwent a two-stage coding procedure. Initial manual coding was conducted using Google Docs, followed by a second round of coding in MaxQDA to have a more systematic qualitative analysis. Codes were subsequently organized into thematic categories based on the knowledge-practice-belief complex by Berkes (2017). Codes that did not align with predefined categories were further reviewed and were reassessed. Finally, codes were weighted by frequency, and similar codes were consolidated according to thematic alignment. The resulting subthemes used to code the qualitative data are presented in Appendix E.

2.8 Ethical Considerations

I followed the principles of Gender Equality, Disability, and Social Inclusion (GEDSI) during the data collection process to ensure that participants would have fair and equitable engagement in the research process and avoid reproduction or exacerbation of existing structural and systematic inequalities (Niaz & Rose, 2025). Both verbal and written informed consent were obtained from participants in POs, KIIs, and FGDs, and were communicated using Kinaray-a. The consent included information on the nature and purpose of the research project, the people involved, and the assurance of anonymity. It also covers their voluntary participation and right to withdraw at any time without any consequences, and the expected outcomes of the study.

Coordination was made through the municipal government and the other customary leaders of the community to establish informal courtesy. Field visits were conducted in close coordination with their offices. Interviews and POs were also conducted in accordance with the ethical guidelines prescribed by Lund University's Faculty of Social Sciences and the Swedish Research Council. My positionality statement for this study is provided to ensure transparency throughout the research process and is included in Appendix C.

3 Results

3.1 Demographic data

In total, 48 participants from three communities collaborated in the study. Most of them classify themselves as *Tumandúk (*referred to as a person born and raised in the same place). 90% (n = 43) of the participants declared that they had lived in their communities for more than 21 years. All of them (n = 48) shared that their livelihood is their primary source of income. The age range for women is 33-75 years old ($\bar{x}$ = 55 years) and 26-84 ($\bar{x}$ = 56 years) for men. Knowledge acquisition data were based on normative questions asking participants how many years since they first started learning the livelihood. Formal educational attainments were also collected to better understand the social positions and their lived experiences with livelihoods. Table 3 shows detailed demographic data.

Table 3. Demographic data of participants

	Community A	Community B	Community C
	Barangay Union	Barangay Inyawan	Sitio San Juan, Barangay San Roque
Gender			
Woman	12	8	11
Man	2	7	8
Total	14	15	19
Age			
18–35	1	0	1
36–59	7	7	14
60+	6	8	4
Formal Education			
No formal education	0	1	0
Primary	4	8	5
Secondary	6	6	13
Certificate/Diploma	2	0	0
Degree Holder	2	0	0
Main Income			
Freshwater shrimp fishing	0	6	17
Bariw harvesting/weaving	11	9	0
Farming	0	0	0
Other	3	0	2
Knowledge Acquisition			
Since childhood	9	3	4
More than 40 years	2	10	10
More than 20 years	2	2	4
Less than 10 years	1	0	1

3.2 Livelihoods

ILK is an accumulated knowledge transmitted over time and consistent with local observations of the environment. *Bariw* use and shrimp fishing were selected as primary focus because they remain important as subsistence livelihoods and clearly demonstrate intergenerational ecological knowledge and close interactions with the local ecosystems. Although rice and coconut farming are also practiced within the communities, they were not prioritized in the study because some of the emerging farming

methods such as mechanized rice cultivation were considered less relevant to the study´s focus. Nevertheless, these livelihoods remain interconnected through shared social mechanisms and collective responses to social-ecological changes. Such interactions are mediated through livelihood practices, remembered through social mechanisms such as informal institutions, norms, and taboos, and internalized through culture and heritage (Vergotine et al., 2025). I documented the layers of ILK including ecological knowledge, its application as resource management and practices, informal institutions (considering rules-in-use, taboos, and norms), actors and networks involved, and worldviews and belief systems associated with them. However, I observed that these layers are not rigidly separated, as they frequently overlap and interact in practice.

Figure 3. Livelihoods and their resource units that were investigated in the study

Note. Bariw harvesting and freshwater shrimp fishing are two livelihoods that are associated with Indigenous and local knowledge systems. (1) A participant demonstrates the *pagriras* method of harvesting the *Bariw* plant. (2) The weaving of a bag from dried *Bariw* leaves. (3) The crafting of a *Ta-ûn*, an indigenous shrimp trap made of bamboo. (4) A sample of the shrimp caught with the Indigenous name, *Piripihún*. Images provided by the author.

3.2.1 ILK associated with Bariw use

Bariw use practices were documented in Barangay Union and Barangay Inyawan, with a focus on the processes of harvesting, processing, and weaving *Bariw* (*Benstonea copelandii*), a shrub endemic to the Philippines (Callmander et al., 2012) as shown in Figure 3 (1) and Figure 5 (1). The plant is a major

source in traditional weaving particularly in the production of *Banig*, a traditional mat commonly used in the region (Redison, 2025). The majority of *Bariw* are sourced from family-owned and ancestral lands, as well as semi-managed areas in lower- to mid-level forests outside the NPPNP.

The weavers and harvesters, referred to as Bariw users in this study, follow management practices and norms informed by accumulated and transmitted ecological knowledge. Participants demonstrate understanding of ecological factors, including species identification, taxonomy, growth and development, habitat dynamics, and environmental conditions affecting Bariw quality. Consequently, B*ariw* groves in the communities were often planted and are naturally regenerated. The plant reaches 3-9 meters in height, it favors limestone or volcanic soils and often tolerates peat and swampy areas (Callmander et al., 2012). Participants are familiar with the process of resource reproduction. *Bariw* is a dioecious species, and both male and female plants produce a cylindrical fruit composed of multiple drupes containing seeds (Tropical Plants Database, n.d.). One participant described this process:

> "Bariw does not necessarily need to be planted since it will bear its own fruit. We don't harvest that fruit anymore. It will just spread its seeds around the area, and it will grow" (P-A-07, 02.12-FGD).

Participants also shared that when planting, the use of *Tagád,* or wooden stakes, is practiced as a norm, as it is believed to produce more pliable leaves for weaving. Additional management practices include trimming the plant's leaves, maintaining patch vegetation, and leaving some leaves to support regeneration. According to participants, *Bariw* reaches maturity for harvesting after three years. Several participants also reported a preference for harvesting *Bariw* in riparian groves. These individuals select groves based on quality, prioritizing characteristics such as leaf pliability and ease of use:

> "But it is always better [to harvest] near the river because the leaves will be crisper and softer when we use them. Those [*Bariw* groves] near the river and areas shadowed by larger trees, *Bariw* leaves are crisper there..."(P-A-07, 02.12-FGD).

Participants also reported that, on occasions, the plants exhibited signs of infestation by unidentified pests. These pests were characterized as unidentified minute entities that had a detrimental impact on plant health and growth, as evidenced by changes in leaf color, quality, and length. The practice of cutting infected plants or branches is a norm of livelihood to prevent the spread of infestation in the grove. Pests were observed to target the plant's core.

Figure 4. Ecological calendar for *Bariw* harvesting.

Note. Ecological Calendar for *Bariw* use practices. Months are labeled with Spanish loanwords in Kinaray-a. (A) *Bariw* illustration shows active harvest with the onset of cooler, dry months from January to May. (B) Cutting and slicing leaves occur for sale or drying. (C) Stocks of *nilikid* are prepared. (D) The sunny, dry season is illustrated. (E) *Bariw* products such as banig, hats, and bags are crafted year-round if *nilikid* stocks are available. (F) The illustration shows the wet and typhoon season. (G) The transition from the wet/typhoon to the dry, cooler season is depicted. (H) Increased river water levels and flooding from wet, typhoon season rains are shown. (I) Rice farming is presented as an alternative livelihood during the wet season.

Most participants indicated that *Bariw* does not adhere to a fixed harvesting schedule and is accessible year-round, as illustrated in the ecological calendar in Figure 4. However, participants tend to avoid the wet and typhoon season, which typically extends from June to November. Participants reported that wet leaves can cause skin irritation. Leaves are required to be dried before use during the dry season, and processing bundles of dry leaves, called *nilikid*, is done afterward. It is then gradually beaten with a wooden club called *sampok* against a flat stone, a process called *pagpalpag*, and repeated several times before the dried leaf is stripped into smaller pieces for weaving. Participants shared that it is a critical step and must be done in cool, shaded areas. This task is also often performed as household work or communally under large tree groves or in a local stalagmite cave (shown in Figure 5 (3)), where participants attribute the cave's cool temperature in maintaining the quality of the dried leaf for processing and weaving. However, if this is not possible, weavers use wet, cool towels to cover

it. Weavers shared that they often save bundles of *Nilikid* for the wet season, serving as an alternative subsistence livelihood during the first months of the wet season.

Figure 5. Resource use practices and management in *Bariw*

Note. (1) A *Bariw* grove located on ancestral property. (2) A wooden shredder with a small blade is used to separate the dried *Bariw* leaves into strips. (3) A stalagmite cave known as *Gi-ëb it Ati* (Cave of the Ati) is a customary site for communal weaving among Indigenous and local (non-IP) communities, which occurs during the dry season. (4) Finished bags woven from *Bariw* leaves are sold by weavers into the market. Photos provided by the author.

Bariw use is reinforced through social mechanisms. Harvesting is determined by property ownership, or the vegetation planted on land by the person. A planted *Bariw* grove is referred to as *Pû-na*, and property inheritance is often passed down through generations within the same family, reinforced by ancestral or formal property ownership rights. Figure 5 (1) shows an example of an ancestral *Pû-na,* claimed by the Indigenous Ati tribe in Barangay Union. In some cases, temporary harvesting rights are established through an informal arrangement, called *Agsá*, a verbal agreement between the property owner and the individual who will be harvesting the crops. The harvester is entitled to receive either half or two-thirds of the harvest, measured in *Si-ak*, a customary unit counting 30 *Bariw* leaves. The landowner receives the remainder in kind (raw or processed *Bariw* leaves, or a finished product) or in cash. Alternatively, an individual may engage another person to harvest their plants in exchange for a

portion of the harvest. *Agsá* is also observed in local rice farming. Participants emphasize that this livelihood norm is predicated on mutual trust. A participant described this as follows:

> "Yes, we help [the person doing *Agsá*]. Most of the time, people still ask for permission to do *Agsá* in our *Bariw,* I just say, yes, do it… We don't have any misunderstandings since we have an abundance of them [*Bariw*] here" (P-A-06, 11.02-KII).

Unlike rice farming and shrimp fishing, *Bariw* use does not follow strict customary restrictions or harvest taboos. However, participants shared that certain planting must be observed. A *Tagad* is any wooden stake used to dig shallow planting holes. They shared that using *Tagad* enables the plant to produce pliable leaves. Participants believe that using steel rods results in rigid leaves of low quality.

Since 2000, Libertad, Antique, has been the only municipality in the region to formally institutionalize its *Bariw* use traditions, which are culturally internalized through its annual celebrations (Municipality of Libertad, Antique, n.d.). Local weaving associations were formed in every Barangay, but the activities vary widely. In response to market demand over the past few years, *Banig* weavers diversified their product offerings to include bags, kitchen accessories, and hats as shown in see Figure 5 (4). The primary actors involved in these livelihoods are local weavers organized under LIBAWFED (Libertad Bariw Weavers Federation), a social enterprise that facilitates coordination among other local weaver associations, local harvesters, and product buyers (Dioso, 2025). The harvesting process is meticulous and requires the collection of only fully mature leaves.

All participants acquired their knowledge by observing community elders, parents, and grandparents, and by participating in demonstrations of weaving transmitted through intergenerational knowledge and ancestral heritage. However, communal weaving, called *Hil-o-anay,* is no longer practiced. A participant reminisced about it as follows:

> "My mother used to schedule *Hil-o-anay* back in the day. We usually do it in turns, but we don't practice it anymore. When it was my mother's turn to do the *riras* [leaf processing], they would plan their turn; they would group themselves again. It is like community work; it was enjoyable, we got together and learned how to weave, now it's no longer practiced, and we usually just purchase the dried ones." (P-A-07, 02.11-KII).

Participants also attributed market changes to the decline in communal weaving. Demand in weaving was concentrated mostly in modified products such as bags, purses, and hats, which turned *Bariw*

into an individual subsistence livelihood and are organized through often loose community weaving associations, supported by the municipal government through training programs and funding.

Participants also shared their personal experiences of the impacts of climate change and weather variations on their livelihoods. Despite the absence of explicit mention of a conceptual or scientific understanding of climate change in the definitions employed during the discussions, the participants offered descriptions of perceived changes in weather patterns and phenomena. The preferred harvesting season generally extends from January to May. However, participants acknowledged that typhoons and extreme drought had a detrimental impact on their harvesting and weaving routines. For instance, an elderly participant shared the following:

> "Yes, it's different than before. Back in the day, if we said it was summer [dry season], it didn't normally rain; it just got hotter. Nowadays, if we say it's summer, it rains, and tropical storms come. It's really different… we cannot harvest and dry our *Bariw* leaves in this case" (P-A-03, 02.02-PO).

3.2.2 ILK associated with Shrimp fishing

Freshwater shrimp (*Macrobrachium rosenbergii*), or locally referred as *Urang*, remained a main source of subsistence and income in Barangay Inyawan and Sitio San Juan. This livelihood relies on accessible rivers (*subâ* or *mayor*) and streams (sapâ), which are collectively viewed as a common resource by each community. The local term for shrimp fishing varies between the two communities and is referred to as either *pagapanagûb* or *pagpanagûn* although there is no significant difference in the livelihood or methods.

Shrimp fishing tends to exhibit wider ecological knowledge among participants who have knowledge of species, taxonomy, behavior, habitat dynamics, spatial distribution, life histories, and changing ecosystem conditions. The knowledge of taxonomy is not related to scientific ecology; however, participants referred to them in their Indigenous names as illustrated in Figure 3 (4). Practices are also guided by knowledge of shrimp´s behavior, local spatial distribution, and habitat. For instance, participants shared that they prefer to fish in areas they regard as *Linaw*, referring to the still and deeper parts of the river where shrimps often live. They also avoid *Dûgsanan,* referring to shallow areas of the river with no large rocks, which is used to identify areas where shrimps are scarce. Participants also use indigenous Kinaray-a directional systems when navigating through the river and the riparian areas, using the word *Iraya* referring to the upstream flow or the higher areas and *Ilawod* referring to the downstream or the lower areas, generally pointing to the sea (Gallego, 2018).

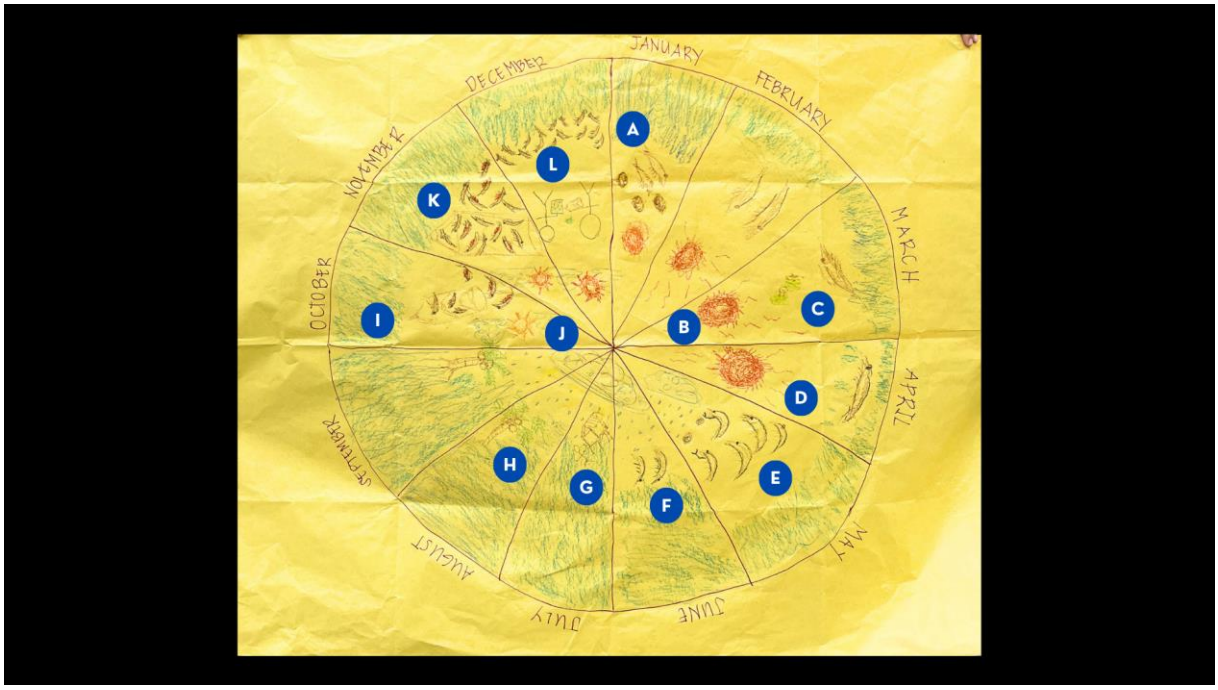

Figure 6. Ecological calendar for shrimp fishing

*Note. A*n ecological calendar for shrimp fishing. The calendar months are labeled in English. (A) The peak of shrimp fishing occurs at the start of the dry, cooler season. Rotten coconut meat, shown as a coconut, is used as bait. (B) The sun begins to expand, and the months that follow demonstrate their experience with hotter temperatures throughout the dry season. (C) The amount of shrimp catch is shown to be minimal due to the decreasing water level. Algae growth in the river is also illustrated. (D) The dry season is at its peak, and shrimp fishing is at its lowest. (E) Wet season is shown, and the rising river level helps increase the amount of shrimp caught. (F) The shrimp catch decreases due to flooding caused by increased rainfall. (G) Destroyed houses illustrate the start of typhoon season. (H) Coconut farming illustrates an alternative livelihood during the wet, typhoon season. (I) The river's water level returns to normal, and the breeding season is illustrated by berried shrimps, which fishers separate from their regular catch. (J) The sun illustrates the transition from the wet, typhoon season to the dry season. (K) Berried shrimps are illustrated in November, perceived as the breeding season and the best time for fishing. (L) The best shrimp catch and highest sales of shrimp-related livelihoods occur in December, coinciding with the Christmas holiday season.

In Figure 6, participants shared their knowledge of the shrimps' breeding season, which occurs between October to November, guiding their fishing activities. One participant shared this knowledge as follows:

> ". …and we observed that, we can see those observations in a place, why there are many shrimplets over there, why shrimps are more abundant in an area even if there is no water stream.” (P-C-13, 03.23-KII).

Figure 7. Shrimp fishing practices and fishing areas

Note. *(1) Ta-ûn*, an Indigenous shrimp fishing trap. (2) An improvised *Ta-ûn* using plastic materials, frequently seen in Sitio San Juan, (3a) and an Indigenous shrimp trap with its *Garaw* (trap opening) and (3b) its *Paran-an,* which is the catch opening. (4) Participants show a previously abundant fishing spot that was altered by rock debris and boulders due to massive flooding brought by a typhoon in November 2025.

Shrimp traps used are locally known as *Ta-ûn* and are made from locally sourced materials such as *Ban-ban* (*Donax cannaeformis*) or *Patong* or Bamboo (*Dendrocalamus latiflorus*). An example of a *Ta-ûn* made of *Ban-ban* is shown in Figure 7 (3a and 3b). The process of weaving an indigenous *Ta-ûn* is passed down through generations through observation and demonstration by parents or grandparents. Depending on the community, the indigenous *Ta-ûn* has an average length of 60-86 cm. However, plastic materials, like 1.5-liter plastic bottles, are increasingly being used as well. Participants find that plastic materials, such as 1.5-liter or 10-liter PET (Polyethylene terephthalate) bottles, are more durable and easier to use. Some reported they use a soldering iron to make narrow holes that allow smaller shrimp to escape. Plastic *Ta-ûns* are vulnerable to being washed away during flooding or heavy rainfall because they are lightweight. They also shared that the use of indigenous *Ta-ûns* declined in the past years because of the difficulties in maintaining it, which deteriorates after six months of repeated use. However, this practice was innovated by participants from Sitio San Juan, who used revolved plastic mesh screens tied with nylon ropes and traps measuring roughly less than 9-12

cm in length. Trap ownership also varies per shrimp fisher with the most common responses around 20-30 traps.

Knowledge of shrimp behavior is reflected in baiting practices. Rotten coconut meat as bait traps is a common practice that influences harvest quantity. Bait quality is based on its strong odor; some participants shared that they grill the coconut bait before use. The meat is left out overnight and then used the following day. The bait is then changed daily or at most after three uses. The openings of the traps are placed in the direction of the *Ilawod*. This can also exemplify a close interaction between land uses and water, using sustainable practices demonstrated using other agricultural products and their close links to land-based livelihoods.

Selective fishing is practiced by creating trap holes and openings that are narrow enough to allow shrimp and other small shrimp to escape, thus allowing for resource reproduction. The same practice involves leaving caught berried shrimps (female shrimps carrying fertilized eggs) in the trap for longer periods of time (hours or often days) to allow egg dispersal. Most participants shared that they typically release the berried shrimps and the smaller ones. Smaller shrimps are not seen as commercially valuable since buyers mostly buy larger ones, so they are released. One participant described it as follows:

> "We release them [shrimplets, smaller shrimps], and the berried ones, we separate them because we know they often disperse their eggs naturally." (P-C-02, 02.20-KII)

Spatial knowledge of the river seems to influence the preference for fishing spots. Shrimp fishers from both communities often refrain from fishing upstream, knowing that shrimps will eventually flow downstream. However, during the dry season, when the river water is low, some shrimp fishers move upstream. Good fishing spots often can be near a large rock or a large native tree. A participant described as follows:

> "We usually put the traps over areas with larger *linaw* [deeper pools]. We know there are abundant shrimps there. We put the traps on the side…The *dugsanan* [shallow pools] does not have much [shrimps or fish], it is very different in areas where large trees are around" (P-B-07, 02.20-KII).

These practices are sustained through intergenerational transmission of knowledge, often passed down within families or other community members. Some participants shared that their knowledge was acquired through self-learning, communal exchange, adapting methods from neighboring

communities, and even through social media. Also, shrimp fishers continue to practice *Pangatas*, a communal work that involves constructing temporary dams or reservoirs by rearranging river rocks and gravel and is often joined by the younger members of their communities. It is typically done during the dry season, when lower water levels make it easier to trap shrimp and fish. The practices were also documented in other parts of Northwest Panay (Maliao et al., 2023).

Norms and taboos are also prominently documented in the practices. Participants shared that some of these practices are no longer observed due to their perceived irrelevance to the number of catches. One example is *Paarangyan,* where indigenous shrimp traps and their bait are smoked with "*Kamangyan,*" an incense made from the dried resin of native rainforest trees. However, most norms around shrimp fishing and consumption are reinforced by a taboo concerning *Angël*, the consequence of violating the taboo is described as an unexplained illness (described variously from stomachaches to skin diseases or neck twisting) affecting the individual or community. The taboo prohibits roasting, burning, or littering the *Lukaba* (shrimp shells), especially in the river. It is also applied when cooking shrimps, by making sure that the soup should not overflow, called *Pagsubó*. Participants shared that *Angël* can only be cured through a ritual called *subó-subó,* which is encircling the victim with a burned K*amangyan* (incense from a tree resin). Although some participants shared that they stopped the practice since there is no perceived difference in their catches. The act of harming or abusing the river (or any natural resource) is referred to as *Halit* and is used to describe when taboos are violated.

Mariit, an indigenous worldview in Panay Island, significantly influences the areas where participants leave their traps. Magos et al. (1994) and Zayas (2019) describe *Mariit* as any natural environment that generates a sense of danger and reinforces a deep sense of respect for the unknown. *Panabî-tabî*, an act of seeking permission, is often performed orally when entering *Mariit* areas. Some of these norms are summarized as follows by participants:

- When doing the shrimp catch, one should be silent or avoid talking loudly.
- Always ask permission to the "unknown" when entering the areas by saying "*Tabî-tabî pô*, *ma-agi kami*" (To the beings of this place, please let us pass).
- Avoid large and old trees near the river since they are inhabited by the *spirits or the unseen,* referred to as *Mga Tag-lugar (*beings of the place*)* or *Tawo sa Talon* (People of the Forest).

Mariit areas also appear to function as customary reserves. Participants shared that the shrimps in these areas are more abundant and larger in size, often located in the upstream areas, and are difficult to access because of its geographical distance from the communities. It is also perceived to be legally

restricted because they are situated inside the NPPNP protected area. Shrimp fishers see local rivers and streams as a common resource, and outsiders are prohibited unless they conduct *Halit,* connoting prohibited fishing activities, such as poison (use of agricultural insecticides) or electrical fishing. Participants attribute the decline of shrimp catches to these activities and recognized as illegal by authorities. .

There is no formal organization or association among shrimp fishers in both communities; participants appear to identify all the fishers in their respective communities. Information and knowledge are exchanged during daily conversations, and whenever they group and look for areas in upper streams where they can leave their traps. Relationships among shrimp fishers are based on familial connections or shared community membership. Because of this, the resource use conflict associated with shrimp fishing is very minimal. Participants shared that if there are instances where conflict occurs, management is preferably through informal agreement, done by voluntarily yielding spots for others. All participants shared that they prefer informal ways to resolve a conflict rather than bringing it to the Barangay. Exclusion of resource use extends to the sense of community membership and stewardship of the resources. Participants described it as follows:

> "... .Because for me, if we can negotiate anything in the hinterlands, then we shouldn't have any problem, and there's no need to bring the issue to the Barangay, because if you do that, it's a little embarrassing. If you can just talk about it with the person, then it's much better." (P-B-07, 02.20-KII).

> "We don´t discuss anything else, sir. As long as we see that there is something already [someone left *ta-ûn* in the river], we usually just move somewhere further … even when I was young, I never heard someone having a conflict by competing for a spot to catch shrimps, because everybody here understands each other, when someone got that spot first, then you should move somewhere else." (P-B-08,02.26-KII).

The Barangay serves as the final option for both communities if conflicts cannot be resolved informally. However, regulation and sanctions are left to the Barangay or the local DENR enforcement office, which characterizes the presence of cross-scale institutions in both communities. This regulation, however, dominantly follows formal policies rather than considering customary norms and other informal institutions when it comes to resource management. Participants from the

Barangay council shared that there are no local ordinances to help monitor shrimp fishing or consider *Mariit* areas in environmental planning.

Knowledge of changes in the resource and its related ecosystems, however, was also observed by both communities, especially with a significant decline in shrimp catches. Some shared that catching one kilogram only requires one night and one *Ta-ûn*, and now it takes them an average of two to three nights to obtain the same amount. They also highlighted that the extreme weather variations experiencing heavy rainfall, typhoons, and extreme droughts, have become more intense compared to previous years. A participant described as follows:

> "…definitely, we experience the impacts of the typhoons, like for example, we leave our traps when we think that the weather is good, suddenly, if the rainfall pours heavily at night, all of our traps are gone. Just like last time, the weather was fine, but suddenly it changed. I went to *Idlongon*, 10 of my traps were washed away. The river floods were so strong, some of my traps even got badly damaged, I only have 23 left out of my 32 traps." (P-C-10, 02.25-FGD).

3.2.3 Worldviews and belief systems

Worldviews and belief systems collectively constitute the expectations and perceptions of community members, and it reinforces institutions that then reinforce practices (Nurdin & Jamaludin, 2024). Analysis of the interview data revealed no significant differences in worldviews between the two livelihoods, which exhibit relevance with the Panay-Guimaras traditional knowledge system, a compiled framework of worldviews, practices, and beliefs documented in the cultures of the islands of Panay and Guimaras (Ramirez, 2024).

Prominent subthemes include *Kaginhawa-an*, a worldview that embodies holistic well-being, or ease of life (Samaco-Zamora & Fernandez, 2016); fatalism; the reciprocity with nature and its recognition as an entity (*Kinaiya*); *Malasakit,* the concept of care for a shared identity or *Kapwâ*; and optimism. These concepts can be found in many Filipino value systems (Cervantes, 2025).

Furthermore, participants associate *Bariw* plants with ancestral heritage and land stewardship, and therefore, the *Bariw* groves are abided by mutual respect through *Malasakit*, considering weavers regard their livelihood as a significant means for income. Interview data also shows persistence and

valuing the livelihood, a trait that patterns with *Kaginhawa-an*, which is shared by a participant through the following:

> "This livelihood was the reason why I was able to send my children to school…*Bariw* and *banig*, those raised my children…" (P-B-05, 02.20-FGD).

Shrimp fishing has similar attributes. Local rivers and streams are a source of livelihood, which reinforces a sense of communal stewardship among participants. A deeper sense of stewardship lies in the taboos associated with shrimp fishing and use. The fear of *Angël* and the observance of *Mariit* indirectly constitute a belief that sees the rivers as an entity. People with stronger *Dûngan*, an indigenous concept of soul, spirit orenergy, are perceived to be less vulnerable to hexes by the evil spirits or by the *Tag-lugar* (beings of the place) believed to be inhabiting *Mari-it* areas. In addition, some interviews appear to be marked by a pervasive fatalistic attitude, as illustrated by a tendency to rely on chance or indirectly, often tolerate mistreatment of the rivers in avoidance of conflict.

3.2.4 Exogenous drivers affecting ILK practices

Qualitative data initially coded as uncategorized were later organized within themes, revealing several contributing factors to the erosion and changes in ILK within the communities. Although ILK practices in both *Bariw* use and shrimp fishing continue to reflect adaptive reactions to changing social-ecological conditions, participants shared that these practices are increasingly affected by multiple exogenous drivers, including government policies, market forces, socioeconomic pressures, and changing physical and material conditions.

The first identified driver was the legacies of formal institutions and governance, which may have altered customary property regimes and access to resources. Participants shared that traditional concept of land ownership was previously based on vegetation planted or claimed, frequently marked by large trees and plants. In *Bariw* weaving communities, harvesting practices are now largely determined by land ownership, and access to ancestral *Bariw* groves is often restricted because they are located within the protected area. These restrictions also affected customary land-use practices such as *kaingin*, a shifting-cultivation method where felled trees and other vegetation are cleared through the "slash-and-burn method" (Calitang & Orpiano, 2023). As a result, many communities shifted in how they maintained their privately owned *Bariw* groves. Similarly, participants from shrimp fishing communities shared those recent environmental policies limited their access, not only to their customary shrimp fishing grounds, but also to their other livelihoods, such as coconut farming and forestry, for which they have acquired knowledge and practice from their elders.

Recent government policies also contributed to the disengagement of some *Bariw* users from their livelihood. For instance, participants shared that some households stopped *Bariw* weaving and became dependent on government aid (they referred to as *ayuda*) or financial support from their children employed in urban areas.

Market forces and economic needs were also identified as contributors to changes in shrimp fishing. Participants shared that the high market value of shrimps, where a kilogram may be relatively aligned with the local daily minimum wage, has intensified fishing activities and attracted outsiders, who are attributed by participants with overexploitation, illegal fishing, and trap theft. Monitoring is perceived as difficult and costly since theft and illegal fishing often occur at night. Participants also further shared that poverty, and socioeconomic pressures compel many households to exploit river sources for daily means. One participant described this shift as follows:

> "...The elders back in the days caught shrimps for food subsistence, for their usual meals, and they did *Atas.* They just caught it as usual. Today, it is different, since we need money, of course, we catch shrimp so we can earn for our daily means." (P-B-07, 02.20-KII).

These livelihood transformations are also closely linked to ecological degradation. For instance, the waning demand for *Banig* has reduced the harvest and use of *Bariw*, which, in turn, has affected livelihood opportunities for communities based on weaving. Consequently, some *Bariw* users shifted to other, more income-generating livelihoods, such as ginger farming (*Zingiber officinale*), which is often attributed to slash-and-burn practices in forested areas contributing to forest cover loss and degradation, affecting naturally occurring *Bariw* groves, which then inhibits access and supply to other remaining users who continue to depend on the livelihood (Dioso, 2025). A further contributing factor is the decline of traditional weaving knowledge among younger generations. Factors include changing attitudes influenced by socioeconomic and cultural transformations, limited integration of this knowledge into local formal education curricula, and wider environmental changes that disrupt opportunities for intergenerational learning and practice.

4 Discussion

4.1 Overview

I organized this discussion based on the research questions that my study aims to address: (1) How does ILK contribute to the adaptive ecosystem management in Libertad, Antique; (2) How do formal institutions (i.e., government policies and structures) shape ILK use; (3) to what extent does the ILK relate to social-ecological resilience principles in the current institutional arrangements of these communities.

4.2 ILK as adaptive management

Both livelihoods illustrate how ILK systems operate as dynamic processes shaped by continuous interaction between ecological observations and resource-use practices. In both contexts, ILK illustrates learning-by-doing, iterative experimentation, and responsiveness to environmental feedback. For instance, this is evident in how *Bariw* users apply their seasonal knowledge and weather variations to determine the optimal harvesting periods, intentionally avoiding the wet and typhoon seasons to ensure leaf quality and avoid skin irritation. Similarly, shrimp fishers demonstrate sophisticated spatial and temporal adaptability by strategically placing their traps in *Linaw* (deep pools) and using the Indigenous directional names to navigate river dynamics. These strategies are further summarized in Table 4 that shows some of the selected practices, its perceived reasons for practicing, and its highlighted implications and application.

Table 4. ILK practices relating to ecosystem management strategies in *Bariw* use and Shrimp fishing in Libertad, Antique, Philippines

Livelihood	Selected practices	Reason for practicing	Highlighted implications and application
***Bariw* Use**	Use of *Tagád* - a wooden stake used to dig shallow planting holes	Believed to enable pliable and good-quality *Bariw* leaves for weaving, the use of steel rods is discouraged in planting, believing it results in hard, low-quality leaves.	Protection from land-use impacts, notably the roots of other trees and vegetation that support *Bariw* plant growth.
	Panghawan - clearing of weeds and other plants in a *Bariw* grove	Allows the *Bariw* plant to grow taller and to have lusher leaves.	Management of landscape patchiness

	Agsá/Pa-agsá - a socially mediated agreement on harvest between the plant owner and user. It is based on social trust and reciprocity of resource use.	Provides non-property owners with informal access rights for their livelihoods and is based on a reciprocal labor exchange. This is also observed in rice harvest.	Reinforces social cohesion and mutual trust within the community.
	Hil-ó/Paghil-ó-anay - a communal activity on traditional weaving, particularly in producing *banig* (traditional mats)	Institutionalizes traditional practices through communal work, reciprocity, mutual trust, and cooperation.	It reinforces a reciprocal relationship among users of shared resources and fosters a sense of community. It also provides opportunity for the transmission of knowledge among the younger generation.
Shrimp fishing	*Atás/Pangatás* - a communal activity during the dry season where shrimp fishers create temporary dams or reservoirs to catch fish and shrimp, when the river water is low or has dried up.	Shrimp fishers adapt to river-level conditions, particularly during the dry season.	A form of adaptive watershed management that reinforces communal work and camaraderie among community members.
	Use of plastic materials as *Ta-ûn* (shrimp traps)	A form of adaptation by innovating from available low-cost materials.	A form of adaptive response to changes based on the availability/affordability of resources, and to lengthen the durability of shrimp traps.
	Placing of the *garaw* (trap opening) in the direction of *Ilawod* (direction leading to the sea/coastal areas).	Shrimp fishers adapt their methods based on their knowledge of shrimp's behavior when swimming and moving backward against the river or stream current.	Characterizes knowledge of species behavior and use of technology using locally sourced or available materials.
	Fear of A*ngël* - a form of taboo concerning shrimp consumption.	It is mostly associated with food preparation and consumption; it discourages polluting, burning, or roasting shrimp shells, fearing the outcome, described as an unexplained disease	Reinforces stewardship of the resource, regulates resource abuse, and reinforces respecting the unseen inhabitants of the land and the rivers.

	ranging from stomachaches to skin diseases to neck twisting.	
Halit - Prohibiting acts that harm the natural system (i.e., rivers, forests, and seas)	Used as a term to describe illicit activities related to shrimp fishing, such as the use of agricultural insecticides (cymbush), electric fishing devices, and theft	This reinforces customary regulations to prevent abuses or overexploitation of sources of livelihood and instills stewardship among community members, especially resource users.
Paasó it kamangyan - smoking ritual for a shrimp trap using incense made from tree resin.	Smoking the *ta-ûn* using the *kamangyan* (tree resin incense) is believed to cleanse energy and bring good catch.	Reinforces the holistic identity and co-ownership of the community, as well as the unseen resources provided by nature.
Avoidance of *Mariit* - signifies spaces that prohibit, are sacred, and dangerous. It is used to describe specific places on land, rivers, and seas. Proper conduct must be observed when entering the place.	The fear of *Mariit* transgression is rooted in the belief that the *Tag-lugar* (beings of the place) inhabiting areas recognized as *Mariit* can bring danger and misfortune. This belief limits or often forbids access to these places.	It reinforces resource regulation to prevent overexploitation and fosters reciprocity and respect for the *Tag-lugar* and nature.

In addition, these practices are rooted in the community´s social memory, a reservoir of long-term environmental observations that Folke et al. (2002, p. 20) describe as a self-organized process of testing and revising knowledge. Social memory is operationalized through communal livelihood traditions such as *Pangatas* (dry season damming), which facilitates collective resource management during periods of scarcity. Such systems are reinforced by local social mechanisms and worldviews like *Malasakit* (collective care) and *Kaginhawa-an* (holistic well-being), which provide cultural internalization necessary for the encoding of intergenerational transmission of these practices (Berkes et al., 2000).

However, the adaptiveness of ILK is not uniform and varies significantly based on the biophysical characteristics of the resource itself (Fernández-Llamazares et al., 2015). *Bariw,* as a relatively stationary and abundant resource, is managed through routinized practices and socially mediated

access arrangements such as *Agsá* (informal harvesting rights). While *Agsá* may ensure social continuity, changes in the market and the decline of intergenerational knowledge transmission make *Bariw* use vulnerable to rapid social-ecological changes, subjecting it to other exogenous pressures such as state-imposed protected area restrictions or dependence on welfare.

In contrast, shrimp fishing operates within a more dynamic and uncertain ecological context, as characterized by resource mobility and perceived depletion. These conditions generated stronger, more specific adaptive responses, such as selective harvesting (using traps with narrow holes allowing shrimplets to escape) and the release of berried (egg-carrying) shrimps. This behavior is further reinforced by taboos and worldviews such as *Mariit* (sacred unknown areas) and fear of *Angël* (supernatural illness), which may serve as customary reserves that limit exploitation and offer regulation.

This contrast highlights that ILK may not be inherently adaptive in a vacuum; its capacity rather, is contingent upon the resource dynamics and its embedding within local institutional frameworks (Gómez-Baggethun & Reyes-García, 2013). Currently, these adaptive capacities are increasingly constrained by exogenous drivers, including market integration (high market value of shrimp attracting outsiders) and formal institutional policies that disregard customary stewardship.

At the same time, these adaptive capacities are increasingly constrained by broader social-economic changes such as market shifts, livelihood diversification, formal institutional influences, and decreasing mechanisms for intergenerational transmission of knowledge, which may contribute to the continued erosion of ILK. This highlights that sustaining adaptive ecosystem management requires not only the integration and use of ILK but also addressing and understanding its underlying social and institutional arrangements.

4.3 Institutional arrangements and other exogenous factors shaping ILK

My findings show that Indigenous and Local Knowledge (ILK) in Libertad, Antique, is maintained not solely through ecological knowledge, but also through broader institutional arrangements that influence how knowledge is practiced, transmitted, and embedded in daily livelihood activities. This perspective corresponds to Crawford and Ostrom's (1995) definition of institutions as continuing systems of agreed rules, norms, and collective strategies. ILK in both *Bariw* use and freshwater shrimp fishing is sustained through the interaction of customary practices, beliefs, and social mechanisms.

However, these institutional arrangements are increasingly shaped by market integration, formal institutional policies, and socioeconomic changes, creating conditions for both the persistence and erosion of ILK over time.

It also further demonstrates that ILK persists when communities maintain continuous engagement with their livelihoods, which depends on the characteristics of their resource systems (such as dynamic rivers or static forests) and the capacity to generate new knowledge in response to environmental variability (Reyes-García et al., 2014). For example, in freshwater shrimp fishing, fishers in Sitio San Juan have adopted plastic mesh screens for their traps and partially abandoned indigenous traps due to durability and cost concerns. Social cohesion reinforces ILK practice through daily participation in livelihood activities, therefore supporting intergenerational learning and internalization (Ford et al., 2000).

While informal institutions persist to sustain aspects of ILK, the findings suggest that broader institutional and socioeconomic changes increasingly disrupt the factors essential for knowledge transmission and adaptive management. One major factor is the market integration and commodification of natural resources, as demonstrated by participants' observation that high market value of freshwater shrimp has intensified overexploitation and attracted outsiders to local shrimp fishing grounds. As shrimp fishing became increasingly income-oriented, customary stewardship became more difficult to maintain. This shows a shift toward destructive methods in fishing and theft, and an erosion of belief in customary restricted areas (i.e., *Mariit).* Market forces often increasingly emphasize short-term gains for resource users, notably in contexts of poverty and constrained livelihood opportunities (Piñeiro et al., 2020), thereby weakening the informal institutions that traditionally regulated resource use and prevented overexploitation.

Formal institutional arrangements also reshape ILK practices in significant ways. Protected area governance and environmental regulations have restricted access to previously held ancestral harvesting grounds, such as *Bariw,* as well as to other interconnected livelihoods associated with shrimp fishing, such as coconut farming and access to non-timber forest products, such as bamboo and *Ban-ban* (native shrub). Although these policies are intended to support biodiversity conservation, they frequently fail to adequately recognize customary management systems and access rights (Aswani et al., 2018; Des Roches et al., 2021). Reduced access to these environments limits communities' ability to continue engaging in the very livelihoods through which ILK is reproduced and

transmitted. This is especially important under conditions of rapid ecological change, where regular observation and interaction with local ecosystems are necessary for communities to adapt their livelihood strategies (Danugroho et al., 2026).

Similarly, the restrictions of customary practices such as *kaingin* (slash-and-burn farming) may have contributed to the decline of interconnected livelihoods that have historically supported local subsistence. As access to these customary farming practices has been restricted alongside the decline in demand for *Bariw*-based products, some community members have shifted to other income-generating livelihoods, particularly ginger plantations, which are associated with increased forest conversion and loss of forest cover, including *Bariw* groves (Dioso, 2025). It suggests how formal institutional policies may contribute to the erosion of ILK when communities become structurally disconnected from the environments in which knowledge is practiced and reproduced (Reyes-García et al., 2005). At the same time, these livelihood transformations show how these policies create feedback that reshape land-use practices and contribute to vulnerability.

Modernization through socioeconomic and cultural transformations has shaped the opportunities for knowledge transmission. The expansion of higher-income employment opportunities and skills development has contributed to younger generations' declining interest in engaging with their livelihoods, particularly in *Bariw* weaving. This supports that ILK is gradually abandoned as it becomes increasingly difficult to sustain under changing socioeconomic and cultural conditions experienced by Indigenous and local communities (Reyes-García et al., 2013).

At the same time, climate variability and environmental change shape limitations and adaptive capacities of ILK. The Philippines is among the most vulnerable countries to climate-related risks (World Risk Report, 2025). Participants shared that, through the ecological calendars, their observations of increasingly variable weather patterns, including lengthy droughts, intensified rainfall, and more frequent typhoons, have made it challenging to practice their customary ways in their livelihoods. These perceived changes are reflected in social memory and traditionally used to guide livelihood activities and resource use. However, increasing uncertainty continually challenges ILK, affecting the communities' ability to strategize and adapt their livelihoods, hence contributing to vulnerability (Fernández-Llamazares et al., 2015; Schlingmann et al., 2021).

The adaptive capacity of ILK, therefore, appears to depend on wider social conditions that enable communities to continue engaging with their livelihoods and retain their agency over knowledge generation and transmission (Gómez-Baggethun et al., 2013). This is shown when communities can generate and regenerate knowledge through experiential learning, collective observation, and practicing customary regulations of resource use. This shows that the persistence of knowledge systems may depend not on the existence of ecological knowledge itself but on the social or institutional conditions that allow knowledge to be continuously generated and transmitted. In addition, its strength also comes with its integration with other knowledge systems through cultural continuity and adaptation of new forms of strategies to cope with changes (Allassad Alhuzail et al., 2026; Silva-Ávila et al., 2025).

4.4 **Mapping Social-Ecological Resilience Principles**

In this context, resilience refers to a system's ability to cope with and maintain itself in the face of external pulses, shifts, and shocks while remaining within its thresholds (Piñeiro et al., 2020) and is considered a property of the system (Biggs et al., 2015). Adaptability is a widely accepted indicator of a knowledge system's ability to respond and adjust to these changes and a mechanism that either generates or retains resilience (Folke et al., 2016; McMillen et al., 2014). In social-ecological systems, a key feature is the ability of complex systems to self-organize without intent. From an anthropocentric point of view, however, human actors dominate the system and are an important part of the biosphere (Berkes & Folke, 2002; Biggs et al., 2015). Thus, this capacity is a key function seen through how people act individually and collectively to manage a system (Walker et al., 2004).

Reflecting on the findings, both livelihoods exhibit knowledge systems that embody the co-creation of ecosystem services by social and ecological components of SES. For instance, *Bariw* users determine the harvesting time since plantation based on their temporal knowledge of mature leaf growth after three years and seasonal knowledge by opting harvest during the cooler and dry months where rain is not frequent as shown on how they perceive it in the ecological calendar (Figure 4). While shrimp fishers shared that they opt for coconut farming in response to the difficulties of doing shrimp fishing during the typhoon season, heavy flooding often occurs, as illustrated in Figure 6. This suggests that ecosystem services in these livelihoods are co-produced by both social-ecological processes and characterize this adaptability (Reyers et al., 2013).

A critical aspect of this adaptability is learning and memory, which connects present-day decision-making processes to a body of knowledge accumulated and tested across generations. Through social memory, ILK allows the communities to continually adjust their practices (including innovation and forgetting) while maintaining their relationships with local ecosystems (Ammar et al., 2023; Tran et al., 2022). In this sense, adaptability contributes to the resilience of the local SES by supporting the continued provision of ecosystem services through livelihoods despite variability and change. Viewed through the social-ecological resilience lens, the livelihoods investigated provide empirical insights into how resilience is sustained in practice. The qualitative findings correspond with several identified principles for sustaining social-ecological resilience (Biggs et al., 2015). Table 6 outlines these principles and were relabeled in a manner that maintains their alignment with the definitions.

Table 6. Mapping Social-Ecological Resilience principles

Resilience principles	*ILK in Bariw-use and Shrimp Fishing*
Adaptive learning	Adaptive learning tends to be particularly present in shrimp fishing, as demonstrated by users' modification of technologies (i.e., transition to plastic traps) and self-organizing response to environmental variability and declining yields. On the other hand, *Bariw* also exhibits adaptive learning through changing their weaving products from *Banig* to other handicrafts, such as bags. However, these practices are still contingent on market changes and transmission of knowledge.
Feedback awareness	Awareness of social-ecological feedback is evident across both livelihoods, as demonstrated by the participants' sensitivity to signals such as weather pattern variations, pest infestations, and declining shrimp populations. Observations directly inform their resource-use practices and decision-making, which indicates strong coupling between ecological knowledge and practices.
Collective stewardship	A sense of stewardship emerges as a feature of collective action, especially regarding dynamic resources in shrimp fishing communities where rivers are perceived as common-pool resources.

Maintaining diversity and redundancy	The varied roles and responses of actors contribute to diversity and redundancy within the social-ecological system by providing multiple ways of managing resources and responding to change. For instance, alternative livelihoods such as coconut farming during the wet season ensures other sources of income for Bariw users and shrimp fishers, and maintenance of prohibited areas for fishing/resource access (Mariit) provide resource reserves that allow biological diversity to function and affect the provision of ecosystem services.
Social memory and knowledge transmission	This principle remains active in both livelihoods, but it appears to be increasingly sensitive to exogenous drivers. While intergenerational learning and transmission of knowledge still occur in shrimp fishing, its mechanisms appear to be declining, particularly in *Bariw* use practices.

It is important to note, however, that this does not capture the full picture. Resilience principles among the ILK of both livelihoods are important; it is apparent that these principles are described unevenly and are also currently under pressure. Exogenous drivers, including social and market changes, livelihood diversification, and formal policies, are reshaping both knowledge systems and their institutional contexts (Ruiz-Mallén & Corbera, 2013). The relevance and effectiveness of ILK's continued support for social-ecological resilience may be better understood by considering its role within broader institutional frameworks. For ILK being able to continue and eventually sufficiently regenerate, its knowledge holders and their practices must be integrated into the broader institutional context, such as allowing self-organized practices and autonomy and recognition of its informal institutions (i.e., customary concepts of resource ownership), which would then require the presence of supportive cross-scale institutional conditions (Gómez-Baggethun, 2022; Gómez-Baggethun & Reyes-García, 2013).

4.5 Methodological limitations

My study primarily relies on thematic analysis to identify patterns and meanings in the qualitative data by generating themes and matching them with the theoretical frameworks I chose. While this approach may allow for in-depth interpretation, it is inherently interpretive and may be influenced by my own analytical viewpoint. Also, the relatively limited fieldwork duration may have affected the depth of the qualitative data learned through natural social interactions and establishment of

relationships with the participants, meaning that some emerging insights would have benefited from further validation through long-term engagement or additional sources of empirical evidence.

Several key elements such as worldviews, belief systems, and rules-in-use were derived from the semi-structured interview data and subsequently coded during the analysis. Because these findings are based on the participants´ accounts and as well as my own interpretation, variations and differences in how these elements are represented may be inevitable; my study acknowledges the potential for differing interpretations and perspectives.

Another limitation is related to the scope of the study, which solely focused on two livelihoods. While this may allow for a detailed documentation and investigation of *Bariw* use and freshwater shrimp fishing, it may also have limited the analysis to other components of the local social-ecological system such as the linkages of coconut farming intersecting with shrimp fishing or how rice farming functions as an alternative livelihood for *Bariw* users. A broader understanding of ILK in Northwest Panay would benefit from comparisons with other subsistence livelihoods that also depend on the ecosystem services or nature´s contributions provided by the Northwest Panay Peninsula Natural Park.

It is also worthy to note that the findings on the characteristics of the resource units (dynamic vs static resources) were not originally posed as a research question, but it emerged as a data during the thematic analysis on ILK's links to adaptive ecosystem management, these findings have implications for collective action that may be further expounded as research under this social-ecological context in Northwest Panay and aligns in the fields of ecological economics and sustainability science.

Finally, the study lacked complementary ecological data due to limited fieldwork time and data access constraints. Detailed information on Biophysical properties such as weather patterns, ecological processes, and species' life histories could have strengthened the analysis of institutions by supporting a more robust biophysical context for understanding the livelihood practices that characterize adaptive ecosystem management. Addressing this gap may represent an important opportunity for relevant future transdisciplinary research in Northwest Panay.

5 Conclusion

My study aimed to understand the conditions under which Indigenous and Local Knowledge (ILK) nurture human-nature relationships by looking at its interactions with institutional dynamics that shape ecosystem management in two livelihoods in Northwest Panay: Bariw harvesting and weaving,

and freshwater shrimp fishing. The findings suggest that ILK in this context operates as a form of adaptive ecosystem management grounded in continuous observation, intergenerational knowledge transmission, and locally embedded institutions. It reflects a dynamic process of learning-by-doing, where ecological feedback, social memory, and informal institutions all shape resource use and stewardship.

At the same time, the findings show that the adaptability of ILK is not inherent. It is rather contingent on the institutional arrangements and the wider socio-economic conditions in which it is situated. Informal institutions such as norms, rules-in-use, taboos, and other communal practices continue to regulate access and resource exclusion, influence stewardship, and help nurture social cohesion. It is, however, increasingly intersecting and often in conflict with formal governance structures, market integration, and environmental change. Restrictions on resource access, shifting property regimes, and prioritization of formal policies over customary practices show how institutional arrangements and their dynamics can enable or constrain ILK.

My study also shows that ILK remains aligned with key principles of social-ecological resilience principles, such as adaptability, feedback awareness, and collective action. Customary practices in both livelihoods, such as selective harvesting, seasonal responses, and certain informal institutions and worldviews (i.e., Mariit), appear to contribute to ecosystem function, which supports the continued practice of the livelihoods. However, these resilience capacities are increasingly under pressure from multifaceted exogenous drivers notably climate variability, market changes, and erosion of intergenerational knowledge transmission.

Overall, these findings suggest that ILK persists in Libertad, Antique, moreover in the communities in Northwest Panay, not because it is inherently resilient, but because it is continuously negotiated, adapted, and reproduced within the dynamic social-ecological system. The future of these knowledge systems, therefore, depends on the extent to which institutional arrangements, both formal and informal, can support these processes. This also highlights the need for more inclusive and context-sensitive governance approaches that recognize ILK, not as a mere catalogue of knowledge, but a co-existing, valid, and relevant knowledge system - it is therefore imperative that such approaches, at the same time avoiding its romanticization, should include ILK's inherent value systems, worldviews, and customary practices, as well as enabling institutional conditions for its reproduction and nurturing

reciprocal relationships for co-learning and co-production (Luque-Lora, 2024; Subramanian et al., 2025; Teixidor-Toneu et al., 2025).

Lastly, the outcome of this study contributes to the developing understanding of ILK within social-ecological systems by showing that resilience may emerge not only from knowledge itself, but from the relationships, institutions, and conditions that will sustain it. Strengthening this understanding will be critical to ensuring that ILK will continue to support local adaptive ecosystem management and the communities that depend on it in the age of the wider and more persistent environmental and social transformations and changes.

6 References

Adger, W. N. (2000). Social and ecological resilience: Are they related? *Progress in Human Geography*, *24*(3), 347–364. https://doi.org/10.1191/030913200701540465

Allassad Alhuzail, N., Zanoon, A., & Alhujjaj, M. (2026). Indigenous Knowledge among Elderly Bedouin Women in the Negev: Memory, Practice, and Intergenerational Transmission. *Journal of Cross-Cultural Gerontology*, *41*(2), 23. https://doi.org/10.1007/s10823-026-09571-2

Altieri, M. A. (2004). Linking ecologists and traditional farmers in the search for sustainable agriculture. *Frontiers in Ecology and the Environment*, *2*(1), 35–42. https://doi.org/10.1890/1540-9295(2004)002%255B0035:LEATFI%255D2.0.CO;2

Ammar, M., Fogarty, L., & Kandler, A. (2023). Social learning and memory. *Proceedings of the National Academy of Sciences*, *120*(33), e2310033120. https://doi.org/10.1073/pnas.2310033120

Aniah, P., Kaunza-Nu-Dem, M. K., & Ayembilla, J. A. (2019). Smallholder farmers' livelihood adaptation to climate variability and ecological changes in the savanna agroecological zone of Ghana. *Heliyon*, *5*(4), e01492. https://doi.org/10.1016/j.heliyon.2019.e01492

Aswani, S., Lemahieu, A., & Sauer, W. H. H. (2018). Global trends of local ecological knowledge and future implications. *PLOS ONE*, *13*(4), e0195440. https://doi.org/10.1371/journal.pone.0195440

Berkes, F. (2004). Rethinking Community-Based Conservation. *Conservation Biology*, *18*(3), 621–630. https://doi.org/10.1111/j.1523-1739.2004.00077.x

Berkes, F. (2017). *Sacred Ecology* (4th ed.). Routledge. https://doi.org/10.4324/9781315114644

Berkes, F., Colding, J., & Folke, C. (2000). Rediscovery of Traditional Ecological Knowledge as Adaptive Management. *Ecological Applications*, *10*(5), 1251–1262. https://doi.org/10.1890/1051-0761(2000)010%255B1251:ROTEKA%255D2.0.CO;2

Berkes, F., & Folke, C. (Eds.). (2002). *Linking social and ecological systems: Management practices and social mechanisms for building resilience* (Transferred to digital printing). Cambridge Univ. Press.

Biggs, R., Preiser, R., De Vos, A., Schlüter, M., Maciejewski, K., & Clements, H. (2021). *The Routledge Handbook of Research Methods for Social-Ecological Systems* (1st ed.). Routledge. https://doi.org/10.4324/9781003021339

Biggs, R., Schlüter, M., & Schoon, M. L. (2015). An introduction to the resilience approach and principles to sustain ecosystem services in social–ecological systems. In R. Biggs, M. Schlüter, & M. L. Schoon (Eds.), *Principles for Building Resilience* (1st ed., pp. 1–31). Cambridge University Press. https://doi.org/10.1017/CBO9781316014240.002

Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners* (First published). SAGE.

Briggs, J. (2013). Indigenous knowledge: A false dawn for development theory and practice? *Progress in Development Studies*, *13*(3), 231–243. https://doi.org/10.1177/1464993413486549

Brondízio, E. S., Aumeeruddy-Thomas, Y., Bates, P., Carino, J., Fernández-Llamazares, Á., Ferrari, M. F., Galvin, K., Reyes-García, V., McElwee, P., Molnár, Z., Samakov, A., & Shrestha, U. B. (2021).

Locally Based, Regionally Manifested, and Globally Relevant: Indigenous and Local Knowledge, Values, and Practices for Nature. *Annual Review of Environment and Resources*, *46*(1), 481–509. https://doi.org/10.1146/annurev-environ-012220-012127

Calitang, G. L., & Orpiano, R. G. (2023). Kaingin farming practices of Hanunuo farmers in Paclolo, Magsaysay, Occidental Mindoro, Philippines. *IOP Conference Series: Earth and Environmental Science*, *1145*(1), 012002. https://doi.org/10.1088/1755-1315/1145/1/012002

Callmander, M. W., Lowry, P. P., Forest, F., Devey, D. S., Beentje, H., & Buerki, S. (2012). Benstonea Callm. & Buerki (Pandanaceae): Characterization, Circumscription, and Distribution of a New Genus of Screw-Pines, with a Synopsis of Accepted Species. *Candollea*, *67*(2), 323. https://doi.org/10.15553/c2012v672a12

Casalan, M., & Dita, S. (2022). *The Nominal Marking System of Kinaray-a*. SSRN. https://doi.org/10.5281/ZENODO.5778128

Castonguay, A. C., Burkhard, B., Müller, F., Horgan, F. G., & Settele, J. (2016). Resilience and adaptability of rice terrace social-ecological systems: A case study of a local community's perception in Banaue, Philippines. *Ecology and Society*, *21*(2), art15. https://doi.org/10.5751/ES-08348-210215

Cervantes, C. L. (2025). Filipino Psychology Is a Transpersonal Psychology. *Journal of Humanistic Psychology*, 00221678251322215. https://doi.org/10.1177/00221678251322215

Chiblow, S., & Meighan, P. J. (2022). Language is land, land is language: The importance of Indigenous languages. *Human Geography*, *15*(2), 206–210. https://doi.org/10.1177/19427786211022899

Cochran, F. V., Brunsell, N. A., Cabalzar, A., Van Der Veld, P.-J., Azevedo, E., Azevedo, R. A., Pedrosa, R. A., & Winegar, L. J. (2016). Indigenous ecological calendars define scales for climate change and sustainability assessments. *Sustainability Science*, *11*(1), 69–89. https://doi.org/10.1007/s11625-015-0303-y

Crawford, S. E. S., & Ostrom, E. (1995). A Grammar of Institutions. *American Political Science Review*, *89*(3), 582–600. https://doi.org/10.2307/2082975

Danugroho, A., Rustinsyah, R., Adib, M., & Idris, U. (2026). Climate adaptation and livelihood strategies in the Madurese community of Sumenep, Indonesia. *Development in Practice*, *36*(2), 209–221. https://doi.org/10.1080/09614524.2025.2551852

Des Roches, S., Pendleton, L. H., Shapiro, B., & Palkovacs, E. P. (2021). Conserving intraspecific variation for nature's contributions to people. *Nature Ecology & Evolution*, *5*(5), 574–582. https://doi.org/10.1038/s41559-021-01403-5

Díaz, S., Demissew, S., Carabias, J., Joly, C., Lonsdale, M., Ash, N., Larigauderie, A., Adhikari, J. R., Arico, S., Báldi, A., Bartuska, A., Baste, I. A., Bilgin, A., Brondizio, E., Chan, K. M., Figueroa, V. E., Duraiappah, A., Fischer, M., Hill, R., … Zlatanova, D. (2015). The IPBES Conceptual Framework—Connecting nature and people. *Current Opinion in Environmental Sustainability*, *14*, 1–16. https://doi.org/10.1016/j.cosust.2014.11.002

Dioso, S. (2025). *Local Governance and the Pagrara Heritage of Northwest Panay*. UP Center for Integrative and Development Studies. https://cids.up.edu.ph/wp-content/uploads/2025/07/Local-Governance-and-the-Pagrara-Heritage-of-Northwest-Panay.pdf

Dong, S., Lassoie, J., Shrestha, K. K., Yan, Z., Sharma, E., & Pariya, D. (2009). Institutional development for sustainable rangeland resource and ecosystem management in mountainous areas of northern Nepal. *Journal of Environmental Management*, *90*(2), 994–1003. https://doi.org/10.1016/j.jenvman.2008.03.005

Dudgeon, R. C., & Berkes, F. (2003). Local Understandings of the Land: Traditional Ecological Knowledge and Indigenous Knowledge. In H. Selin (Ed.), *Nature Across Cultures* (Vol. 4, pp. 75–96). Springer Netherlands. https://doi.org/10.1007/978-94-017-0149-5_4

Fernández-Llamazares, Á., Díaz-Reviriego, I., Luz, A. C., Cabeza, M., Pyhälä, A., & Reyes-García, V. (2015). Rapid ecosystem change challenges the adaptive capacity of Local Environmental Knowledge. *Global Environmental Change*, *31*, 272–284. https://doi.org/10.1016/j.gloenvcha.2015.02.001

Folke, C., Biggs, R., Norström, A. V., Reyers, B., & Rockström, J. (2016). Social-ecological resilience and biosphere-based sustainability science. *Ecology and society*, *21*(3). http://dx.doi.org/10.5751/ES-08748-210341

Folke, C., Carpenter, S., Elmqvist, T., Gunderson, L., Holling, C. S., & Walker, B. (2002). Resilience and Sustainable Development: Building Adaptive Capacity in a World of Transformations. *AMBIO: A Journal of the Human Environment*, *31*(5), 437–440. https://doi.org/10.1579/0044-7447-31.5.437

Folke, C., Carpenter, S. R., Walker, B., Scheffer, M., Chapin, T., & Rockström, J. (2010). Resilience Thinking: Integrating Resilience, Adaptability and Transformability. *Ecology and Society*, *15*(4), art20. https://doi.org/10.5751/ES-03610-150420

Folke, C., Hahn, T., Olsson, P., & Norberg, J. (2005). ADAPTIVE GOVERNANCE OF SOCIAL-ECOLOGICAL SYSTEMS. *Annual Review of Environment and Resources*, *30*(1), 441–473. https://doi.org/10.1146/annurev.energy.30.050504.144511

Galappaththi, E. K., Ayesu-Danso, B., Jayasekara, S. M., Baird, T. D., Bukvic, A., & Rijal, S. (2025). Voices from Akplabanya: Community adaptation and social-ecological changes in coastal Ghana. *Cambridge Prisms: Coastal Futures*, *3*, e19. https://doi.org/10.1017/cft.2025.10011

Gallego, M. K. (2018). Directional Systems in Philippine Languages. *Oceanic Linguistics*, *57*(1), 63–100.

Godoy, R., Reyes-García, V., Byron, E., Leonard, W. R., & Vadez, V. (2005). THE EFFECT OF MARKET ECONOMIES ON THE WELL-BEING OF INDIGENOUS PEOPLES AND ON THEIR USE OF RENEWABLE NATURAL RESOURCES. *Annual Review of Anthropology*, *34*(1), 121–138. https://doi.org/10.1146/annurev.anthro.34.081804.120412

Gómez-Baggethun, E. (2022). Is there a future for indigenous and local knowledge? *The Journal of Peasant Studies*, *49*(6), 1139–1157. https://doi.org/10.1080/03066150.2021.1926994

Gómez-Baggethun, E., Corbera, E., & Reyes-García, V. (2013). Traditional Ecological Knowledge and Global Environmental Change: Research findings and policy implications. *Ecology and Society: A Journal of Integrative Science for Resilience and Sustainability*, *18*(4), 72. https://doi.org/10.5751/ES-06288-180472

Gómez-Baggethun, E., & Reyes-García, V. (2013). Reinterpreting Change in Traditional Ecological Knowledge. *Human Ecology*, *41*(4), 643–647. https://doi.org/10.1007/s10745-013-9577-9

Hammersley, M., & Atkinson, P. (2019). *Ethnography: Principles in Practice* (4th ed.). Routledge. https://doi.org/10.4324/9781315146027

Hernández-Vélez, C. A., Jackson, G., & Krause, T. (2026). Indigenous and local knowledge inclusion in forest fauna research: A systematic review in the tropics. *Ambio*. https://doi.org/10.1007/s13280-026-02378-y

Hoque, S. F., Quinn, C. H., & Sallu, S. M. (2017). Resilience, political ecology, and well-being: An interdisciplinary approach to understanding social-ecological change in coastal Bangladesh. *Ecology and Society*, *22*(2), art45. https://doi.org/10.5751/ES-09422-220245

Jorgensen, D. L. (2020). *Principles, approaches and issues in participant observation*. Routledge.

Kassam, K.-A. S., & Bernardo, J. (2022). Role of Biodiversity in Ecological Calendars and Its Implications for Food Sovereignty: Empirical Assessment of the Resilience of Indicator Species to Anthropogenic Climate Change. *GeoHealth*, *6*(10), e2022GH000614. https://doi.org/10.1029/2022GH000614

Krause, T., Mesa, M. P. Q., & Yucuna, U. M. (2020). Indigenous ecological knowledge in the Colombian Amazon – challenges and prospects for a more sustainable use of local forest fauna. *Indigenous Knowledges and the Sustainable Development Agenda*. https://www.taylorfrancis.com/chapters/oa-edit/10.4324/9780367853785-7/indigenous-

ecological-knowledge-colombian-amazon-challenges-prospects-sustainable-use-local-forest-fauna-torsten-krause-maria-paula-quiceno-mesa-uldarico-matap%C3%AD-yucuna

Libertad, Antique Profile. (2026). PhilAtlas. https://www.philatlas.com/visayas/r06/antique/libertad.html

Luque-Lora, R. (2024). IPBES: Three ways forward with frameworks of values. *Environmental Science & Policy*, *159*, 103827. https://doi.org/10.1016/j.envsci.2024.103827

Magos, A. P., Ushijima, I., & Zayas, C. N. (1994). The Concept of Mari-it in Panaynon Maritime Worldview in Visayan Fisherfolks. *Fishers of the Visayas*.

Maliao, R. J., Cahilig, R. C., Cahilig, R. R., & Jaspe, B. T. (2023). Climate change, traditional ecological knowledge, and riverine biodiversity conservation: A case in Aklan, Central Philippines. *Environment, Development and Sustainability*, *27*(2), 4745–4767. https://doi.org/10.1007/s10668-023-04096-x

McCarter, J., Gavin, M. C., Baereleo, S., & Love, M. (2014). The challenges of maintaining indigenous ecological knowledge. *Ecology and Society*, *19*(3), art39. https://doi.org/10.5751/ES-06741-190339

McElwee, P., Fernández-Llamazares, Á., Aumeeruddy-Thomas, Y., Babai, D., Bates, P., Galvin, K., Guèze, M., Liu, J., Molnár, Z., Ngo, H. T., Reyes-García, V., Roy Chowdhury, R., Samakov, A., Shrestha, U. B., Díaz, S., & Brondízio, E. S. (2020). Working with Indigenous and local knowledge (ILK) in large-scale ecological assessments: Reviewing the experience of the IPBES Global Assessment. *Journal of Applied Ecology*, *57*(9), 1666–1676. https://doi.org/10.1111/1365-2664.13705

Municipality of Libertad, Antique. (n.d.). *History of Libertad, Antique*. Retrieved https://libertadantique.gov.ph/wp-content/uploads/2025/11/HISTORY-OF-LIBERTAD-Reference_CLUP-Draft.pdf

Niaz, L., & Rose, P. (2025). *Systematic review of Gender, Equality, Disability and Social Inclusion in implementation science research* (1st ed.). What Works Hub for Global Education. https://doi.org/10.35489/BSG-WhatWorksHubforGlobalEducation-WP_2025/002

Nurdin, A. A., & Jamaludin, A. N. (2024). The Relationship Between Belief System and Traditional Ecological Knowledge among the Kuta Indigenous People in Ciamis, West Java. *Journal of Education Culture and Society*, *15*(2), 835–847. https://doi.org/10.15503/jecs2024.2.835.847

Nykvist, B., & Von Heland, J. (2014). Social-ecological memory as a source of general and specified resilience. *Ecology and Society*, *19*(2), art47. https://doi.org/10.5751/ES-06167-190247

Olsson, P., Folke, C., & Berkes, F. (2004). Adaptive Comanagement for Building Resilience in Social?Ecological Systems. *Environmental Management*, *34*(1). https://doi.org/10.1007/s00267-003-0101-7

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action* (1st ed.). Cambridge University Press. https://doi.org/10.1017/CBO9780511807763

Paing, J. N., Van Bussel, L. G. J., Gomez, R. A., & Hein, L. G. (2022). Ecosystem services through the lens of indigenous people in the highlands of Cordillera Region, Northern Philippines. *Journal of Environmental Management*, *308*, 114597. https://doi.org/10.1016/j.jenvman.2022.114597

Pearson, J., Jackson, G., & McNamara, K. E. (2023). Climate-driven losses to knowledge systems and cultural heritage: A literature review exploring the impacts on Indigenous and local cultures. *The Anthropocene Review*, *10*(2), 343–366. https://doi.org/10.1177/20530196211005482

Pecl, G. T., Araújo, M. B., Bell, J. D., Blanchard, J., Bonebrake, T. C., Chen, I.-C., Clark, T. D., Colwell, R. K., Danielsen, F., Evengård, B., Falconi, L., Ferrier, S., Frusher, S., Garcia, R. A., Griffis, R. B., Hobday, A. J., Janion-Scheepers, C., Jarzyna, M. A., Jennings, S., … Williams, S. E. (2017). Biodiversity redistribution under climate change: Impacts on ecosystems and human well-being. *Science*, *355*(6332), eaai9214. https://doi.org/10.1126/science.aai9214

Piñeiro, V., Arias, J., Dürr, J., Elverdin, P., Ibáñez, A. M., Kinengyere, A., Opazo, C. M., Owoo, N., Page, J. R., Prager, S. D., & Torero, M. (2020). A scoping review on incentives for adoption of sustainable agricultural practices and their outcomes. *Nature Sustainability*, *3*(10), 809–820. https://doi.org/10.1038/s41893-020-00617-y

Polski, M. M., & Ostrom, E. (1999). An Institutional Framework for Policy Analysis and Design. In *Elinor Ostrom and the Bloomington School of Political Economy: A Framework for Policy Analysis* (1st ed.). https://doi.org/10.5040/9781666993875

Porio, E., & Roque-Sarmiento, E. (2019). Barangay. In A. M. Orum, *The Wiley Blackwell Encyclopedia of Urban and Regional Studies* (1st ed., pp. 1–5). Wiley. https://doi.org/10.1002/9781118568446.eurs0016

Ramirez, A. R. (2024). *Pagdahu ka Surundon: A Reference Book on Panay and Guimaras Traditional Knowledge Systems*. Kasing-Kasing Press.

Redison, F. A. (2025). *Issues and Concerns Crafting the Weaves of Northwestern Panay* (Discussion Paper Nos. 2025–18). University of the Philippines Center for Integrative and Development Studies.

Rentillo, P. (2025). Lexicophonetic dialectology of Panay. *Dialectologia*, (.34). https://doi.org/10.1344/Dialectologia.34.10

Reyes-García, V., García-Del-Amo, D., Porcuna-Ferrer, A., Schlingmann, A., Abazeri, M., Attoh, E. M. N. a. N., Da Cunha Ávila, J. V., Ayanlade, A., Babai, D., Benyei, P., Calvet-Mir, L., Carmona, R., Caviedes, J., Chah, J., Chakauya, R., Cuní-Sanchez, A., Fernández-Llamazares, Á., Galappaththi, E. K., Gerkey, D., . . . Zant, M. (2024). Local studies provide a global perspective of the impacts of climate change on Indigenous Peoples and local communities. *Sustainable Earth Reviews*, *7*(1). https://doi.org/10.1186/s42055-023-00063-6

Reyes-García, V., Guèze, M., Luz, A. C., Paneque-Gálvez, J., Macía, M. J., Orta-Martínez, M., Pino, J., & Rubio-Campillo, X. (2013). Evidence of traditional knowledge loss among a contemporary

indigenous society. *Evolution and Human Behavior*, *34*(4), 249–257. https://doi.org/10.1016/j.evolhumbehav.2013.03.002

Reyes-García, V., Paneque-Gálvez, J., Luz, A. C., Gueze, M., Macía, M. J., Orta-Martínez, M., & Pino, J. (2014). Cultural Change and Traditional Ecological Knowledge: An Empirical Analysis from the Tsimane' in the Bolivian Amazon. *Human Organization*, *73*(2), 162–173. https://doi.org/10.17730/humo.73.2.31nl363qgr30n017

Reyes-García, V., Vadez, V., Byron, E., Apaza, L., Leonard, W. R., Perez, E., & Wilkie, D. (2005). Market Economy and the Loss of Folk Knowledge of Plant Uses: Estimates from the Tsimane' of the Bolivian Amazon. *Current Anthropology*, *46*(4), 651–656. https://doi.org/10.1086/432777

Reyers, B., Biggs, R., Cumming, G. S., Elmqvist, T., Hejnowicz, A. P., & Polasky, S. (2013). Getting the measure of ecosystem services: a social–ecological approach. *Frontiers in Ecology and the Environment*, *11*(5), 268–273. https://doi.org/10.1890/120144

Ruiz-Mallén, I., & Corbera, E. (2013). Community-Based Conservation and Traditional Ecological Knowledge: Implications for Social-Ecological Resilience. *Ecology and Society*, *18*(4), art12. https://doi.org/10.5751/ES-05867-180412

Samaco-Zamora, M. C. F., & Fernandez, K. T. G. (2016). A Grounded Theory of Filipino Wellness (Kaginhawaan). *Psychological Studies*, *61*(4), 279–287. https://doi.org/10.1007/s12646-016-0373-7

Sangha, K. K., Leyton-Flor, S. A., Kassa, G., Ahammad, R., & Dendup, S. (2026). Key lessons from Indigenous Peoples and Local Communities' farming systems: Insights from a global review. *Frontiers in Sustainable Food Systems*, *10*, 1743959. https://doi.org/10.3389/fsufs.2026.1743959

Schlingmann, A., Graham, S., Benyei, P., Corbera, E., Martinez Sanesteban, I., Marelle, A., Soleymani-Fard, R., & Reyes-García, V. (2021). Global patterns of adaptation to climate change by

Indigenous Peoples and local communities. A systematic review. *Current Opinion in Environmental Sustainability*, *51*, 55–64. https://doi.org/10.1016/j.cosust.2021.03.002

Silva-Ávila, P., Rojas Hernández, J., & Barra, R. O. (2025). Knowledge Alliances for Global Change Adaptation: A Relational Approach Based on Traditional Ecological Knowledge, Territorial Management, and Community Practices in the Chilean Context. *Sustainability*, *17*(8), 3653. https://doi.org/10.3390/su17083653

Subramanian, S., Kelemen, E., De Vos, A., Krause, T., Mayhew, M., Mead, A., Nuesiri, E., Perritt, J., Islar, M., Amaruzaman, S., Arroyo-Robles, G., Nakangu, B., Kosmus, M., Porter-Bolland, L., Yiu, E., & Varga, A. (2025). Inclusion in body and mind: Ensuring full participation of Indigenous peoples and local communities in decisions related to nature. *Ecology and Society*, *30*(3), art13. https://doi.org/10.5751/ES-16300-300313

Teixidor-Toneu, I., Fernández-Llamazares, Á., Alvarez Abel, R., Batdelger, G., Bell, E., Caillon, S., Cantor, M., Correia, J. E., Díaz, S., Fisk, J., Greene, A., Greening, S., Hoyte, S., Kalle, R., Loayza, G., Mattalia, G., Montúfar, R., Ojeda, J., Phatthanaphraiwan, S., … Ban, N. C. (2025). Human–nature relationships through the lens of reciprocity: Insights from Indigenous and local knowledge systems. *People and Nature*, *7*(5), 922–933. https://doi.org/10.1002/pan3.70036

Tengö, M., Brondizio, E. S., Elmqvist, T., Malmer, P., & Spierenburg, M. (2014). Connecting Diverse Knowledge Systems for Enhanced Ecosystem Governance: The Multiple Evidence Base Approach. *AMBIO*, *43*(5), 579–591. https://doi.org/10.1007/s13280-014-0501-3

Tran, T. A., Rigg, J., Taylor, D., Miller, M. A., Pittock, J., & Le, P. T. (2022). Social Memory in the Mekong's Changing Floodscapes: Narratives of Agrarian Communities' Adaptation. *Human Ecology*, *50*(5), 879–893. https://doi.org/10.1007/s10745-022-00362-0

Tropical Plants Database. (n.d.). [Dataset]. Retrieved April 20, 2026, from https://tropical.theferns.info/viewtropical.php?id=Benstonea+copelandii&redir=Pandanus+copelandii

Turreira-García, N. (2025). West African Shea Processors in a Changing Global Market: Effects of Market Integration on Traditional Knowledge Resilience. *Economic Botany*, *79*(3), 287–309. https://doi.org/10.1007/s12231-025-09646-0

Uddin, M. S., Haque, C. E., Khan, M. N., Doberstein, B., & Cox, R. S. (2021). "Disasters threaten livelihoods, and people cope, adapt and make transformational changes": Community resilience and livelihoods reconstruction in coastal communities of Bangladesh. *International Journal of Disaster Risk Reduction*, *63*, 102444. https://doi.org/10.1016/j.ijdrr.2021.102444

Vergotine, G., Mazigo, A., Molebatsi, P., Ramsarup, P., Mayega, J., & McCowan, T. (2025). Co-creating climate knowledge: Informal networks, local innovation, and ecosystem restoration in coastal Tanzania. *Local Environment*, 1–25. https://doi.org/10.1080/13549839.2025.2579585

Vila-Henninger, L., Dupuy, C., Van Ingelgom, V., Caprioli, M., Teuber, F., Pennetreau, D., Bussi, M., & Gall, C. L. (2022). Abductive Coding: theory building and Qualitative (Re)Analysis. Sociological Methods & Research, 53(2), 968–1001. https://doi.org/10.1177/00491241211067508

Walker, B., Holling, C. S., Carpenter, S. R., & Kinzig, A. (2004). Resilience, adaptability and transformability in social-ecological systems. *Ecology and Society*, *9*(2). https://www.ecologyandsociety.org/vol9/iss2/art5/

Widiono, S., Wahyuni, E. S., Kolopaking, L. M., & Satria, A. (2024). Livelihood vulnerability of indigenous people to climate change around the Kerinci Seblat National Park in Bengkulu, Indonesia. *Regional Sustainability*, *5*(4), 100181. https://doi.org/10.1016/j.regsus.2024.100181

World Risk Report. (2025). Institute for International Law of Peace and Armed Conflict (IFHV) at Ruhr University Bochum, Bündnis Entwicklung Hilft (Alliance Development Works). https://www.misereor.org/fileadmin/user_upload_misereororg/publication/en/worldriskreport-2025.pdf

Yeboah-Assiamah, E., Muller, K., & Domfeh, K. A. (2017). Institutional assessment in natural resource governance: A conceptual overview. *Forest Policy and Economics*, *74*, 1–12. https://doi.org/10.1016/j.forpol.2016.10.006

Zayas, C. N. (2019). "Bínasët, Palyën, Mariit, Tempat: Place-based notions of conservation and resource right. *Aghamtao*.

7 Appendix A

Interview Consent form (English)

Research Project Title:	Indigenous and Local Knowledge and Social-Ecological Resilience in Northwest Panay, Philippines
Researcher	John Carl Alonsagay
Affiliated Institution:	Lund University Centre for Sustainability Studies, Sweden / PhilinCon

Good day! The interview will take (amount of time). We don't anticipate any risks associated with your participation, but you have the right to stop the interview or withdraw from the research at any time. Thank you for agreeing to be interviewed as part of the research project above. Ethical procedures for academic research undertaken at Lund University in Sweden require that interviewees explicitly agree to being interviewed and how the information contained in their interview will be used. This consent form is necessary to ensure that you understand the purpose of your involvement and agree to the conditions of your participation.

The following will be done during this interview:

1. The interview will be recorded, and a verbatim transcript of the original language will be produced.
2. The transcript of the interview will be analyzed by John Carl as the researcher.
3. Access to the interview transcript will be limited to John Carl, his project assistant, and research supervisor in Sweden with whom he will collaborate as part of the research process;

4. Any summary interview content, or direct quotations from the interview, that are made available through academic publication or other academic outlets will be anonymized so that you cannot be identified, and care will be taken to ensure that other information in the interview that could identify yourself is not revealed.
5. The actual copy of the recording will be kept and destroyed until the end of the research project on 28 May 2026;
6. Any changes of the conditions above will only occur with your further explicit approval.

Quotation Agreement

I understand that the words may be quoted directly. With regards to being quoted, please "check" next to any of the statements that you agree with:

	I wish to review the notes, transcripts, or other data collected during the research pertaining to my participation.
	I agree to be quoted directly.
	I agree to be quoted directly if my name is not published and a made-up name *(code, i.e. Participant 1, Participant 2)* is used
	I agree that the researchers may publish documents that contain my quotations.

By agreeing to proceed, I agree that;

1. I am voluntarily taking part in this research project. I understand that I do not have to take part, and I can stop the interview at any time;
2. The transcribed interview or extracts from it may be used as described above;
3. I have read the Information Sheet;
4. I don't expect to receive any benefit or payment for my participation;
5. I can request a copy of the transcript of my interview and may make edits I feel necessary to ensure the effectiveness of any agreement made about confidentiality;
6. I have been able to ask any questions I might have, and I understand that I am free to contact the researcher with any future questions.

Participant's name and signature: _____

Date signed: _____

Researcher's name and signature: **John Carl T. Alonsagay**

Date signed: _____

8 Appendix B

Interview guide (Key Informant Interview – Resource Management)

The aim of the interview is to:

a. *Understand the current state of livelihood and its related practices;*
b. *Know the actors and users involved;*
c. *Understand the individual/group decision-making regarding the use of the resource;*

1. Opening and introductions

- The principal researcher and/or assistant introduce themselves.
- The interview will take around 45 minutes.
- Reading/showing of printed consent form;
- Freedom to decline or to say unsure or "I don't know."

2. Background:

- *If consent is obtained, the interview proceeds.*
- Please tell us about yourself:
    - Name, age
    - How long have you been living in this community?
    - How long have you been doing this livelihood/using the resource?
    - What is the level of your formal education?

3. Livelihood context

- Please describe your livelihood.
- What makes it important for your family or community?

3.1 Positions/roles

- Who are the people involved in this livelihood, and what are their roles and responsibilities?

3.2 Allowable and forbidden actions

- What activities are considered acceptable?
- What activities are forbidden or discouraged?
- How do people here learn what is allowed and what is not?

3.3 Decision-making/control over actions

- When using the resource, do people decide on their own or consult with others?
- Are there activities that require permission or agreement in the group?

3.4 Information and knowledge sharing

- How do people know the resource's condition/abundance/scarcity?
- How do people know if there are rules violated?

3.5 Outcomes and impacts

- What changes in the resource(s) have you observed over time?
- Which area(s) are usually harvested/fished by the community?
- How do people know the limits of where and how the resource can be used?

3.6 Sanction enforcement and conflict management

- What happens when someone breaks a rule related to using the resource?
- Who is responsible for enforcing the rules, and how do they do it?
- Are the sanctions seen as fair by most people in the community? Why or why not?
- How are conflicts related to resource use/livelihood resolved?

4. *Thank the participants and inform them that the interview recording is finished.*

Interview guide (Key Informant Interview – Worldviews)

1. Opening and introductions

- The principal researcher and/or assistant introduce themselves.
- The interview will take around 45 minutes.
- Reading/showing of printed consent form;
- Freedom to decline or to say unsure or “I don’t know.”

2. Background:

- *If consent is obtained, the interview proceeds.*
- Please tell us about yourself:
    - Name, age
    - How long have you been living in this community?
    - How long have you been doing this livelihood/using the resource?
    - What is the level of your formal education?

3. Worldviews and beliefs

A. Are there stories, beliefs, or teachings about how Bariw/Shrimps:
    - How should it be used?
    - If there are stories about it, where did the resource come from?
    - Who does it belong to?
    - What happens if it is misused?

B. Are there places connected to this resource that are considered special, sacred, or sensitive?
    - How do we know if these places are considered *Mariit?*
    - How should people behave in these places?

A. How does the "Mariit" or other worldview explain changes in the resource? (i.e. decline, scarcity, unpredictability?)

Interview guide (Focus Group Discussions – Eliciting discussions on ILK)

1. Opening and introductions

- The principal researcher and/or assistant introduces themselves.
- The interview will take around 45 minutes.
- Reading/showing of printed consent form;
- Freedom to decline or to say unsure or "I don't know."

2. Background:

- *If consent is obtained, the interview proceeds.*
- Please tell us about yourself:
    - Name, age

- How long have you been living in this community?
- How long have you been doing this livelihood/using the resource?
- What is the level of your formal education?

3. Ecological knowledge

- Can you please describe your livelihood and the environment you depend on?
  - Has its location or abundance changed in the past years?
- How do you know if the resource is ready to be used/harvested?
- How do the dry and wet seasons affect the quality, processing, and harvesting?
- Are there differences between areas where it grows or is accessed?
- How did you learn about this, and how is this knowledge used compared to your elders/parents?

4. Beliefs and worldviews

- How would you describe your connection with this livelihood, the resource, and your community/family?
- What are the stories, beliefs, or teachings that you learned about:
  - Where did the resource come from?
  - Who does it belong to?
- Are there places that you're allowed or not allowed to use this resource?
  - What happens if it is misused?
- Based on your experience, how would you explain the changes in the resource since you started doing the livelihood (i.e., since childhood, etc.)?

5. Norms

- Who is allowed to use or harvest this resource?
- Are there any agreements or ways between your fellow users about:
  - How much to harvest/use?

    - When to harvest?
    - Which techniques/methods are usually used?
- What happens if someone does not follow these rules?
    - Who notices?
    - Who takes action/responds?
- Please describe any practices of cooperation or mutual help, if there are.
    - How do these work, and is it still practiced today?
    - Why do you think it is thriving/eroding?
- Who used to say that everyone must follow these rules? And are these rules still respected? Why or why not?

6. Concluding questions:

- What are your hopes for the future of this livelihood? For the younger generations in particular?

7. Thank the participants and inform them that the interview recording is finished.

9 Appendix C

Positionality Statement

I, as the researcher, acknowledge that my insider positionality may have influenced the research processes, including how the knowledge was co-produced, how community relationships were established, and how interpretations were formed throughout the study. My familial and cultural roots in Panay Island were among the primary motivations for undertaking this research. Together with the project assistant, we communicated in Kinaray-a during fieldwork and interviews, which helped participants feel more comfortable expressing their thoughts, experiences, and lived realities, and build trust. I considered immersion within the communities necessary to develop an in-depth understanding of their knowledge systems, particularly the unwritten norms, taboos, and customary practices that shaped their relationships with nature through their livelihoods.

It is likely, however, that our shared ethnolinguistic backgrounds (my own and the project assistant's) may have influenced the interpretation of the qualitative data - the familiarity of the local context may have shaped how meanings were understood, emphasized, or interpreted during the research process. To avoid speaking for the data, I made sure to reflect on and observe my position and relationship to the process throughout. I ensured that all preconceptions regarding the population and study settings were taken into account in consultation with the communities' customary leaders and the host civil society organization (PhilinCon), which had prior experience working closely with the communities involved in the study.

I further acknowledge the methodological decision not to distinguish the situated knowledge of Indigenous and non-indigenous community members involved in the study may have affected the dynamics of my analytical viewpoint. However, this decision was informed based on my own observations during the knowledge coproduction process, where traditional belief systems, practices, and livelihood relations appeared closely interconnected across both Indigenous and nonindigenous community members. Practical and technical constraints also influenced this decision. Nevertheless, I fully recognize that the Indigenous peoples possess distinct historical experience and rights that significantly differ from those non-Indigenous community members and that this methodological choice may have indirectly influenced the interpretation and representation of data.

I also acknowledge that, as a non-indigenous researcher educated at a western academic institution, this study is situated within structural privileges and a broader postcolonial power context that may reproduce existing power imbalances in natural resource management in the area. These dynamics are also reflected in the concepts, methods, and frameworks used in this study, as well as in western scientific traditions and epistemological foundations shaped by colonial histories. These are aspects that cannot be ignored and therefore require explicit recognition and reflective engagement.

To address this, I deliberately exerted effort to ensure that the fieldwork was conducted in an ethically transparent and respectful manner, including clearly communicating the aims and intentions of the study, obtaining voluntary informed consent, ensuring participants' anonymity and confidentiality, recognizing participants' right to withdraw at any stage, and allowing the full deletion and destruction of contributed information upon request.

Lastly, I recognize that the knowledge produced through this study does not claim to represent the entirety of the diverse knowledge systems in Northwest Panay/Panay Island nor the full range of dynamics associated with social-ecological resilience principles. The knowledge system discussed here is relational, situated, and context-specific, and it was presented as a theoretical approximation

developed to address the research questions and the particular place context where the research was conducted.

10 Appendix D

Table of Traditional Practices/Customary Beliefs in Bariw Harvesting and Weaving

I. 14 steps for *Banig* Weaving (*Pagrara*)	
Word	Definition/Traditional Description
Paghapnig	Gathering of slashed *Bariw* leaves in a 30-piece bundle.
Pagriras	Tripping off thorns along the leaf edges and the middle ridge of the leaf. The *Bariw* leaf is divided into 2. Each half is piled separately until a bundle is stripped of the thorns. The thornless pieces will be tightly tied up so that each piece will not curl up when it dries.
Pagbulad	Sundrying of *Bariw* leaves to obtain a shiny brown tone and strengthen the fibers.
Pagpalpag or *Pagbalbal*	Gradual beating of *Bariw* leaves with the use of a wooden club known as sampok, against a flat stone until the leaves become “soft.”
Paglikid	One way of keeping the “softness” of the *Bariw* and preventing it from going stiff for weaving. It is rolled like a coil. Participants shared that the tighter it is coiled, the more it sustains its softness.
Pagbuntay	In case the *Bariw* fails to maintain its suppleness, unwinding the link to straighten the spiraled *Bariw* leaves is necessary.
Pagkëlhad	By passing the *Bariw* through the shedder, the desired sizes of strands are measured. The shedder, commonly known as *kulhadan* or *kurulhadan* is made of wood and blade, which also gives name to it as *gilit*, referring to the blade’s brand names (Gillette).
Pagkuyupis	The method refers to the start of the weaving process. The *Bariw* strands are folded in half. Each *kyupis* consists of four strands, folded together in pairs, one horizontal and the other vertically.

Pagtay-tay	The method of identifying the size and length of the mat; the width of the mat will be determined through the weaving of both sides.
Pagrara	The actual process of weaving, crossing two strands together to create a flat dimension for the mat. Participants shared that is the most important process in using *Bariw.*
Sapay	Method of refining the edge on both sides of the mat.
Hurip	The method of folding the remaining strands in the sides or edge line to keep the weave tightly locked securely in place. This is also a necessary repair in some worn-out and damaged mats made during weaving and while in continued use.
Gutab	The method of cutting of excess strands in the mat.

II. Other words associated with *Bariw Harvesting*	
Word	Definition/Traditional Description
Pagdugos it bariw	The process of harvesting the *Bariw* leaves, using *sanggët*, a small hand-knife sickle also used for coconut and rice harvest. Participants also reported that they often use a bamboo pole for taller *Bariw* plants.
Nilikid	Coiled sundried *bariw* leaves for gradual beating.
Hil-o or *Paghil-o-anay*	The past practice of communal weaving was based on reciprocity and social trust. Participants reported that the practice has declined in recent years as community members have opted for individualized weaving due to changes in income and market demand.
Urihing tubô	Roughly translates to “new bud” - often used referring to the younger generation.

Agsá	An informal person-to-person agreement on temporary harvesting rights between the plant owner and the other resource user is based on social trust and reciprocity of resource use.
Tagad	Use of wooden stakes in planting *Bariw* results in pliable leaves/plants, compared to the use of steel rods, which results in rigid leaves/plants; it is considered a social livelihood norm.
Kabaririhan or Punâ	A *Bariw* Grove.
Panid (singular) /Pinanid (plural)	Referred to sheets of raw *Bariw* leaves.
Si-ák	A customary unit of measurement to count *Bariw* leaves. One *si-ák* is counted as 30 *panid/pinanid* (leaves).

Table of Traditional Practices/Customary Beliefs in Freshwater Shrimp Fishing

Indigenous word	Definition/Explanation
Linaw	Referred to as the deeper, stiller parts of the river • Some linaw areas are sometimes temporarily closed or avoided for fishing to allow urang (*Macrobrachium rosenbergii*) and other freshwater organisms to breed, spawn, and replenish their populations • Shrimps live or are abundant in large linaw areas
Dûgsanan	Referring to shallow river areas with no large rocks, it is used to identify areas where shrimps are scarce.
Ta-ûn	A river fishing trap traditionally made from woven bamboo (*Dendrocalamus latiflorus)* or banban (*Donax canniformis)* slats. In recent years, plastic bottles and plastic mesh have been adopted by shrimp fishers in the study areas.
Pa-ûn	This is a bait made from rotten or roasted coconut meat used in a shrimp fishing trap. The bait is changed daily, every third use of the trap, or when the odor is no longer potent.
Banban	Local name for *Donax canniformis.* Participants report using the wild plant to make Indigenous shrimp fishing traps that last 3-6 months.
Lukaba	Local name referring to the freshwater shrimp shell. Taboos regarding its use and disposal are highly observed by the communities.
Angël	Referred to as the consequence of violating the taboo on freshwater shrimps, crabs, and other crustaceans. Locals described it as an unexplained illness that often involves skin diseases, neck-twisting, vomiting, or severe abdominal pain.

Halit	Any activity that harms the natural resource system or nature is often associated with negative outcomes for communities.
Pangatas or *Atas*	A communal activity of building temporary dams or reservoirs to catch fish and shrimp is done during the Christian Lent, which coincides with the dry season in the Philippines from March to late April or mid-May.
Iraya	Referring to the sense of direction used for upstream or areas toward the mountains or highlands.
Ilawod	Referring to the sense of direction used for downstream or areas towards the sea or the lowlands.

11 Appendix E

Overarching themes and its corresponding subthemes generated from thematic coding

Themes	Code	Subthemes
A. Ecological knowledge	A1	Species knowledge, identification, and taxonomy
	A2	Life histories
	A3	Knowledge of spatial distribution
	A4	Species behavior
	A5	Knowledge of the ecosystem and habitat dynamics
	A6	Knowledge of local landscape and geography
	A7	Knowledge of weather variations
	A8	Knowledge of ecosystem fluctuations, shocks, and transformations
	B1	Monitoring resource abundance and change in ecosystems
	B2	Protection of vulnerable life history stages
	B3	Resource rotation
	B4	Protection/forgoing of specific habitats

B. Customary land and resource management systems	B5	Management of landscape patchiness
	B6	Maintenance of ecosystem structure and function
	B7	Site selection
	B8	Responding to shock and changes
C. Customary leaders, norms, institutions, and networks	C1	Generation, accumulation, and transmission of knowledge
	C2	Intergenerational transmission of knowledge
	C3	Reinforcement of social codes and relationships
	C4	Cross-scale institutions
	C5	Social norms
	C6	Taboos and sanctions
	C7	Social relationship to resource
	C8	Roles of stewards/elders/customary leaders
	D1	*Kaginhawa-an*
	D2	Fatalism

D. Worldviews and belief systems	D3	Reciprocal relationship with nature
	D4	*Malasakit*
	D5	*Kinaiyahan*
	D6	*Optimism*
E. Exogenous drivers	E1	Normative shifts
	E2	Influence & Constraints from Formal Institutions
	E3	Physical and Material Conditions
	E4	Institutional capacity constraints
	E5	Market forces