Asia-Pacific Social Science Review

Manuscript 1539

Contextualizing the SDGs in the Anthropocene: Case Study of Mekong Women's Adaptation to Hydropower Dams in Northern Thailand

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RESEARCH ARTICLE

Contextualizing the SDGs in the Anthropocene: Case Study of Mekong Women's Adaptation to Hydropower Dams in Northern Thailand

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Abstract: Large dams are among the most massive infrastructures built in the Mekong River and provide water-energy generators in the Lower Mekong Basin (LMB). Nevertheless, the Mekong River's current transformation using electricity utilizing hydropower technology has damaged the local ecosystem in the LMB with social and environmental effects. Drawing upon feminist posthumanism, this study argues that the ongoing hydropower dam constructions in the LMB reflect uneven development and exclusion for women and the more-than-human nature of Mekong biodiversity. With a case study of Mekong women's adaptation to regional development projects, this study aims to contextualize SDGs in the global crisis of the Anthropocene through the lens of the local milieu. The qualitative research was grounded in the Chiang Khong district in the northernmost part of Thailand in Chiang Rai province due to its proximity to the Xayaburi Dam and the center of women collecting Kai along the mainstream Mekong. The findings show that the energy development in the Mekong River has destroyed ecological functions and constricted women's and more-than-human natures' survival. The construction of dams across the Mekong River Basin catalyzes environmental transformation and livelihood disruptions. Moreover, the loss of biodiversity and ecosystem integrity will undermine efforts to assess SDG targets in Thailand, making it even more difficult to report progress, especially on well-being and biodiversity. This study foregrounds multispecies justice as a strategy to rethink SDGs in the reality of waterscape degradation in the Anthropocene by focusing on revitalizing the well-being of all beings in the Mekong River, achieving the promise of leaving no one behind.

Keywords: SDGs, the Anthropocene, Mekong River, women, biodiversity

The global community has now recognized that the world is entering a new geological epoch when humanity becomes the dominant force in the alterations of the Earth's system and biosphere, known as the Anthropocene (Crutzen & Stoermer, 2003; Cook et al., 2015). The term Anthropocene, according to LeCain (2015), was derived from the Greek roots *anthropo-* (human being) and *-cene* (new or age). Since Crutzen and Stoermer propounded the term "Anthropocene" in the early 2000s, it has been habituated in scholarship and research on the global environmental challenges to address the multifaceted ecological crises and critical ecosystem services at risk (Davis et al., 2019). There are several recognitions of the human actions that have transformed the ecosystems, such as agriculture-

related activities or the transformation of land for food production (Vanwalleghem et al., 2017; Zimmerer et al., 2019), urban expansion (Pagani-Núñez et al., 2019), intensive consumption and use of animals (Kona-Boun, 2020), and increasing exploitation of natural resources since the Industrial Revolution (Rockström et al., 2009).

Global research has shown that flow change negatively impacts riverine species and dangers the local environment (Rolls et al., 2012). Construction of dams across rivers in developing countries, especially in the world's most biodiverse riverine ecosystems, catalyzes environmental transformation and livelihood disruptions, for example, in the Congo riverine ecosystems (Inogwabini, 2020), Brazilian Amazonia (Latrubesse et al., 2017), and the Mekong River Basin (Soukhaphon et al., 2021). A study by Ganoulis (2022) characterized the control of the river system by human-related forces under global hydropower development as a major feature of the Anthropocene. With the rising demand for energy power, rivers around the world are becoming vulnerable to anthropogenic stressors with the development of hydropower dams and the illusion that renewable energy will eventually solve the problem of climate change.

In the Lower Mekong Basin (LMB), Yoshida et al. (2020) recorded that 46 dams have been constructed (from the first dam of the Lancang dam completed in 1995 to the present day), with 11 more proposed for the river mainstream to generate energy for regional countries. A study by Frey & Linke (2002) argued that the hydropower development project is an attractive renewable energy resource that will meet global energy demands, diversify the energy mix for the country's future energy security, and attract substantial foreign direct investment to grow the GDP rapidly. Indeed, hydropower dams in the LMB are seen as sources of green energy and are considered sustainable energy production in the 21st century (Hecht et al., 2019). However, dam technologies have also undermined the river's ecosystem balance, causing cumulative cascading effects on river flow conditions and sediment load transport because they intervene in the natural process of river water and the nutrient cycle (McCartney, 2009). The escalation of hydropower production also reduced aquatic biodiversity and agricultural production, which provide food security for nearly 60 million of the river basin population (Pittock, 2019).

Using the local realities in the Chiang Khong district in Chiang Rai province, northernmost Thailand, the Mekong River serves as transboundary water resources and the natural border between Thailand and Laos in the LMB. The river is the home of the aquatic ecosystem in the ancestral Baan Had Krai community lands. However, Chiang Khong district in northern Thailand is also the center stage of China's Belt and Road Initiative's (BRI) investments in global infrastructure development strategy (Saiyarod, 2023). In this research, the hydropower dam projects are considered manifestations of a new era for the current geological epoch, the Anthropocene, which describes a situation where human actions have drastic effects on large-scale environmental changes on Earth (Crutzen & Steffen, 2003). In Chiang Khong, the impact of the regional project development is mostly felt by women residing on the Mekong riverbank in Ban Haad Krai village. In this village environment, there lives a local community of women who, for generations, have depended on the Mekong River biodiversity, particularly the green river Algae, locally known as "Kai," to support their livelihood. These women are kin with the river through diverse ways of practices to aspire bonds and intimacies with more-than-human nature.

This study seeks to situate the Sustainable Development Goals (SDGs) in the global predicament of the Anthropocene, viewed through the lens of the local ecology in Chiang Khong in Northern Thailand as part of the LMB. This study contends that the continuous development of hydropower dams in the LMB, which might contribute to Goal 7 (Affordable and Clean Energy), mirrors a pattern of disparate progress and marginalization affecting both women and the diverse ecosystems of the Mekong. Utilizing a feminist-posthumanism framework, this study addresses the rising injustice of the local women and biodiversity as more-than-human entities with the case study in Chiang Khong district in Chiang Rai province, Northern Thailand. Likewise, this study shows that development impacts are not homogenous and equal for humans and more-than-human. The ongoing conversion of river water to electrical energy under development projects has disrupted surrounding communities and altered the natural landscape with the multispecies entangled in the ecosystem.

In this new crisis era, the Anthropocene, new ways of thinking and innovative forms of action are

necessary if the global population is to have a viable future on this planet (Folke et al., 2020). In the local milieu, women are profoundly dependent on the river biosphere's capacity to provide services for their societal development and well-being as the increasing human economic activities have threatened the Mekong's environmental tipping point. Although the SDG targets were formulated to view social, ecological, and economic systems as interlinked frameworks, there is a need for greater focus and action on these targets to ensure their effective implementation. Thus, this study also explores possible pathways to environmental sustainability in the Mekong region by foregrounding social and ecological systems in integrated and dynamic relations by noticing that the entanglement of the local women and river biodiversity is vital to empowering the local economy, contributing to the conservation of multispecies biodiversity, and navigating to the ultimate goal of the SDGs, leaving no one behind, in the inclusive vision.

Situating the Mekong River in Regional Hydropower Dams Development

The Mekong River, the longest river in Southeast Asia, is where more than 70 million people of mainland Southeast Asia depend on their livelihood on the river for drinking water, food, irrigation, hydropower, transportation, and commerce (Cosslett & Cosslett, 2018). As the world's second most biodiverse river after the Amazon, Mekong's flood pulse features, with considerable inter-seasonal flow variance, are the source of Southeast Asia's prolific biodiversity, particularly in river-floodplain ecosystems (Baird & Hogan, 2023). The Mekong region is Asia's rice bowl (Molle & Srijantr, 2003), and it is home to a dynamic hydro-ecological system that supports rich biodiversity and provides food security for the people in the region.

Since the 1990s, energy development has been a key emphasis of economic cooperation among countries in the Mekong River Basin. During the 2000s, there has been a growing interest in the effects of investments and policies (Chheang, 2010). However, the establishment of the hydropower dams has also created significant environmental disruptions and has imperiled the lives and livelihoods of millions of people residing on the Mekong riverbank. One of the notable impacts associated with hydroelectric plants is the modification of the river's hydrological cycle (Timpe & Kaplan, 2017). The construction of hydroelectric dams also hinders the migratory routes of fish, disrupting their reproductive patterns and altering their entire life cycle (Arantes et al., 2019).

Apart from negatively affecting fish populations, hydroelectric dams also have repercussions on human communities that depend on fishing resources (Richter et al., 2010). The Lower Mekong Basin fisheries, producing between 2.0 and 2.6 million metric tons annually, are crucial for the protein intake of local communities and accessible sources of nutrition (Mekong River Commission, 2014). The consequential environmental disruptions, notably alterations to the hydrological cycle, have raised serious concerns about the sustainability of such projects (Middleton, 2022). These disruptions not only pose a threat to the intricate ecosystems of the Mekong River but also jeopardize the lives and livelihoods of millions of people dependent on the river for sustenance (Pal et al., 2023). Thus, as nations seek to balance economic development and social consideration with environmental preservation, a comprehensive understanding of the intricate interplay between hydroelectric initiatives and the diverse ecosystems they impact is essential for informed decision-making and the sustainable future of the Mekong River Basin.

Hydropower Dams and the Sustainable Development Goals (SDGs) in Thailand

Introduced in 2015, SDGs provide a universal framework for countries, organizations, and individuals to work together in addressing global challenges and creating a more sustainable and equitable world by the year 2030 under the official title "Transforming our world: the 2030 Agenda for Sustainable Development", consisting of 169 global targets with 17 goals (United Nations, 2015). Based on the Sustainable Development Report 2023 (Sachs et al., 2023), Thailand is positioned at 43 out of 166 countries with a score of 74.7, which is above the ASEAN regional average of 67.2.

Although this report is not an official UN document, it offers valuable insights by utilizing 97 global indicators. Approximately two-thirds of the data used in the report are sourced from official UN agency statistics, while the remaining third comes from research institutions, universities, and reputable private

development organizations. The report aims to provide a comprehensive overview of global progress and setbacks, ensuring data comparability across regions and countries. However, the indicators and criteria are designed to reflect a global perspective, which may lead to differences in assessment results when applied to specific national contexts. Therefore, the findings should be later interpreted with these considerations in mind, acknowledging potential variations in the assessment results compared to official national data.

For a more comprehensive view and accurate representation of the situation in Thailand, it is also essential to consider the insights and incorporate national data provided by the 13th Thailand's National Economic and Social Development Council (NESDC) 2023–2027. The NESDC (2023) report highlights key challenges such as the decline in natural resources, intensifying environmental problems, and growing pollution. These issues, along with the increasing release of greenhouse gases (GHGs), are critical obstacles to achieving the SDGs, which are also integral to Thailand's 20-year National Strategy aimed at "Security, Prosperity, and Sustainability."

Based on the Sustainable Development Report 2023, the SDG trends in Thailand vary from fully achieving SDG targets on SDG 1 (No poverty) and SDG 4 (Quality education) on track to maintaining SDG achievement. However, it is facing significant challenges on SDG 6 (Clean water and sanitation), SDG 7 (Affordable and clean energy), and SDG 12 (Responsible consumption and production). Morever, it has major challenges on SDG 2 (Zero hunger), SDG 3 (Good health and well-being), SDG 15 (Life on land), and stagnating on SDG 8 (Decent work and economic growth). Table 1 summarizes the status of Thailand's progress on the 17 SDGs, as contained in the Sustainable Development Report 2023 (Sachs et al., 2023).

Table 1

Thailand Sustainable Development Report 2023 with 17 Targets of SDGs

SDGs	Target	Status
1	No poverty	SDG achieved by maintaining trends
2	Zero hunger	Major challenges remain with stagnating trends
3	Good health and well-being	Major challenges remain with moderately improving trends
4	Quality education	SDG achieved with moderately improving trends
5	Gender equality	Significant challenges remain with moderately improving trends
6	Clean water and sanitation	Significant challenges remain with maintaining trends
7	Affordable and clean energy	Significant challenges remain with maintaining trends
8	Decent work and economic growth	Significant challenges remain with stagnating trends
9	Industry, innovation, and infrastructure	Significant challenges remain with moderately improving trends
10	Reduced inequalities	Significant challenges remain with stagnating trends
11	Sustainable cities and communities	Significant challenges remain with moderately improving trends
12	Responsible consumption and production	Significant challenges remain with moderately improving trends
13	Climate action	Significant challenges remain with stagnating trends
14	Life below water	Major challenges remain with stagnating trends
15	Life on land	Major challenges remain with decreasing trends
16	Peace, justice, and strong institutions	Major challenges remain with stagnating trends
17	Partnerships for the goals	Significant challenges remain with stagnating trends

The NESDC 2023-2027 report has also outlined significant environmental challenges, such as resource depletion and pollution, which impede progress toward the SDGs. Hydropower projects, while promoting clean energy (SDG 7), often disrupt aquatic ecosystems and local livelihoods, posing challenges to goals like life below water (SDG 14) and life on land (SDG 15). These projects also influence water security (SDG 6), food security (SDG 2), and economic growth (SDG 8), highlighting the need for a balanced approach that mitigates negative impacts while advancing sustainable development. This context underscores the importance of integrating national data and insights to develop policies that address the multifaceted effects of hydropower on both environmental and socio-economic dimensions, ensuring that Thailand's development aligns with the SDGs holistically and equitably.

Despite being seen as a source of clean energy, hydropower dams significantly influence the underlying ecological processes that support aquatic ecosystem biodiversity (Baird & Hogan, 2023). The construction of hydropower dams along the Mekong has been a contentious issue with implications for the economic development of the region, the uneven distribution of benefits and costs, and the environmental and social impacts on local communities. The impact of hydropower dams on the Mekong River in Thailand can be related to several SDGs outlined by the United Nations. Although hydropower projects can contribute to some goals, they may also pose challenges to others. Following Griggs et al. (2013), this study frames the SDGs constituent targets related to social, economic, and environmental in five focal areas, namely lives and livelihoods, food secu-rity, water security, clean energy, health ecosystems, and governing for sustainability. As shown in Figure 1, there are SDG targets that share a direct relation to the impacts from the hydropower dams and also indirect impacts, as follows.

Hydropower dams contribute to the generation of renewable energy, contributing to efforts to combat climate change by reducing reliance on fossil fuels, aligning with the goal of ensuring access to affordable, reliable, sustainable, and clean energy to support SDG target 7 (Affordable and clean energy) and target 13 (Climate action). Yet, the dams also hinder efforts to achieve other targets in the SDGs. In particular, Thailand is able to maintain the trends of clean energy. However, significant challenges remain, especially in SDG 7 (Affordable and clean energy) on renewable energy share in total final energy consumption and targets in SDG 13 (Climate action) on carbon cycling. There are also major challenges for Thailand to be on track maintaining SDG 6 (Clean water and sanitation) on anthropogenic wastewater that receives treatment to attain water security for the country, SDG 2 (Zero hunger) with indicator on mostly prevalence of undernourishment with a downgrading trend to achieve

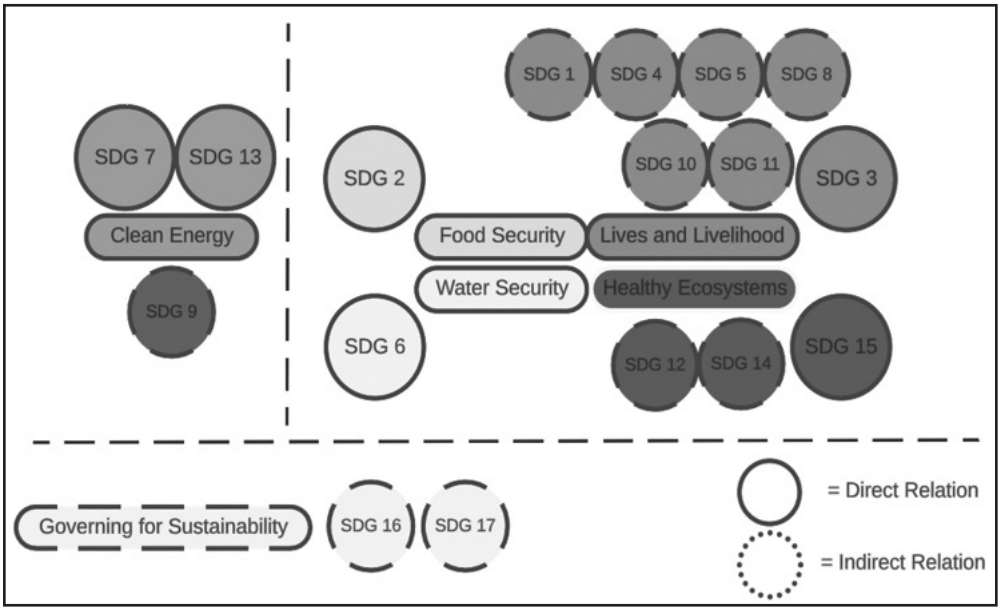

Figure 1. The Focal Areas of SDGs Constituent Targets (Adapted from Griggs et al., 2013)

food security, SDG 3 (Good health and well-being) on subjective well-being to fulfill livelihood for the people, and SDG 15 (Life on land) on decreasing numbers of species survival in terrestrial sites important to biodiversity to create healthy ecosystem. Accordingly, in the context of the anthropogenic rivers through the establishment of the hydropower dams, there are still several key challenges for Thailand in promoting sustainable development across social, economic, and environmental dimensions.

Although the study effectively links its findings to the SDGs, this paper will also later address specific targets within these goals to provide a deeper analysis (in the discussion part) of the actual impacts. For instance, rather than broadly stating that the construction and operation of hydropower dams challenge the achievement of the SDGs, this paper will specify which targets are impacted by the case study in Chiang Khong district, Chiang Rai province, Thailand. For example, SDG 6 (Clean water and sanitation), Target 6.6: Protect and restore water-related ecosystems, and SDG 15 (Life on land), Target 15.1: Ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems. Thus, by focusing on these specific targets, the analysis can be developed into the direct and indirect effects of hydropower projects on these aspects, providing a more practical understanding of the challenges and potential solutions.

Feminist-Posthumanism Framework in the Anthropocene

This study employs a feminist posthumanism framework to explore the interconnectedness of humans and more-than-humans in the context of the Lower Mekong River Basin. This perspective is particularly important for analyzing SDG 6 (Clean water and sanitation), Target 6.6: Protect and restore water-related ecosystems, and SDG 15 (Life on land), Target 15.1: Ensure the conservation, restoration, and sustainable use of terrestrial and inland freshwater ecosystems. In Thailand, it emphasizes the importance of diverse contributions to sustainability. Feminist posthumanism not only challenges traditional binary distinctions but also expands the understanding of resilience. Resilience in this context involves the capacity of communities to withstand, adapt to, and recover from challenges and hardships while facilitating sustainable development and well-being.

The Anthropocene is well-known for the substantial human-induced changes to the Earth's climate, biology, and geology, leading to a profound anthropogenic impact on the environment and widespread species extinctions (Steffen et al., 2011). However, as emphasized by numerous feminist philosophers and critical scholars, the concept of the Anthropocene obscures problematic distinctions among humans and conceals intricate connections between technology, humans, and entities beyond the human realm (Arias-Maldonado, 2015). By acknowledging the entanglement of human and more-than-human agents, feminist posthumanism suggests that resilience involves transforming relationships and structures to create more sustainable communities. Women are central to nurturing this resilience through their contributions to environmental stewardship, social cohesion, and economic activities. Their traditional knowledge and practices in foraging and managing natural resources play a crucial role in maintaining the health and productivity of ecosystems.

In response to various contemporary posthumanism ideas and theories, feminist posthumanism challenges binary distinctions like human versus non-human. Specifically, feminist-posthumanism rejects an obvious split between nature and culture; for instance, Donna Haraway (2003) depicted nature and culture as already entwined in complex relationships known as *natureculture* to underscore that these concepts are always interwoven in human lives, social practices, and roles and responsibilities. In contrast to the modern Western ontology of separation and independence, Haraway introduced the ontology of feminist-posthumanism in relationality, where entities come into existence and are transformed through relations.

As Haraway (2015) stated, human actions always involve other abiotic processes and biotic organisms in a kin-making process, and they do not terraform the world independently. Haraway (2015) also introduced the "species turn" to explore non-human and human collaboration through the co-construction of the niche and the entanglement of "intra-acting," coevolutionary histories, and co-becoming in her concept of "making kin," proposing interconnection, co-becoming, and mutual complementarity thinking as fundamental existential principles that are all inseparable in *natureculture*. Haraway's posthumanism

has been particularly influential, offering conceptual tools for structuring multispecies research, especially concerning the inseparability of the *natureculture* web (Huff & Jolly, 2022).

In the face of the ecological crisis confronting humanity in the 21st century, upholding the traditional separation between non- or subhuman and human, nature, and culture is no longer practical (Burke, 2022). According to Haraway (2016), the Anthropocene grapples with concepts that are urgent for humanity, situated in a relational universe, to "make kin" with the more-than-human world. In this study, Haraway's posthumanist framework offers a lens through which scholars can navigate the challenges of the Anthropocene. By embracing the principles of "making kin" (Haraway, 2015) and recognizing the interdependence of all entities, collaborative paths toward sustainable development are viable in the face of the complex, interconnected, and urgent challenges presented by the Anthropocene.

This study uses Haraway's feminist-posthumanism framework to examine the interconnectedness of humans and non-human entities, identifying collaborative paths for sustainable development in the Anthropocene. This approach aligns with the SDGs by fostering inclusive, sustainable, and resilient societies. For instance, SDG 6 (Clean water and sanitation) and SDG 15 (Life on land) both emphasize the importance of building resilience to climate-related hazards and conserving ecosystems.

The integration of feminist posthumanism into this study highlights how local women's ecological knowledge and practices can enhance community resilience, ensuring that both human and non-human entities thrive in the face of environmental and social challenges. By emphasizing the principles of "making kin" and recognizing interdependence, this research aims to foster inclusive and sustainable solutions that integrate human and more-than-human perspectives. This approach is crucial for rethinking environmental policies and conservation strategies to address the complex challenges of the Anthropocene in our era.

Method

This research employed a qualitative case study methodology in social science research as a practical investigation into a phenomenon within its authentic context, utilizing a research strategy to examine a social unit (Yin, 2018). The foundation of the case study approach lies in the constructivist paradigm, asserting that truth is subjective and contingent on the observer's perspective, grounded in the idea of a socially constructed reality (Pfadenhauer & Knoblauch, 2019). By utilizing an explanatory case study, this study aims to explain a real-life complex phenomenon in in-depth explorations to gain a deep and contextual understanding of the observed phenomenon (Baxter & Jack, 2008).

The study focused on Baan Had Krai village along the Mekong River in the Chiang Khong district. A purposive sampling method was used to select 15 local women who had significant experience and knowledge related to the foraging and use of Mekong freshwater green algae (Kai). These women were reached through local community leaders and local community organizations (such as Mekong River School). The participants were well-informed and willing to share their insights. Although the primary focus was on women due to their unique role in Kai-related activities, fishermen and representatives from the Mekong School were also included in the broader community discussions to provide a comprehensive understanding of community dynamics and ecological practices.

Data were collected through semi-structured interviews, which facilitated an in-depth exploration of the women's narratives, experiences, and perceptions. Additional data collection methods included archival research to provide historical and contextual information, observations to gain insights into daily activities and interactions, and discourse analysis to examine communication patterns and uncover underlying social constructs. Explanatory case studies allow for a holistic examination of a case, taking into account multiple variables and their interactions.

In case study research, the determination of the "unit of analysis" is crucial, ranging from an individual, family, or household to a community. Therefore, a key strength of this approach lies in the close collaboration between the researcher and the participant, fostering an environment where participants can articulate their narratives (Baxter & Jack, 2008). Through these narratives, participants articulate their perceptions of reality, providing the researcher with deeper insights into their actions (Robottom & Hart, 1993).

Archival research involves collecting historical and contextual information from existing records, reports, and documents related to the region and its practices. This provided a foundational understanding of the environmental, social, and economic backdrop against current practices. Observations were conducted to gain insights into the daily activities and interactions of the participants within their natural settings. This method helped capture the practical aspects of Kai foraging, including techniques, community interactions, and environmental conditions. The semi-structured interviews were designed to facilitate an in-depth exploration of the women's narratives, experiences, and perceptions. Questions were open-ended to allow participants to articulate their stories, providing rich qualitative data on their roles, knowledge, and contributions to local sustainability practices. Discourse analysis was employed to examine the language and communication patterns of the respondents. This method helped uncover underlying meanings, social constructs, and cultural narratives embedded in the participants' discussions about their work and its impact on their community and environment. By employing this multi-method approach, the study aimed to achieve a deep and contextual understanding of the observed phenomenon, highlighting the contributions of local women's ecological knowledge and practices to the sustainable development goals in the Anthropocene context.

Case Study of Chiang Khong District in Northern Thailand

The research was conducted in Chiang Khong district in Chiang Rai province, in the northernmost part of the Thai border, and in the Lao border town of Huay Xao, which is crossed by the Mekong River. Chiang is a Northern Thai (Kam Mueang) dialect word that translates literally as "town," whereas Khong refers to the Mekong River. The site in the Chiang Khong district was selected for its proximity to the Xayaburi Dam, the Jinghong Dam, and the Mekong River, with its tributaries as the center stage of BRI investments in global infrastructure development strategy (Saiyarod, 2023). The BRI is a global infrastructure development strategy aimed at enhancing trade and economic integration across Asia, Africa, Europe, and beyond, focusing on building infrastructure such as roads, railways, ports, and energy projects to facilitate connectivity and cooperation among participating countries (Siddiqui, 2019). Big-scale hydropower dams are deemed formidable ideals of economic achievement, modernization, and industrial progress as the most significant tools employed for river basin management to provide water storage for hydropower generation, irrigated agriculture, industrial production, and flood control (Soukhaphon et al., 2021).

The research was grounded in the Chiang Khong district in Chiang Rai province, the northernmost province of Thailand, with "Baan Had Krai village" selected as a unit of analysis to understand multispecies entanglement between the local women and more-than-human nature in the Mekong River as a social phenomenon. Chiang Khong is known as the home of the aquatic ecosystem in Northern Thailand. The income of the local people living in Chiang Khong depends on nature's gift economy, which includes collecting plants (such as river algae) and catching fish, the knowledge that specifically has been passed down from generations in Chiang Khong. In the village of Had Krai, the Chiang Khong women make a living from farming rice, gardening vegetables on the banks of the Mekong River, and foraging local green algae called "Kai." Hence, this study collected narrative information from 15 local women about the Chiang Khong women's entanglements with a more-than-human nature in the Mekong River. This research applies three steps in data collection and analysis: composing theories and concepts, contextualizing the research site, and analyzing the local people's experience. Several techniques to collect data include archival research, observation, semi-structured interviews, and discourse analysis.

Results

Natureculture Narrative of Mekong Local Women and Biodiversity

The district of Chiang Khong, situated in the Thai border with the Lao border town of Huay Xao, is intersected by the Mekong River. Local communities in this area have a rich history of engaging in river-related activities, specifically fishing and foraging. According to the interviewees, the task of catching fish is traditionally associated with men, whereas the women are responsible for collecting Kai. Fishing, seen as a male domain, involves the preparation of

wooden boats and machinery to venture into the river early in the morning to hunt fish in the deeper parts of the river. On the other hand, foraging, considered a female sphere, entails the safe collection of food resources like Kai from the shallower riverside areas. These gender roles originated from ancestral practices where cooperation was essential for hunting animals and gathering wild plants in riverine landscapes.

Also, according to the interviewees, local women residing in villages along the Mekong riverbank play a crucial role in preserving traditional knowledge, particularly in foraging of Mekong freshwater green algae known as *Cladophora glomerata*, locally referred to as Kai. These women contribute to ensuring food security for their families by cooking in the kitchen and engaging in foraging activities along the riverbanks to find various riverine species, such as mushrooms, bamboo shoots, fish, crabs, and edible insects. In Ban Haad Krai, the women rely on Kai harvesting and riverside agriculture for their livelihoods, a practice that has been passed down through many generations. Kai holds significant cultural importance as a staple food among Thai-Laos communities residing along the Mekong River, particularly in the village of Ban Haad Krai.

Discovered in locations where water flows over rocks, Kai is found thriving in specific environmental conditions. In areas where the river flows with clarity and cleanliness, Kai adheres to the rocks, forming a lengthy and vivid green line. Characterized by its long strands resembling bright green yarn and its appearance resembling silk and adorned with a vibrant fresh green hue, Kai captivates observers with a pleasant aroma to enhance its culinary appeal. During the dry season spanning from January to April, when the water level of the Mekong River is low, Chiang Khong's local women engage in the collection of Kai. This activity typically occurs from morning to afternoon. The gathered Kai is then brought home to be used in various dishes, such as curry or roasted chili paste.

After collecting Kai from the river rocks, the local women wash the algae to clean its surface, rinse it thoroughly in the water to remove any soil debris, twist and mold it into cubes, store it in baskets, and then dry it for further food processing. Another technique employed for the drying process involves hanging the algae from eaves, allowing the wind to enter from all directions. The timing and location of the drying process are carefully calculated because exposure to strong sunlight can diminish the nutritional quality of Kai. The versatility of Kai is evident in its potential for development into a diverse array of food products. The freshly dried Kai can be sold in the local border market for 100 baht per kilogram. The less selected Kai is often used as feed for farm and pond animals like chickens, pigs, and fish.

Kai production has recently become a distinctive economic activity for local women. The Ban Haad Krai Farmers Group, a community organization that facilitates knowledge-sharing and provides additional income opportunities, was established to support the local women's entrepreneurship ability from Kai production. Maintained by the Department of Agricultural Promotion, this community initiative helps sustain products derived from Kai. Utilizing the abundant natural resources with Kai along the river, Chiang Khong local women cultivate various plants to ensure food security for their families. These include cabbage, chili, morning glory, gourds, beansprouts, and many other riverine plants and animals to prepare dishes such as Pla Ra, Larb, Bamboo Shoot Curry, roasted/grilled/boiled/dried river fish, stir-fried vegetables, shrimp or crab vegetable salads, and herbal soup.

The local women also utilize natural plants for medicinal purposes, blending them into traditional medicine to address ailments such as stomachaches, fever, coughs, and wounds (Thiamdao & Peerapornpisal, 2009). The cultural practice of using Kai and other herbal plants as traditional medicine has deep roots in the Chiang Khong local community (Phurisamban, 2019). The interviewees also mentioned that the local people in the village believe that consuming Kai algae can slow the aging process due to its rich vitamins and proteins. Other herbal plants used by Chiang Khong local women include lime for cholesterol, celery for high blood pressure, river morning glory for insomnia, ginger for muscle aches, and turmeric for bleeding and diarrhea. In employing medicinal plants for traditional medicine, the local women must understand processing methods and how to use specific parts of the plants. This symbiotic connection between local women and Kai algae in Chiang Khong not only manifests as a socio-economic lifeline but also aligns with several SDGs that emphasize community livelihood and well-being, food and water security, and healthy ecosystems. Table 2 breaks down the alignment of the local practice in Chiang Khong with the global targets as follows.

Table 2

Aligned Activities From Local to Global Targets (Adapted from Griggs et al., 2013)

SDG	Target	Aligned Activities
1	No poverty (Lives and Livelihoods)	The community organization Ban Haad Krai Farmers Group and the economic activities related to Kai cultivation contribute to poverty alleviation by providing additional income opportunities for Chiang Khong local women.
2	Zero hunger (Food Security)	The foraging and cultivation practices, including traditional fishing, shrimp casting, and the utilization of natural plants, contribute to food security for the local community. The diverse range of food items, including Kai-based snacks and traditional dishes, supports SDG 2.
3	Good health and well-being (Lives and Livelihoods)	The use of Kai and other herbal plants for traditional medicine aligns with SDG 3 by promoting holistic health practices within the community. Traditional medicinal knowledge contributes to well-being and addresses various health concerns.
5	Gender equality (Lives and Livelihoods)	The involvement of Chiang Khong local women in economic activities, decision-making processes, and community initiatives illustrates progress toward gender equality. The community organization provides a platform for knowledge-sharing, and women play a vital role in economic empowerment through Kai-related activities.
8	Decent work and economic growth (Lives and Livelihoods)	The establishment of the Ban Haad Krai Farmers Group and economic activities related to Kai, including processing and selling Kai products, contribute to decent work and economic growth within the community.
12	Responsible consumption and production (Healthy Ecosystems)	The sustainable practices of foraging Kai during its season, traditional fishing techniques, and the use of natural plants for various purposes demonstrate a commitment to responsible consumption and production. The community's knowledge of seasonal changes and ecosystem diversity contributes to sustainable resource utilization.
15	Life on land (Healthy Ecosystems)	The traditional fishing, foraging, and cultivation practices are interconnected with the land and river ecosystems. The community's knowledge of the river's seasonal changes and their reliance on natural resources highlight a balanced approach to life on land.
17	Partnerships for the goals (Governing for Sustainability)	The collaboration with the Department of Agricultural Promotion reflects a partnership for achieving common goals related to sustainable agriculture and the preservation of traditional practices. The community organization fosters local partnerships and knowledge-sharing among its members.

As shown in Table 2, the economic empowerment of women through Kai foraging corresponds directly with SDG 1 (No poverty) and SDG 8 (Decent work and economic growth). According to the NESDC report (2023), Thailand's poverty rate was 6.32% in 2021, down from 6.83% in 2020, with the national poverty line set at 2,803 Baht per month. These national indicators highlight the ongoing efforts to reduce poverty, yet they also underscore the necessity for sustainable livelihoods to drive this progress further. By participating in Kai foraging, women contribute to household income, helping to alleviate poverty and ensuring economic stability within their communities. This activity not only supports SDG 1 by providing a crucial source of income but also aligns with SDG 8 by promoting decent work and economic growth through sustainable and culturally significant practices. As such, Kai foraging represents a vital intersection of traditional knowledge and economic

development, empowering women and fostering resilience in local communities.

The entwined relationship between local women and Kai significantly contributes to economic well-being and social empowerment in Chiang Khong's rural households. Foraging Kai becomes a source of income, especially for women, fostering a strong sense of community and enabling women to empower themselves through the value-added creation of Kai products. This economic activity financially benefits local women and enhances female participation in group activities during and after the foraging process (Chouichom, 2021). By transforming Kai into a source of income, particularly for women, this community engagement contributes to poverty alleviation and economic resilience.

Furthermore, the integration of local women into the economic fabric of Kai-related activities not only bolsters SDG 5 (Gender equality) but also enhances ecosystem services. By participating in the sustainable harvesting of Kai, these women help maintain the health and productivity of the Mekong River ecosystem, which provides vital resources and supports biodiversity. The enhanced female participation in group activities signifies progress towards achieving gender parity and fostering inclusivity within community initiatives. This economic empowerment not only serves as a means of financial independence for women but also promotes their active involvement in decision-making processes, aligning with SDG 8 (Decent work and economic growth). The creation of value-added Kai products demonstrates the potential for sustainable entrepreneurship, linking back to SDG 12 (Responsible consumption and production). This economic diversification not only benefits individual households but also contributes to the overall economic development of the community, reinforcing the interconnectedness of SDGs.

Moreover, the strong sense of community fostered by Kai foraging and product creation supports SDG 3 (Good health and well-being) and SDG 17 (Partnerships for the goals). The shared activities and economic cooperation contribute to the overall well-being of the community, creating a positive ripple effect on both physical and social health. Similarly, the cultivation and utilization of Kai algae underscore the significance of terrestrial ecosystems, aligning with the objectives of SDG 15 (Life on land). By ensuring the sustainable management of land and forests, Chiang Khong's community exemplifies a commitment to the conservation of biodiversity on land, including protecting the habitats of various species and promoting the overall well-being of terrestrial ecosystems.

Damming the Mekong and Disrupted Ecosystems

Although Kai and other river biodiversities remain a crucial source of livelihood for riverbank communities, the construction of hydropower dams in the LMB disrupts the regular wet-dry season cycle of the Mekong, causing profound impacts on the natural river system, altering the river's pulse, and affecting the availability of Kai and various fish species. In the dry season, when Kai experiences its seasonal growth, the dams release stored water, leading to the flooding of the Mekong River. This inundation washes away Kai from the rocks it typically clings to and obstructs the migration routes of fish to their feeding and spawning grounds. Conversely, in the wet season, the dams retain water, causing the river to dry up. Thus, the absence of Kai in the Mekong River reflects changes in the river's ecology.

In light of the complex challenges posed by hydropower development in the LMB, the implications extend beyond local ecosystems and communities, resonating with global sustainability goals, particularly those outlined in the United Nations' SDGs (Tsalis et al., 2020). The disruption of the Mekong's natural cycles, as illustrated by the impact on Kai and other river biodiversity, parallels SDG 15 (Life on land), emphasizing the need to protect terrestrial and riverine ecosystems. Likewise, the alteration of the river's pulse speaks to the urgency of addressing SDG 6 (Clean water and sanitation), recognizing the interdependence between water systems and the broader human environment. Moreover, the gendered dimensions of environmental impacts, particularly the adverse effects on local women and their traditional knowledge, highlight the importance of considering social equity and justice, aligning with SDG 5 (Gender equality). The disruption of Mekong women's ability to apply their survival knowledge underscores the broader challenge of achieving SDG 2 (Zero hunger) and SDG 3 (Good health and well-being) by undermining the stability of local livelihoods and food security. Table 3 summarizes the direct impacts of the hydropower dam establishment on the Mekong *natureculture* ecosystem in Chiang Khong.

Table 3

Direct Impacts From the Hydropower Dams to Mekong Natureculture

Challenges	Impacts
Lives and Livelihoods	The seasonal cycles of the river, which were once predictable, have become erratic, impacting the timing and availability of critical resources such as Kai algae and diverse fish species. The livelihoods that were once sustained by the river's pulse are now threatened, leading to economic uncertainties for the local community.
Food Security	The dams disrupt fish migration routes during both the dry and wet seasons, affecting the abundance and variety of fish available for consumption. Additionally, the release of water during the dry season, intended to generate hydropower, washes away the Kai algae that cling to the river rocks, jeopardizing a valuable food source and cultural symbol.
Water Security and Healthy Ecosystems	The construction of hydropower dams alters the water flow and sediment transport in the Mekong, leading to issues related to water security and ecosystem health. The dams can cause fluctuations in water levels, affecting the availability of water for various purposes, including agriculture and daily household use. These changes also impact the health of the river ecosystem, disrupting the delicate balance that sustains biodiversity and overall ecological well-being.
Community Resilience	The local women's traditional knowledge, developed over generations in harmony with the natural cycles of the river, is challenged by the unpredictability introduced by the dams. This disrupts the cultural practices and rituals associated with foraging, fishing, and the utilization of Kai algae, eroding the cultural fabric that has bound the community to the river for centuries.

This study shows that the impacts of hydropower development are not uniform and equitable for both women and the more-than-humans. Local women engage in direct interactions, collaborating with nature to sustain their livelihoods and ensure survival. Their entanglement with nature is rooted in traditional knowledge passed down from ancestors, forming their lifeworld. Consequently, environmental degradation resulting from development projects has deprived women of the ability to apply their survival knowledge, significantly disrupting the continuity of their daily lives and hindering the progress toward SDGs' achievement in the country.

Discussion

Anthropocene is the contemporary global social-ecological crisis narrative for understanding the planetary history of crises and emergencies that impacted humans and more-than-human that humans caused (Dominey-Howes, 2018). Worse, as part of these changes, the world is experiencing what is being called the sixth mass extinction (Pievani, 2013; Padilla, 2021). From the United Nations perspective, the global population is now facing the Triple Planetary Emergency, which refers to three main interlinked issues that humanity currently faces: climate change, pollution, and biodiversity loss (United Nations, 2021).

The triple planetary crises have their causes and effects, and each issue needs to be resolved. Some scholars have applied Social Return on Investment (SROI; Yates & Marra, 2017; Mansell & Philbin, 2020; Nikolakis & da Veiga, 2023; Basset, 2023) as also reported by the World Bank (2019) and other various international organizations, to quantify the value of ecosystem services and biodiversity, highlighting their contributions to sustainable development goals (SDGs). In the context of the Anthropocene, where climate change, pollution, and biodiversity loss are critical issues, SROI provides a lens to account for the social, environmental, and economic impacts of these services. SROI is helpful in providing a quantitative assessment of the economic, social, and environmental impacts of ecosystem services.

In this study, the feminist posthumanism perspective offers a qualitative approach, emphasizing the interconnectedness of humans and non-humans and the importance of diverse contributions to sustainability, thereby enhancing ecosystem services

and promoting sustainable livelihoods. This perspective is particularly important for analyzing SDG 15 (Life on land) in Thailand, which focuses on protecting, restoring, and promoting sustainable use of terrestrial ecosystems, managing forests sustainably, combating desertification, halting and reversing land degradation, and halting biodiversity loss. In Thailand, SDG 15 (Life on land) is experiencing decreasing trends with the red list index of species survival. Meanwhile, the existence of biodiversity plays a crucial role in sustaining the livelihood of the local women residing on the Mekong riverbank.

The empirical evidence from Chiang Khong highlights the decline in species survival, emphasizing the pressing need for concerted efforts to reverse this trend. Within the context of Thailand's decreasing trends in SDG-related food security and healthy ecosystems, the study draws attention to the dichotomy between the global sustainability agenda and the local reality where riverine biodiversity is integral to the well-being and livelihoods of the women residing on the Mekong riverbank. The feminist posthumanism framework is crucial for SDG 15 because it challenges traditional human-centered conservation strategies and highlights the need to consider the interdependent relationships between humans, non-humans, and the environment.

By acknowledging the roles and knowledge of local women and their engagement with the ecosystem, feminist posthumanism provides a holistic understanding of biodiversity conservation. This approach helps to uncover how local practices and traditional knowledge contribute to biodiversity preservation and sustainable land use, which are essential for the successful implementation of SDG 15 in Thailand. The traditional ecological knowledge held by these women becomes a reservoir of wisdom contributing not only to SDG 15 but also to other goals, such as SDG 2 (Zero hunger), SDG 3 (Good health and well-being), and SDG 6 (Clean water and sanitation). This interconnectedness, rooted in feminist posthumanism, mirrors the holistic aspirations of the SDGs.

Drawing on Donna Haraway's concept, this study emphasizes the intricate connections between nature and culture, encapsulated in *natureculture* relationships. It remains attentive to the agency of the more-than-human world, shedding light on the intersections between ecological relations, political economy, and cultural representations. Examining the local realities in the Chiang Khong district in northernmost Thailand, the study recognizes the Mekong River not only as a transboundary water resource and the natural border between Thailand and Laos but also as the habitat of the aquatic ecosystem, serving as companion species for local women within an ecological niche. Women, through their roles as caretakers and traditional knowledge holders, contribute significantly to achieving this goal. The relationship between Chiang Khong local women and the river species is one of mutual dependence, with each influencing the other in a co-constitutive two-way dynamic. The river, being a source of food, economy, and health security, reciprocally benefits from the activities of the local women, particularly in the collection of Kai Algae. The local women's role in collecting algae contributes to ecological restoration, ensuring the health of the ecosystem for the river species.

Feminist posthumanism emerges as a powerful lens, shedding light on the interconnectedness of women with their environments and their pivotal role in building community resilience. The study aligns this perspective with the UN's SDGs, particularly emphasizing SDG 15 (Life on land) on healthy ecosystems and the crucial role of biodiversity conservation. Moreover, the local women have been practicing a self-sufficient and resilient way of life through their traditional ecological knowledge that primarily contributes to food security (SDG 2), livelihood (SDG 3), water security (SDG 6), economic growth (SDG 8), and responsible consumption (SDG 12). Riverine biodiversity provides essential ecosystem services, including clean water and medicinal plants, impacting the overall well-being of the local women. Similarly, women's traditional ecological knowledge promotes responsible resource use and sustainable consumption patterns, contributing to biodiversity conservation.

Finally, this study has examined the potential application of relational thinking toward multispecies justice (Haraway, 2018), which acknowledges the interdependencies among human and non-human entities within a web of relationships, forming a narrative of *natureculture* that goes beyond a human-centric perspective. Within the context of Chiang Khong, this approach considers it as a multispecies field, recognizing the interconnected and inseparable nature of humans and other life forms, thus expanding social research beyond the human realm. The intricate

relationships between local women and the river species unfold as a story of mutual dependence, with women acting as stewards of ecological restoration through practices such as the foraging of Kai.

The interconnectedness of human and more-than-human entities, as emphasized by feminist posthumanism, aligns with the holistic approach of these SDGs, recognizing the vital contributions of women to health, water management, and responsible consumption for sustainable development. Thus, recognizing women's roles in biodiversity conservation aligns with the principles of multispecies justice, fostering a more balanced and equitable coexistence among different species to promote a more inclusive and equitable approach to sustainable development.

Conclusion

Although securing water supply and myriads of biodiversity are vital for sustainable development, the riverine landscape is also one of the most degraded ecosystems in the world. The freshwater resources are finite, and they form the biotic-abiotic components of the river ecological systems that provide a multitude of ecosystem services to support the local people's livelihood. This study focuses on Chiang Khong going through dramatic socio-ecological changes unfolding at multiple scales, from the scale of the village household to a process of political and economic regionalization and global environmental change in a geohistorical period known as the Anthropocene.

The findings of this research show that activities and practices conducted by the local women in Chiang Khong have been aligned with the targets of SDGs, showcasing a holistic and community-centric approach that contributes to social, economic, and environmental well-being, particularly in food and water security, healthy ecosystem, and the livelihood of the local community. However, despite the positive contributions of local women's activities to the targets of SDGs, the narrative takes a turn when examining the negative impact of hydropower dam development in the region.

The construction and operation of hydropower dams have significantly impacted the local community in Chiang Khong, presenting challenges for achieving the SDGs in this specific area. Although these findings are based on a detailed case study of Chiang Khong, they highlight potential implications for other regions in Thailand facing similar socio-ecological dynamics. The insights gained from this study can inform broader strategies and policies aimed at mitigating the adverse effects of hydropower projects and promoting sustainable development across the country.

Finally, this paper contributes to understanding the anthropogenic stressors in the Lower Mekong River Basin by applying a feminist posthumanism approach, highlighting the interconnectedness of humans and non-humans and valuing the role of local women's ecological knowledge. This perspective provides a more holistic view of environmental challenges, promoting inclusive and sustainable solutions that incorporate diverse voices. By integrating this framework, the study enhances our understanding of socio-ecological dynamics and informs contextually relevant policies for sustainable development in the Anthropocene.

Acknowledgment

Ph.D Program in Social Science, Faculty of Social Sciences, Chiang Mai University, under the CMU Presidential Scholarship (2021)

Declaration of Ownership

This report is our original work.

Conflict of Interest

None.

Ethical Clearance

This study was approved by our institution.

References

Arantes, C. C., Fitzgerald, D. B., Hoeinghaus, D. J., & Winemiller, K. O. (2019). Impacts of hydroelectric dams on fishes and fisheries in tropical rivers through the lens of functional traits. *Current Opinion in Environmental Sustainability*, *37*, 28–40. https://doi.org/10.1016/j.cosust.2019.04.009

Arias-Maldonado, M. (2015). Spelling the end of nature? Making sense of the Anthropocene. *Telos*, *2015*(172), 83–102. https://doi.org/10.3817/0915172083

Baird, I. G., & Hogan, Z. S. (2023). Hydropower dam development and fish biodiversity in the Mekong River Basin: A review. *Water*, *15*(7), 1352–1352. https://doi.org/10.3390/w15071352

Basset, F. (2023). The evaluation of social farming through social return on investment: A review. *Sustainability, 15*(4)*,* 3854.

Baxter, P., & Jack, S. (2008). Qualitative case study methodology: Study design and implementation for novice researchers. *The Qualitative Report*, *13*(4), 544–559.

Burke, A. (2022). Interspecies cosmopolitanism: Non-human power and the grounds of world order in the Anthropocene. *Review of International Studies*, *49*(2), 201–222. https://doi.org/10.1017/s0260210522000171

Chheang, V. (2010). Environmental and economic cooperation in the Mekong region. *Asia Europe Journal*, *8*(3), 359–368.

Chouichom, S. (2021). Readiness of entrepreneurs towards group performance development of OTOP product: A case study in Northeastern Thailand. In M. Behnassi, M. B. Baig, M. El Haiba, & M. R. Reed (Eds.), *Emerging challenges to food production and security in Asia, Middle East, and Africa: Climate risks and resource scarcity* (pp. 317–328). Springer. https://doi.org/10.1007/978-3-030-72987-5.

Cook, B. R., Rickards, L. A., & Rutherfurd, I. (2015). Geographies of the Anthropocene. *Geographical Research*, *53*(3), 231–243. https://doi.org/10.1111/1745-5871.12127

Cosslett, T. L., & Cosslett, P. D. (2018). *Sustainable development of rice and water resources in Mainland Southeast Asia and Mekong River Basin*. Springer.

Crutzen, P. J., & Steffen, W. (2003). How long have we been in the Anthropocene era? *Climatic Change*, *61*(3), 251–257. https://doi.org/10.1023/b:clim.0000004708.74871.62

Crutzen, P. J., & Stoermer, E. F. (2003). The "Anthropocene." *Global Change Newsletter*, 41(May), 17–18.

Davis, J., Moulton, A. A., Van Sant, L., & Williams, B. (2019). Anthropocene, Capitalocene, … Plantationocene?: A manifesto for ecological justice in an age of global crises. *Geography Compass*, *13*(5), 1–15. https://doi.org/10.1111/gec3.12438

Dominey-Howes, D. (2018). Hazards and disasters in the Anthropocene: Some critical reflections for the future. *Geoscience Letters*, *5*(1). https://doi.org/10.1186/s40562-018-0107-x

Folke, C., Carpenter, S. R., Chapin, F., Gaffney, O., Galaz, V., Hoffmann, H., Lamont, M., Polasky, S., Rockstrom, J., Scheffer, M., Westley, F., & Österblom, H. (2020). Our future in the Anthropocene biosphere: Global sustainability and resilient societies. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.3671766

Frey, G. W., & Linke, D. M. (2002). Hydropower as a renewable and sustainable energy resource meeting global energy challenges in a reasonable way. *Energy Policy*, *30*(14), 1261–1265. https://doi.org/10.1016/s0301-4215(02)00086-1

Ganoulis, J. (2022). Water security in the Anthropocene: A dialectical water–man interaction model. *Sustainability*, *14*(12), 6955. https://doi.org/10.3390/su14126955

Griggs, D., Stafford-Smith, M., Gaffney, O., Rockström, J., Öhman, M. C., Shyamsundar, P., & Noble, I. (2013). Sustainable development goals for people and planet. *Nature*, *495*(7441), 305–307.

Haraway, D. J. (2003). *The companion species manifesto: Dogs, people, and significant otherness* (Vol. 1, pp. 3-17). Prickly Paradigm Press.

Haraway, D. (2015). Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making kin. *Environmental Humanities*, *6*(1), 159–165.

Haraway, D. (2018). Staying with the trouble for multispecies environmental justice. *Dialogues in Human Geography*, *8*(1), 102–105.

Hecht, J. S., Lacombe, G., Arias, M. E., Dang, T. D., & Piman, T. (2019). Hydropower dams of the Mekong River basin: A review of their hydrological impacts. *Journal of Hydrology*, *568*, 285–300. https://doi.org/10.1016/j.jhydrol.2018.10.045

Huff, C. A., & Jolly, M. (2022). *Engaging Donna Haraway: Lives in the natureculture web*. Routledge. https://doi.org/10.4324/9781003259824

Inogwabini, B. (2020). The changing water cycle: Freshwater in the Congo. *WIREs Water*, *7*(2). https://doi.org/10.1002/wat2.1410

Kona-Boun, J.-J. (2020). Anthropogenic suffering of farmed animals: The other side of zoonoses. *Animal Sentience*, *5*(30). https://doi.org/10.51291/2377-7478.1207

Latrubesse, E. M., Arima, E. Y., Dunne, T., Park, E., Baker, V. R., d'Horta, F. M., Wight, C., Wittmann, F., Zuanon, J., Baker, P. A., Ribas, C. C., Norgaard, R. B., Filizola, N., Ansar, A., Flyvbjerg, B., & Stevaux, J. C. (2017). Damming the rivers of the Amazon basin. *Nature*, *546*(7658), 363–369. https://doi.org/10.1038/nature22333

LeCain, T. J. (2015). Against the Anthropocene. A neo-materialist perspective. *International Journal for History, Culture and Modernity*, *3*(1), 1-28. https://doi.org/10.18352/hcm.474

Mansell, P., & Philbin, S. (2020). Measuring sustainable development goal targets on infrastructure projects. *The Journal of Modern Project Management, 8*(1), 50–63.

McCartney, M. (2009). Living with dams: Managing the environmental impacts. *Water Policy*, *11*(S1), 121–139.

Mekong River Commission. (2014). *Fisheries in the Mekong River*. MRC.

Middleton, C. (2022). The political ecology of large hydropower dams in the Mekong Basin: A comprehensive review. *Water Alternatives*, *15*(2), 251-289.

National Economic and Social Development Council. (2023). *The 13th National Economic and Social Development Plan 2023–2027.* Office of the Prime Minister, Thailand.

Nikolakis, W., & da Veiga, R. M. (2023). Introduction–Social value and social return on investment: Theory and practice. In W. Nikolakis & R. M. da Veiga (Eds.), *Social value, climate change and environmental stewardship: Insights from theory and practice* (pp. 1-10). Springer International Publishing.

Molle, F., & Srijantr, T. (2003). *Thailand's rice bowl: Perspectives on agricultural and social change in the Chao Phraya Delta* (No. 12). White Lotus Press.

Padilla, L. A. (2021). *Sustainable development in the Anthropocene: Towards a new holistic and cosmopolitan paradigm*. Springer. https://doi.org/10.1007/978-3-030-80399-5

Pagani-Núñez, E., Liang, D., He, C., Zhou, X., Luo, X., Liu, Y., & Goodale, E. (2019). Niches in the Anthropocene: Passerine assemblages show niche expansion from natural to urban habitats. *Ecography*, *42*(8), 1360–1369. https://doi.org/10.1111/ecog.04203

Pal, I., Dhungana, G., Baskota, A., Udmale, P., Gadhawe, M. A., Doydee, P., Nguyen, N., & Sophat, S. (2023). *Multi-hazard livelihood security and resilience of Lower Mekong Basin communities*, *15*(11), 8469–8469. https://doi.org/10.3390/su15118469

Pfadenhauer, M., & Knoblauch, H. (2019). *Social constructivism as paradigm?: The legacy of the social construction of reality*. Routledge.

Phurisamban, R. (2019). *Against the current?: Using local ecological knowledge to negotiate impacts from large-scale Mekong River development* [Unpublished doctoral dissertation]. Geographisches Institut der Universität Zürich.

Pievani, T. (2013). The sixth mass extinction: Anthropocene and the human impact on biodiversity. *Rendiconti Lincei*, *25*(1), 85–93. https://doi.org/10.1007/s12210-013-0258-9

Pittock, J. (2019). Trade-offs between hydropower development and food security in river management. In H. James (Ed.), *Population, development, and the environment: Challenges to achieving the sustainable development goals in the Asia Pacific* (pp. 53–68). Palgrave Macmillan. https://doi.org/10.1007/978-981-13-2101-6

Richter, B. D., Postel, S., Revenga, C., Scudder, T., Lehner, B., Churchill, A., & Chow, M. (2010). Lost in development's shadow: The downstream human consequences of dams. *Water Alternatives*, *3*(2), 14-42.

Robottom, I., & Hart, P. (1993). Towards a meta-research agenda in science and environmental education. *International Journal of Science Education*, *15*(5), 591–605. https://doi.org/10.1080/0950069930150511

Rockström, J., Steffen, W., Noone, K., Persson, Å., Chapin III, F. S., Lambin, E., Lenton, T. M., Scheffer, M., Folke, C., Schellnhuber, H. J., Nykvist, B., De Wit, C. A., Hughes, T., van der Leeuw, S., Rodhe, H., Sörlin, S., Snyder, P. K., Costanza, R., Svedin, U., Falkenmark, M., Karlberg, L., Corell, R. W., Fabry, V. J., Hansen, J., Walker, B., Liverman, D., Richardson, K., Crutzen, P., & Foley, J. A. (2009). Planetary boundaries: Exploring the safe operating space for humanity. *Ecology and Society*, *14*(2). https://doi.org/10.5751/es-03180-140232

Rolls, R. J., Leigh, C., & Sheldon, F. (2012). Mechanistic effects of low-flow hydrology on riverine ecosystems: Ecological principles and consequences of alteration. *Freshwater Science*, *31*(4), 1163–1186. https://doi.org/10.1899/12-002.1

Sachs, J.D., Lafortune, G., Fuller, G., & Drumm, E. (2023). *Implementing the SDG stimulus. Sustainable development report 2023*. Dublin University Press. https://doi.org/10.25546/102924

Saiyarod, P. (2023). Retrofitting the Mekong: Community-based environmental responses to Chinese transnational infrastructure in a Thai border town. *Journal of Southeast Asian Studies*, *54*(3), 480–501. https://doi.org/10.1017/s0022463423000619

Siddiqui, K. (2019). One Belt and One Road, China's massive infrastructure project to boost trade and economy: An overview. *International Critical Thought, 9*(2), 214–235.

Soukhaphon, A., Baird, I. G., & Hogan, Z. (2021). The impacts of hydropower dams in the Mekong River Basin: A review. *Water, 13(3),* 265. https://doi.org/10.3390/w13030265

Steffen, W., Grinevald, J., Crutzen, P., & McNeill, J. (2011). The Anthropocene: Conceptual and historical perspectives. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, *369*(1938), 842–867. https://doi.org/10.1098/rsta.2010.0327

Thiamdao, S., & Peerapornpisal, Y. (2009). Diversity of edible freshwater macroalgae in Mekong and Nan rivers. *Journal of Fisheries Technology Research*, *3*(1), 115–124.

Timpe, K., & Kaplan, D. (2017). The changing hydrology of a dammed Amazon. *Science Advances*, *3*(11), e1700611. https://doi.org/10.1126/sciadv.1700611

Tsalis, T. A., Malamateniou, K. E., Koulouriotis, D., & Nikolaou, I. E. (2020). New challenges for corporate sustainability reporting: United Nations' 2030 Agenda for sustainable development and the sustainable development goals. *Corporate Social Responsibility and*

Environmental Management, *27*(4), 1617–1629. https://doi.org/10.1002/csr.1910

United Nations. (2021, April 27). *SDGs will address "three planetary crises" harming life on Earth*. https://news.un.org/en/story/2021/04/1090762

United Nations. (2015). *Transforming our world: The 2030 agenda for sustainable development*. https://sdgs.un.org/publications/transforming-our-world-2030-agenda-sustainable-development-17981

Vanwalleghem, T., Gómez, J. A., Infante Amate, J., González de Molina, M., Vanderlinden, K., Guzmán, G., Laguna, A., & Giráldez, J. V. (2017). Impact of historical land use and soil management change on soil erosion and agricultural sustainability during the Anthropocene. *Anthropocene*, *17*, 13–29. https://doi.org/10.1016/j.ancene.2017.01.002

World Bank. (2019). *Integrating value for money and impact evaluations: Issues, institutions, and opportunities*. https://documents1.worldbank.org/curated/en/862091571145787913/pdf/Integrating-Value-for-Money-and-Impact-Evaluations-Issues-Institutions-and-Opportunities.pdf

Yates, B. T., & Marra, M. (2017). Introduction: Social return on investment (SROI). *Evaluation and Program Planning, 64*, 95–97.

Yin, R. K. (2018). *Case study research and applications: Design and methods* (6th ed.). Sage.

Yoshida, Y., Lee, H. S., Trung, B. H., Tran, H.-D., Lall, M. K., Kakar, K., & Xuan, T. D. (2020). Impacts of mainstream hydropower dams on fisheries and agriculture in Lower Mekong Basin. *Sustainability*, *12*(6), 2408. https://doi.org/10.3390/su12062408

Zimmerer, K. S., de Haan, S., Jones, A. D., Creed-Kanashiro, H., Tello, M., Carrasco, M., Meza, K., Plasencia Amaya, F., Cruz-Garcia, G. S., Tubbeh, R., & Jiménez Olivencia, Y. (2019). The biodiversity of food and agriculture (Agrobiodiversity) in the anthropocene: Research advances and conceptual framework. *Anthropocene*, *25*, 100192. https://doi.org/10.1016/j.ancene.2019.100192