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The Political Ecology of Large Hydropower Dams in the Mekong Basin: A Comprehensive Review

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ABSTRACT: Since the early 1990s, the Mekong basin has been transformed from a largely free-flowing basin to one that is increasingly impounded by large hydropower dams, impacting river hydrology, ecology, riparian livelihoods, and water governance. This comprehensive review organises and assesses political ecology literature on large dams in the basin. Following a conceptual scoping of the political ecology of large dams, the review covers: the biophysical impacts of hydropower in the Mekong basin and how the scientific studies that research them relate to political ecology literature; relational hydrosocial approaches, including hydrosocial ordering and networked political ecologies; the ontological multiplicity of the Mekong(s) and associated ontological politics; the political economy of large dams in the Mekong basin and its relationship to transboundary water governance and hydropolitics; the discourses and knowledge production about large dams, including those regarding water data politics, 'international best practices', impact assessments, and public participation; and livelihoods, the commons, and water justice. The review details how some large hydropower dams in the Mekong basin have taken on global salience, including the Pak Mun dam, the Nam Theun 2 dam, and the Xayaburi dam. The review argues that political ecology research has revealed the fundamentally political character of large dams' planning, construction, operation, ownership, and financing and has significantly widened the scope of how large hydropower dams are understood and acted upon, especially by those challenging their realisation. This includes how large hydropower dams' political processes and outcomes are shaped by asymmetrical power relations with consequences for social and ecological justice. Recognising that a substantial portion of political ecology research to date has been conducted as extensive plans for large dams were being materialised and contested, the review concludes by outlining future priority research areas that cover existing gaps and posing new questions that are arising as the river basin becomes progressively more impounded.

KEYWORDS: Political ecology of large hydropower dams, hydrosocial ordering, critical hydropolitics, commons, water justice, Mekong-Lancang River

INTRODUCTION

Large hydropower dams are the epitome of an object of concern in political ecology given that they are major human artefacts that disrupt biophysical processes, rupture nature-society relations, enclose commons, redistribute (or dispossess people of) access to resources and their related benefits, and exist within political economic processes and power relations that almost always privilege elite interests. Researchers from many disciplines have studied the rapid expansion of large hydropower dams in the

Mekong-Lancang basin[1]. This review article addresses research that falls under the umbrella of 'political ecology'. Vandergeest and Roth (2017: 82) scope political ecology as "a field of study that approaches environmental issues through the lens of power relations". Watts (2000: 257) suggests that political ecology aims "to understand the complex relations between nature and society through a careful analysis of what one might call the forms of access and control over resources and their implications for environmental health and sustainable livelihoods". Some aspects of the political ecology of large hydropower dams are relatively well researched in the Mekong basin, including, for example, the processes and power relations that shape project planning, the construction and operation of the dams, and the discourses and knowledge production that legitimise and/or challenge dams. This research has firmly established the political character of large hydropower dams. While this foundational research continues, in part because domestic politics and geopolitics continue to change, more recent research has expanded on political ecologies' relational approach to nature-society relations. Newly researched subjects include the ontological politics of water and the effects that infrastructure itself has on power dynamics as it reassembles hydrosocial relations and hydrosocial territories.

Over the past 30 years, the Mekong basin has been transformed from a largely free-flowing basin to one that is heavily impounded by large dams, impacting hydrology, ecology, riparian livelihoods, and water governance. As of 2019, there were 89 medium and large dams in the lower Mekong basin (Cambodia, Laos, Thailand, and Vietnam), with a further 14 dams under construction and 30 at a planning stage (MRC, 2022a). In China, 11 medium and large hydropower dams have been constructed on the mainstream with another 11 planned, while 95 more dams have been built on the tributaries (Eyler, 2020). Early plans for large dams were produced in the context of the Cold War and drew on studies by the UN Economic Commission for Asia and the Far East (ECAFE) and the US Bureau of Reclamation (Molle et al., 2009b). Yet, until the 1990s, there were no large hydropower dams on the mainstream and only a couple on major tributaries, including the Nam Ngum 1 dam in Laos and the Ubol Ratana, Sirinthorn, and Chulabhorn dams in northeast Thailand (Hirsch, 2010). As the region transformed from 'battlefield to marketplace' (Bakker, 1999), hydropower construction accelerated, slowing during the 1997 Asian Financial Crisis (Middleton et al., 2009). Post-1990 hydropower planning took place in the context of regional economic integration programs, including the Asian Development Bank's (ADB) Greater Mekong Subregion (GMS) program, active since 1992, that progressively institutionalised plans for cross-border electricity trade primarily sourced from large hydropower dams (Boer et al., 2016). Transboundary water governance is institutionalised within the heavily scrutinised Mekong River Commission (MRC), established in its current form in 1995 (Mitchell, 1998).

This comprehensive review draws together political ecology research on large hydropower dams in the Mekong basin. It is not intended to provide a detailed chronological history of large dam building in the Mekong basin, on which there are already comprehensive publications including: Eyler (2019); Hirsch (2010); Molle et al. (2009); and Soukhaphon et al. (2021). Also, while the political ecology of hydropower occurs at the intersection of water and electricity, this review's entry point is water, on which far more has been written. Political ecology research that focuses on electricity has mostly been conducted through a Science and Technology Studies (STS) lens. Such research includes Kaisti and Käkönen (2012); Smits (2015); and Middleton (2016).

There are two caveats to this review. Firstly, it covers materials published in English, which the author considers an important limitation given the growing movement for political ecology to decolonise itself (Loftus, 2019). As highlighted by Vandergeest and Roth (2017), there are a large number of academics

[1] The headwaters of the 4350 km long Mekong River begin on the Tibetan Plateau, which flows southwards through Yunnan Province of China, Myanmar, Laos, Thailand, Cambodia, and Vietnam. Though mountainous in its upper stretch in China and along the Myanmar-Laos Border, the river's waterscape becomes lowland plains as it enters the 'lower basin' in Chiang Saen, Thailand. The delta begins in Phnom Penh, Cambodia, which is also at the confluence of the Tonle Sap river that connects to the Tonle Sap lake, the largest freshwater lake in Southeast Asia.

and other researchers producing political ecology studies within higher education institutions and other organisations within the Mekong region. While some publish in English, many also publish in the region's languages as well – examples include Kanokwan Manorom's books, 'Mekong Ontology: Dams, Water and People' and 'Feminist Political Ecology' (Manorom, 2022a, b). The second caveat is that political ecology is a broad umbrella that covers many conceptual and epistemological approaches. Robbins (2012: 20) suggests that political ecology is best understood as a community of practice that is:

> united around a certain kind of text (…) [that addresses] the condition and change of social/environmental systems, with explicit consideration of relations of power. Political ecology, moreover, explores these social and environmental changes with an understanding that there are better, less coercive, less exploitative, and more sustainable ways of doing things.

This definition implies a broadly shared normative positioning of 'political ecologists' (also Vandergeest and Roth, 2017). In the current review, some authors state that they write on political ecology (for example, Hirsch, 1998; Sneddon and Fox, 2006; Matthews and Geheb, 2015; Blake and Barney, 2018), while others do not specifically situate their research as political ecology. The review author hopes that none of those cited in this article take offense by their inclusion.

The main argument emerging from this review is that political ecology research has contributed significantly to revealing the political character of large hydropower dams in the Mekong basin. The body of research has demonstrated how large dam infrastructure transforms space and material and reorganises hydrosocial relations. It has drawn attention to the political economy, critical hydropolitics, discourses, and knowledge production encompassing large dams, along with the implications for livelihoods, the commons, and environmental justice. Some dams have shaped global dam debates that in turn have influenced debates back in the Mekong region. One such dam is the Pak Mun dam in northeast Thailand, which led the World Bank to suspend its lending to subsequent large dams from the early 1990s and became a case study in the World Commission on Dams (WCD) (Hirsch, 2010; Amornsakchai et al., 2000). Another case is the Nam Theun 2 in Laos, which marked the World Bank's return to large water infrastructure (Shoemaker and Robichaud, 2018b; Porter and Shivakumar, 2011). The construction of dams on the Mekong River's mainstream has also attracted global attention.

In the next section, I outline a conceptual scope for the political ecology of large hydropower dams. I then trace biophysical changes in the Mekong basin to address the question of how much 'ecology' exists in 'political ecology'. The following two sections review literature on relational hydrosocial approaches to large dams and the ontological politics of water. The political economy and governance of large dams is then discussed, followed by a synthesis on discourses, knowledge production, and power relations. A final section before the conclusion addresses livelihoods, the commons, and water justice.

SCOPING A POLITICAL ECOLOGY OF LARGE DAMS

Political ecology is an interdisciplinary field that has grown rapidly since the late 1980s (Robbins, 2012; Perreault et al., 2015; Bryant, 2015; Bailey and Bryant, 1997). It emerged from the merging of human ecology / cultural ecology, development geography, and political economy, and it now draws on many disciplines, including anthropology, human geography, political science, and environmental science, as well as fields such as development studies, STS, and environmental history (Benjaminsen and Svarstad, 2019; Neumann, 2009; Forsyth, 2003). Political ecology's theoretical underpinnings include (Marxist) political economy, Foucauldian poststructuralism, peasant studies / agrarian studies, and new materialism (Benjaminsen and Svarstad, 2019; Conty, 2018). Methods include political-economic analysis, historical analysis, ethnography, discourse analysis, and human ecology field studies (Neumann, 2009). Defining features include: the co-production (or dialectic) of nature and society; unequal power relations, including within (capitalist) economic structures; access, use, and control of resources – including of the commons – and associated governance structures; dominant and marginalised

discourses and narratives, politics of knowledge, and the social construction of the environment; livelihoods, environmental identities, and social movements; and environmental justice (Robbins, 2012; Benjaminsen and Svarstad, 2019). Political ecology's initial focus was in rural areas of the Global South and in the types of large-scale resource extraction and infrastructure projects that large dams typify (Bailey and Bryant, 1997). More recently, the field has expanded in other directions, such as networked political ecology, feminist political ecology, and urban political ecology.

Vandergeest and Roth (2017) map out how political ecologists from the global North and within Southeast Asia have applied and furthered political ecology in the region. They highlight how some early scholars of political ecology, such as Harold Brookfield and Raymond Bryant, specialised on Southeast Asia and drew on this expertise to define the field (Blaikie and Brookfield, 1987; Bailey and Bryant, 1997). Subsequent research in Southeast Asia has also influenced the wider field, such as Peter Vandergeest's and Nancy Peluso's (1995) work on 'territorialisation' that examined state practices of zoning forests in Thailand, Tania Murray Li's research on governmentality and 'rendering technical' in the history of development interventions in central Sulawesi (Li, 2007), and Tim Forsyth's and Andrew Walker's (2008) study 'Forest Guardians, Forest Destroyers' on the politics of environmental knowledge and environmental narratives towards upland agriculture and forests in northern Thailand. Vandergeest and Roth (2017) also highlight the work of engaged political ecologists based in the region, including those within higher education institutions such as the Faculty of Social Science of Chiang Mai University and within environmental and development NGOs.

Philip Hirsch (1998) makes perhaps the first written reference to a 'political ecology of hydropower' in the Mekong basin, focusing on the material impacts of hydropower projects, their discursive legitimisation, the politics of scale between local impacts and national development goals, and the significance of diverse political economies in the region and various forms of environmentalism. This research built on earlier work, such as Hirsch and Lohmann (1989), that drew attention to the emergence of a new form of environmental politics in Thailand in the 1980s.[2] Karen Bakker (1999) further detailed this political economy with an emphasis on the regional expansion of capitalism. Bakker (1999) links the ADB's and the MRC's discursive formations of the Mekong basin as a 'natural' unit and underutilised resource for development to the legitimisation of hydropower plans involving foreign capital, aid, and expertise. Writing at a time when expansive large dam construction was on the cusp of occurring, Bakker anticipated, with reasonable accuracy, the progressive commodification of the river and the territorialisation of the basin, both of which occurred as the states extended control into rural areas via hydropower projects and diverted resources from local use. Lastly, Chris Sneddon and Coleen Fox (2006) co-authored an influential paper that introduced the concept of 'critical hydropolitics', which they used to challenge apolitical assumptions present in some transboundary water governance literature that framed intergovernmental cooperation as a process of achieving 'benefit sharing'. Sneddon and Fox argued that these processes can lead to ecological degradation, local resource exclusions, and environmental conflicts.

THE MEKONG 'ECOLOGY' IN HYDROPOWER'S POLITICAL ECOLOGY

Scientific and technical studies reveal how large hydropower dams have transformed the Mekong River's hydrology, geomorphology and ecology at scales ranging from local to basin wide. It is beyond the scope of this review to assess these fields in detail. Rather, I outline some key findings on hydrology, fisheries, and sediments to then connect them to debates in political ecology.

The Mekong River's flood pulse, driven by the region's monsoonal weather patterns, is central to the river system's overall biodiversity and ecological fecundity (e.g. MRC, 2018), and its 'maintenance' is

[2] More broadly, but beyond the scope of this review, political ecology research on large dams in the Mekong basin is founded upon the insights of an extensive literature on the human ecology/cultural ecology of the basin.

central to the 1995 *Mekong Agreement*, which founded the intergovernmental MRC (Fox and Sneddon, 2005). Large dams change daily hydrological patterns due to their operation, and seasonal hydrology due to the practice of storing water from the rainy season in large reservoirs for operation in the dry season. A review by Hecht et al. (2019) assesses that hydropower reservoirs and diversions are "severely altering Mekong basin streamflow", as water storage has increased from 2 percent of annual flow in 2008 to potentially 20 percent by 2025 (also Hoang et al., 2019). Hecht et al. (2019) suggest that hydrological changes from reservoir operation need to be contextualised with other concurrent changes in climate, water demand, and land use, and future studies must address patterns of hydropeaking, water diversions, and timing to anticipate biophysical and social impacts. Much attention has been paid to the transboundary hydrological impacts of large dams in China by academics (e.g. Lu et al., 2014; Fan et al., 2015; Räsänen et al., 2017), the MRC (2022b), and others, which I discuss later in relation to the politics of water data.

Sediment movement is also affected, as sediment is trapped behind dam walls, thereby changing the sediment balance downstream and creating consequences for various processes such as riverbank erosion and river geomorphology. Diminishing sediment loads also reduce the productivity of fisheries (Baran et al., 2015). While comparatively less studied (Pukinskis, 2013), recent modelling shows that sediment trapping is greatest in the Lancang cascade (also Lu et al., 2014) and in constructed and proposed lower Mekong mainstream dams, though it occurs in all dams across the basin (MRC, 2018: 52-55). There could be a sediment reduction of over 96 percent entering the Mekong Delta by 2040 under a 'full dam development scenario', with implications for delta replenishment and soil fertility (MRC, 2018: 56).

The ecology of the Mekong River is highly biodiverse and productive; there are, for example, over 900 recorded fish species, and the lower Mekong basin is recognised as one of the most productive fisheries globally, with fish catch estimated to be 'worth' US$3.6-6.5 billion dollars at first-sale value (Hortle, 2009). Large dams are fragmenting fish migration routes and disrupting flows that trigger migration (Dugan et al., 2010; Pukinskis and Geheb, 2012), with both processes bearing implications for human nutrition and food security (Golden et al., 2019). The changing river hydrology also impacts wetland flood regimes, which are important fisheries habitats (Soukhaphon et al., 2021). In the Tonle Sap lake, for example, the new flood regime increases the 'open water' in the dry season and reduces the extent of forest flooding in the rainy season. This would reduce fisheries' productivity and impact other ecosystems, creating consequences for people's livelihoods and food security (Cochrane et al., 2014; Arias et al., 2014). The importance of wild-capture fisheries and other river resources to rural livelihoods, local economies, and food security in the Mekong basin – especially for those living with poverty – is central to why plans for large hydropower dams have held political salience in the region and been a focus of political ecology research.

From the perspective of political ecology, claims that physical and ecological scientific studies are 'objective' and 'apolitical' are questioned, "because they inform political choices creating winners and losers, and because their analyses, questions, and categories are inevitably informed by normative assumptions" (Benjaminsen and Svarstad, 2019: 1). In the intense academic debate regarding large hydropower dams in the Mekong region, sometimes these normative underpinnings have been rendered intentionally visible. For example, one article published in the prominent journal *Global Environmental Change* considered the potential impacts of the 11 proposed mainstream dams on fisheries and the implications for land use to replace lost fish protein and calories with livestock products (Orr et al., 2012). It estimated an increased water and land use of 4-7 percent and 13-27 percent respectively, concluding that "basic food security is potentially at a high risk of disruption". The paper was co-authored by researchers from World Wildlife Fund (WWF) and the Australian National University. On publication, WWF issued a media release titled "Mekong dams could rob millions of their primary protein source" amplifying the impact of the study (WWF, 2012).

Political ecologists have debated whether there is enough 'ecology' in political ecology or if the field has become politics without ecology (Walker, 2005). The crux is whether political ecology has paid enough attention to how environmental dynamics relate to politics (Benjaminsen and Svarstad, 2019). A pillar of political ecology has been to connect the expansion of capitalism with ecological change across multiple temporal and spatial scales (Neumann, 2009). However, as argued by Forsyth (2003), political ecology should be founded on empirical research in order to avoid essentialist assumptions of the relationship between capitalism and environmental degradation. An ongoing challenge and important future research agenda for political ecologists is to connect biophysical studies to the politics of large dams and nature-society relations while acknowledging the politics of the scientific knowledge production itself. An excellent recent example from the Mekong region is Baird et al.'s (2020b) paper 'What about the tributaries of the tributaries? Fish migrations, fisheries, dams and fishers' knowledge in North-Eastern Thailand'. This interdisciplinary study focuses on the Pak Mun and Ban Ot dams, examining the dams' impacts on local wild-capture fisheries in tributaries of the Mun River that were not included in official assessments. The method of the study involved working with fishers to record fish catch and triangulate fish names across local dialect and Latin, in addition to conducting interviews to connect this data to fishers' situational knowledge. In another example, Soukhaphon et al.'s (2021) review article on the impacts of hydropower dams in the Mekong River basin draws together biophysical research with social science research, integrating both literatures.

RELATIONAL HYDROSOCIAL APPROACHES

Underpinning political ecology research is a conceptual (and ontological) position that social and ecological processes are 'intertwined and inseparable' (Vandergeest and Roth, 2017: 85). In political ecology literature on water and rivers, this position has been developed in 'hydrosocial literature' that emphasises how rivers are entwined within social processes that produce multiple forms of waterscapes (Karpouzoglou and Vij, 2017), water-society assemblages (Wesselink et al., 2017; Linton and Budds, 2014), or 'hybrid waters' (Swyngedouw, 1999). Political ecologists' relational ontological starting point critiques anthropocentric water resource management approaches that hold a binary ontology of water as separate from society (as 'modern water') and that render water as being merely material, rather than being internally related to society and co-constituting power relations (Linton, 2010).[3] Anthropocentric managerialism legitimises water governance as primarily being about technical concerns and institutional improvements and tends to privilege modernisation and economic growth agendas, including plans for large hydropower dams.

The transformation of biophysical processes through human activity – including large dams – as a relational process has been considered through various political ecology lenses in the Mekong basin. For example, the concept of 'contested waterscapes in the Mekong region' was forwarded in a widely cited edited volume of the same title (Molle et al., 2009c), defined as "an expression of the interaction between humans and their environment [that] encompass[es] all of the social, economic and political processes through which water in nature is conceived of and manipulated by societies".[4] Sneddon (2002, 2003) draws on actor network concepts to examine the co-creation of scale and power in water management plans in northeast Thailand. This research examines state-led plans for the Khong-Chi-Mun infrastructure scheme and the ways in which both human actors (government agencies, local officials…) and non-human

[3] It has been argued that a dualistic ontology of 'modern water' that emphasises the physical dimensions of water as H_2O and disassociates it from the social processes that in fact produce it facilitates its technical management based on claims of scientific neutrality, as well as its commodification (Linton, 2010; Linton and Budds, 2014). Emphasizing how H_2O is always socially embedded, Ahmed and Dixit proposed the formulation H_2OP_4 – "twice hydrogen plus oxygen plus pollution, power, profit and politics" (Ahmed, 2013).

[4] Kaisti and Käkönen (2012) subsequently extended this approach to demonstrate how large hydropower dams in the Mekong basin are embedded in 'energyscapes'.

entities (landscapes, watercourses, aquatic ecosystems, irrigation canals, and weirs) are enrolled and reconfigured, leading Sneddon to argue that "the politics of scale in the context of intractable environmental conflicts are crucially dependent on the manner in which human – nonhuman networks compose and promulgate power effects" (Sneddon, 2003: 2230). Nature's materiality and its interrelation with human action have also been addressed in research on the Mekong's fisheries as a commons (Sneddon, 2007; Grundy-Warr and Lin, 2020) and on the materiality of large dam infrastructure itself (Sneddon, 2015). These 'hydrosocial' approaches point towards the embeddedness of water and infrastructure in social relations and associated hydrosocial ordering (Käkönen, 2020).

This approach also extends to the spatial dimensions of hydrosocial ordering, producing hydrosocial territories (Boelens et al., 2016). For example, Käkönen and Thoun (2019) examine the production of 'resource enclaves' as 'new relations of resource control' when hydropower projects have been built in protected areas in Cambodia. At the regional level, Wang et al. (forthcoming) examine China's water governance rationalities in the China-initiated Lancang-Mekong Cooperation (LMC). They argue that China's discourse is intended to construct governable hydrosocial territories by promoting positive imaginaries such as multilateral politics and economic benefits while downplaying tensions over dam construction. However, in downstream countries, critical discourses such as those describing China as a 'hydro-hegemon' have also emerged (also Sithirith and Gillen, 2017).

Another extension of the relational approach has focused on the 'networked political ecologies' that connect large hydropower dams materially, socially, and politically to distant places via transmission infrastructure and the system's governance. Baird and Quastel (2015), for example, connected the operation of the Nam Theun 2 project in Laos and the transformed nature-society relations nearby on the Xe Bang Fai (XBF) River to patterns of energy consumption – particularly urban air conditioning – in Thailand, which imports the dam's electricity. They argue that through 'regulation by contract', responsibility for environmental and social safeguards were shifted from the Thai and Lao states to the project developers and that "the project prioritised Thai energy system interests over the tens of thousands of XBF-dependent villagers in Laos" (Baird and Quastel, 2015: 1221). Marks and Zhang (2019) widen the analytical lens to consider electricity planning and consumerism in Thailand and consider the cross-border environmental injustices associated with the hydropower projects in Laos that connect via 'circuits of power' to Thailand's grid. Along similar lines, other researchers have discussed how the Mekong watershed is increasingly shaped by 'powersheds' that are material, institutional, and political constructs linking hydropower dams' electricity generation to load centres; Magee (2006) conceived this approach to explain how hydropower planning and operation in Yunnan Province, China, was shaped by electricity demand in southeast China (also Hennig et al., 2016). Middleton and Allouche (2016) extended the powershed concept to the wider Mekong-Lancang basin, with its load centres in Thailand and Vietnam, to argue that the influence of powersheds is an important feature of the region's critical hydropolitics.

Another emerging relational political ecology literature has connected large hydropower dams to wider 'cross-sectoral impacts'. An important paper by Baird and Barney (2017) examines the political ecology of interactions between industrial plantations and hydropower projects in Cambodia and Laos. The paper draws attention to how the environmental and social impact assessments used to assess proposals fail to account for the cumulative interactions between those plantations and hydropower projects, a phenomenon that leads to negative impacts on affected people that are overlooked or underestimated. Conceptually, the authors demonstrated how 'modern landscapes' that separate aquatic and terrestrial environments are "created and materialised through simplified ontological abstractions and discursive framings" (Baird and Barney, 2017: 771).[5]

[5] For a comparable analysis of 'land-centric' water management in South Asia, see Ahmed et al. (1997) and Ahmed (2013).

ONTOLOGICAL POLITICS OF WATER

The 'ontological turn' in anthropology has challenged the assumption that there is a singular, knowable world 'out there', including with regard to water (Yates et al., 2017; Vogt and Walsh, 2021). As observed by Barnes and Alatout (2012: 484), "water is not a singular object of epistemology for which abstract knowledge can be produced and circulated in all times and places without interruption". To acknowledge a multiplicity of water-related ontologies, rather than dismissing these realities as cultural constructs or different 'perceptions' or 'knowledge systems', has profound implications for research related to water because it requires critical examination of the assumptions on the 'nature of water' and human-water relations (Yates et al., 2017). These implications, for example, are that the ontology of 'modern water' introduced in the previous section is only one particular assemblage of water that institutions and individuals enact (Barnes and Alatout, 2012). When different hydrosocial networks enact multiple ontologies of water, contestation – and ontological politics – occurs (Götz and Middleton, 2020; Yates et al., 2017). A political ecology literature on these themes has only recently emerged in the Mekong region. In the following, I suggest that there are at least three coexisting water ontologies and discuss the implications for ontological politics.

A first ontology suggests the river(s) as intimately interwoven with a diversity of local cultures, lives, and meanings that are transformed by the river's modernisation. For example, drawing on multi-species (and, in fact, multi-being) ethnographic research in northeast Thailand, Johnson (2019) examines the presence of 'river beings' such as Naga's in fishers' lives there.[6] His argument draws on concepts of spectrality and potency to show how human lives have transformed materially and immaterially with changing river conditions due to upstream hydropower operation that is distant but 'present in the water's flow' (2019: 392). These changing conditions include the seeming abandonment of the Naga in the fishers' lives and the cultural consequences that have arrived now that "river time is disentangled from Buddhist time, monsoon time, and calendric time". Other anthropologists have sought to develop 'amphibious anthropologies of delta life', reflecting on the hydrosocial relations, volatility, rhythms, and wetness found in places like the Vietnam delta (Krause, 2017). Sithirith and Gillen (2017) have drawn attention to local narratives and ontologies of the Mekong River in counterpoint to how economic and political elites view it as a development resource.

A second ontology situates the Mekong as a resource of economic growth, (ecological) modernisation, and scientific management. In an early article, mentioned above, Bakker (1999) details how, in the 1990s, discursive strategies of the ADB and MRC sought to naturalise the 'watershed' for regional economic development. Furthering this line of inquiry, Hirsch (2016: 72) has analysed how the 'Mekong' as a region has gone through ontological changes from that of "a shared river to a territorially delimited basin, to a wider zone of liberalised economic activity binding national economies across borders, to a zone of less licit border crossing, and to an arena of contestation over hydropower". Planning for hydropower dams as a techno-politics for economic development has been studied, as has its intersection with Cold War geopolitics (Sneddon and Fox, 2011; Sneddon, 2015) and the rise of China's influence after the 1990s (Hirsch, 2010). State approaches towards river engineering for economic growth have also received attention and been understood, for example, as 'hydrocracies' pursuing a 'hydraulic mission' (Blake, 2021; Evers and Benedikter, 2009). The contemporary social-ecological and governance challenges of the Mekong River are often connected to development pressures acting on it (Grumbine et al., 2012). It is important to note that the intensification of economic activity in the basin precedes – and extends well beyond – plans for large hydropower dams. Biggs' (2010) environmental history of the Mekong delta, for example, shows the intensification of economic activities since the colonial period, while Sneddon and

[6] Many cultural events honor the Naga across the region, such as the 'Boun Suang Heua'/'Boun Xuang Heua' boat races on the Mekong in Laos at the end of Buddhist Lent.

Fox (2012) and Ishikawa et al. (2017) detail the progressive commodification of Tonle Sap's wild-capture fisheries via fisheries management since the colonial period.

A third ontology signifies the Mekong as a globally significant river basin for biodiversity and conservation. Large international environmental organisations such as World Wildlife Fund and the International Union for the Conservation of Nature have programs in the Mekong basin that emphasise its ecological significance, highlighting, for example, the discovery of new species (WWF, 2020). These organisations and other researchers also document the threats posed by large dams (Ziv et al., 2012; Soukhaphon et al., 2021), though international conservation organisations have also partnered with hydropower companies on occasions, claiming that conservation can be consistent with – and funded by – individual hydropower dams as the IUCN did at Nam Theun 2 in Laos (Shoemaker and Robichaud, 2018a; Robichaud, 2018). Adding further visibility, internationally recognised biologists such as Zeb Hogan conduct research on the river's megafauna and raise public awareness in high-profile publications such as *National Geographic* (Campbell et al., 2020; Howard, 2015).

In contrast to regions such as Latin America, a literature on the ontological *politics* of large dams in the Mekong River is emerging only now. For example, Whitington (2018) draws attention to the 'ontological politics of uncertainty', examining how managerial, technical, and civil society experts engaged with the environmental- and social-impact mitigation programs of the Theun Hinboun project in Laos. He shows how the experts produced uncertainties through their interactions that intersected with the technologies of the dam, the country's wider economic context, the ecology of the river, and the lives (and worlds) of communities affected by the project. Although not addressing large dams, Venot and Jensen (2021) study a multiplicity of *prek(s)* (waterways associated with irrigation practices) in the Mekong delta of Cambodia to reveal an ontological politics when a prek is viewed as a "socionatural mosaic landscape where many human and more-than-human actors and practices can coexist" (2021: 1). At a regional scale, Wang et al. (*forthcoming*) argue that "The discursive dichotomy reflects multiple ontologies of water and power struggles in international river governance, bringing regional stability and sustainable development into question". Meanwhile, Surimas and Middleton (*forthcoming*) argue that in northern Thailand, the meaning of the Mekong River and its future form is contested as ontological politics, ranging from the river as embedded in, and patterning, the socio-cultural relations of riverside communities to a vision for the river's modernisation that connects with regional economic integration and growth.

POLITICAL ECONOMY AND GOVERNANCE OF LARGE DAMS

In political ecology, the connection between political economy and ecology is a foundational relationship (Blaikie and Brookfield, 1987: 17). A political economy of dam building begins by addressing the strategies, actions, and values of various actors, along with power relations, including those within structuring institutions and economic systems, inclusive of: elite actors from state, business, and financial entities; academics, think tanks, and consultants; and civil society members, social movements, and community groups. In political ecology, 'water' itself is embedded within, and generative of, 'hydrosocial ordering' and its power relations given how its materiality mediates human politics (Käkönen, 2020). Similarly, large dam infrastructure mediates socio-technical and political relations (Strang, 2016; Star, 1999). In this section, I review literature on the political economy of large-dam building and link it to transboundary water governance. Discourses and politics of knowledge are inextricably linked to political economy (Wilson et al., 2019) and are discussed in the next section.

Growing demand for electricity for commercial, industrial, and domestic purposes has, in part, driven hydropower dam construction in the Mekong basin. Matthews and Geheb (2015: 22) connect rising electricity demand to the regional expansion of capitalism, especially in China, Thailand, and Vietnam. In the context of globally expanding financialisation since the 1970s, large hydropower dams are attractive to private investors as they absorb large amounts of capital (Ahlers, 2020). Projects in the Mekong basin

have been attracting private capital from within the region and beyond it (Merme et al., 2014; Matthews, 2012). Even as their proponents continue to legitimise these projects by claiming that they are necessary to meet rising electricity demands, the region's two largest electricity markets, Thailand and China, have seen significant periods of electricity surplus, raising questions as to whether it is electricity demand or investment opportunities that are a key driver of large dam construction. Thailand's electricity surplus has existed – and been debated – for several decades (Greacen and Footner, 2006; Praiwan, 2020). In China, there has been a surplus at least since 2015 in major hydropower producing provinces such as Yunnan Province (Magee and Hennig, 2017), where large dam construction had accelerated following the electricity sector's partial liberalisation and SOE corporatisation (Magee, 2012; Dore et al., 2007). It is worth noting, however, that China also faced a brief recent period of electricity shortage in late 2021 due to a rapid growth in energy-intensive industry demand and the presence of production and policy constraints that limited the availability of coal (Bradsher, 2021).

In the early 1990s, electricity planning and ownership was largely state led, but private sector actors emerged and public private partnerships (PPP) were beginning to be introduced, reflecting global economic trends towards neoliberalism articulating with the specificity of each country's domestic political economy. In Laos especially, where the 1990s hydropower boom seemed imminent, many private hydropower proponents were from Europe, Australia, and the US, with an influential financing and policy role for Western bilateral donors and multilateral development banks, namely the World Bank and the ADB (Bakker, 1999). Under the ADB's GMS, hydropower was envisioned as a means of generating foreign exchange and state revenue through electricity export, first to Thailand and later to Vietnam and China. Completed projects included the 150 MW Houay Ho dam initiated by the South Korean company Daewoo, who then forged a strategic partnership with the Thai company Loxley to conclude a 30-year Build-Operate-Transfer (BOT) contract for the project, and the 210 MW Theun-Hinboun dam contracted as a PPP involving Vattenfall AB, Statkraft AS, and MDX from Sweden, Norway, and Thailand, respectively, as well as Electricity du Laos, which held a 60 percent share, with its equity coming from a concessionary loan from the ADB (Wyatt, 2004). However, plans for many more large dams in Laos were disrupted by the 1997 Asian financial crisis and its impact on Thailand's economy and electricity demand.

In other countries of the region, the state took a lead role at first. In Vietnam, initial large dams in the Mekong basin, such as the Yali Falls on the Sesan River, commissioned in 1993 and built with support from the Soviet Union, was operated by the state-owned enterprise (SOE) Electricity of Vietnam (EVN) (Wyatt and Baird, 2007). In China, on the Lancang River, the initial plans, project design, and construction for the mainstream cascade were advanced by the China Huaneng Group, one of the top-five power-generating companies in China, via its Kunming-based subsidiary, HydroLancang. The dams were advanced in the context of a government policy for regional development in which the projects would export their electricity to China's industrial southeast seaboard and generate revenue for Yunnan province (Magee, 2012; Magee, 2006). In northeast Thailand, medium- and large-scale dams for irrigation and hydropower have been state led and owned, forming part of a wider state-centred vision for 'Greening Isaan' (Molle et al., 2009a). Among the dozens of medium- to large-scale water infrastructure projects, it is the state-owned Pak Mun hydropower dam that has drawn the most attention domestically and globally for being emblematic of poor design and public consultation. The unacknowledged environmental and social impacts, along with the poor economic performance of the project, were included as a case study in the World Commission on Dams (WCD) (Hirsch, 2010). It has resulted in a protracted – and still contested – renegotiation of the project's operation (Foran and Manorom, 2009), such that the dam's rationale for continued operation has shifted over time (Baird et al., 2020a).

As the region's economy and the hydropower industry recovered from the 1997 Asian financial crisis, quasi-state and private developers and financiers from Thailand, Vietnam, and China took a more dominant lead in hydropower investment, construction, operation, and ownership (Middleton et al., 2009). In Laos, the Nam Theun 2 dam was significant domestically, regionally, and globally, and it generated much controversy both within and beyond its formal public participation processes (Lawrence,

2009). Nam Theun 2, designed as a PPP project, was approved in 2005 and commissioned in 2010. Financing for the US$1.5 billion project came from five multilateral development banks, four export credit agencies, two bilateral governmental agencies, nine international commercial banks, and seven Thai commercial banks, and it was rationalised simultaneously as a commercial investment and an aid project. The World Bank, as a key project proponent, argued the project would demonstrate that it could 'do a dam better' (Porter and Shivakumar, 2011). These claims were challenged both during the sixteen-year planning process and during the subsequent emergence of the project's actual social and environmental impacts (Shoemaker and Robichaud, 2018b; Baird et al., 2015). Nam Theun 2 broke the path for dozens more domestic and power export hydropower projects in Laos and marked a turn towards regional project ownership and financing (Merme et al., 2014; Baird and Quastel, 2015).

In the 2000s, the partial liberalisation of the region's electricity sector occurred in a variegated way across the region (Middleton and Dore, 2015). In Vietnam, since the Electricity Law (2005), many large hydropower dams that were initially built by SOEs were corporatised, with the exception of projects deemed to be of national importance, such as the Yali Falls dam. In China, Hydrolancang was also progressively corporatised by 2002, although the state remains influential in practice (Magee, 2012; Magee, 2006; Lyu, 2015). In Cambodia, investment in both electricity generation and transmission comes primarily from the private sector and, in the case of large hydropower dams, has primarily come from Chinese developers and financiers (Siciliano et al., 2016). In Laos, private project developers and commercial financiers have primarily been from Thailand, Vietnam, and China, although actors from other countries, including Japan, Malaysia, and Korea, are also present (Middleton et al., 2009; Souvannaseng, 2019).

The role and geopolitical implications of Chinese project developers and financiers in the lower Mekong basin have received significant attention (Matthews and Motta, 2013; Siciliano et al., 2016; Urban et al., 2018). As China's economic power has grown, attention was paid first to the 'going out policy' (Hirsch, 2016) and subsequently to the China-led LMC, a regional subprogram of the Belt and Road Initiative (BRI) that has aimed to establish regional economic integration while also institutionalising Chinese-led transboundary water governance (Biba, 2018; Middleton and Allouche, 2016). Focusing on Laos, Souvannaseng (2022) suggests that China's growing role in financing hydropower has been facilitated by 'economic statecraft' and enabled by economic restructuring during the major financial crises of 1997 and 2008. Financing through export credits from China's policy banks is a break from the previous 'liberal hydropower finance regime' progressively set in place since the 1970s and led via the Bretton Woods institutions with US and Japanese financing, aid, and technical assistance. There is much debate over whether China's strategies and its support for large dams are aid diplomacy, debt diplomacy, or commercial ventures. In Laos, for example, rising sovereign debt to China's state-owned development banks for infrastructure borrowing, including for hydropower dams, has resulted in a series of sales of state-owned assets, including of the high voltage national transmission network in which the China Southern Power Grid Company – a corporatised SOE fully controlled by China's government (FitchRatings, 2020) – took a majority share (Barney and Souksakoun, 2021).

Hydropower project planning, construction, and operation have been shaped by, and transformative of, changing domestic and transboundary water and electricity governance regimes (Hirsch, 2010). A wider critical literature has examined the emergence of 'green neoliberalism' (Goldman, 2005) or 'environmental neoliberalism' (Barney, 2017) in the region, theorising the implications of expanding capitalism, the commodification of nature, and the governance of the environment through market-based approaches and 'green governmentality'. This theoretical work holds implications for the politics, discourses, and rationalisations of large hydropower dams – especially those led by private developers and financiers (Olson and Gareau, 2018; Johns, 2015). Nonetheless, the co-existence of illiberal institutions and modes of governance in the region means that neoliberal explanations alone cannot suffice (Barney, 2017). Furthermore, in political ecology and related approaches, such as STS, it is well recognised that water infrastructure, while certainly material, also holds relational implications for the

(re)structuring of social processes and power relations, governance and politics, and nature-society relations (Obertreis et al., 2016; Kanoi et al., 2022). These themes have recently been assembled by Käkönen (2020), who examines how hydraulic infrastructure has 'drastically altered' hydrosocial relations, including biophysical, infrastructural, discursive, and socio-political relations, as part of the 'water resourcification' of the Mekong River.

In Cambodia, for example, Käkönen and Thuon (2019) examined how 'enclavistic' post-neoliberal and neopatrimonial state governance in areas like forest conservation, the clean development mechanism, and semi-official logging practices coincided with corporate hydropower practices to produce vulnerability for local communities. The concept of enclavistic governance of hydropower has also been applied in Laos by Whitington (2018), who posed the Theun Hinboun hydropower dam and its domestic and transnational governance processes as 'sustainability enclaves'. Nam Theun 2 could also be considered a form of enclavistic development, although its ambition actually extended beyond the project with aims of transforming Laos national hydropower governance in terms of public participation, social safeguards, and environmental protection (Singh, 2014; Shoemaker and Robichaud, 2018b).

The connections between domestic and transboundary governance also require careful examination. In their analysis of Nam Theun 2, Baird and Quastel (2015) draw attention to the dimension of cross-border power trade in hydropower governance that privileged commercial and technical interests over social and environmental concerns and rescaled governance networks "that make the network neither Thai nor Lao but a hybrid, with additional interventions by investors, the World Bank, and other financial institutions" (Baird and Quastel, 2015: 1225). As argued by Sangkhamanee (2015), in order to study the impact of the legacy of the Pak Mun dam and thereby understand the politics of the Xayaburi Dam in Laos (which exports power to Thailand and is a major Thai private sector investment), it is crucial to pay attention to domestic politics that are relational to regional political processes. Similar arguments have also been made in relation to China's approach towards transboundary water governance (Ptak, 2017) and hydropower decision-making in Laos (Chanthavong, 2019). The Mekong's multi-scaled governance regime has also been examined through a socio-legal lens in Boer et al.'s (2016) pathbreaking book 'The Mekong: A Socio-Legal Approach to River Basin Development'. The book focuses on legal pluralism to examine the "distinct hybridizations of hard and soft, public and private, national, regional and international laws and legal influences" (2016: 36) that are in play in transboundary water and large hydropower dam governance. The book's analysis leads to problematisations of participation, knowledge production, and the way in which the possibility of just outcomes – in the context of significant power inequalities – requires strategic navigation by civil society and social movements through a wide array of hard and soft laws.

Regarding analysis of hydropower's governance and political economy, the categorisations of 'public' and 'private' also gain salience. The influence of private capital's interests has restructured the governance of large hydropower and project contractual arrangements to privilege private interests towards financial risks over public concerns about environmental and social risks and impacts (Merme et al., 2014; Baird and Quastel, 2015; King, 2015). For example, 'take-or-pay' contracts[7] for electricity sales to state utilities significantly reduce risks for developers and investors and socialise the risks/costs of hydropower production (Greacen and Greacen, 2004; Middleton et al., 2015b). Moreover, the corporatisation of SOEs and the prevalence of PPPs leave the line between public and private interests in hydropower increasingly blurred, as examined in detail by Merme et al. (2014) with regard to the Nam Theun 2, and also across the wider region (Middleton et al., 2015b; Wyatt, 2004).

Much research has addressed the role of intergovernmental relations in transboundary water governance. A relatively apolitical interpretation draws attention to benefits from interstate cooperation

[7] Take-or-pay contracts commit utilities to buy electricity whether they need it or not.

(Sadoff and Grey, 2002). A more nuanced 'hydropolitics' approach demonstrates how interstate politics entail conflict and cooperation simultaneously (Mirumachi, 2015). The wide range of research on the MRC[8] extends beyond this review's scope. Some have argued the MRC's unfulfilled potential to enable deliberative decision-making (Dore and Lazarus, 2009). Others have acknowledged the MRC's contribution to governance via its technical and development planning tools but flagged limitations in managing accelerating resource extraction and degradation (Öjendal and Jensen, 2012; Hirsch, 2020; Suhardiman et al., 2015). Still others have highlighted the potential for strengthening the existing legal regime of the MRC (Kinna and Rieu-Clarke, 2017; Middleton and Devlaeminck, 2020). The tensions between intergovernmental cooperation through the MRC, national interests, and local concerns that often do not align with the national interest have also been flagged (Mitchell, 1998; Hirsch and Jensen, 2006; Suhardiman et al., 2011).

With regard to analysing hydropolitics, political ecology moves beyond a state-centric reading. A pathbreaking paper that has been widely cited is Sneddon's and Fox's (2006) 'Rethinking transboundary waters: A critical hydropolitics of the Mekong basin'. They challenge apolitical analyses of transboundary water governance that "privilege the principal of 'cooperation' as [an] analytical category and normative objective" (2006: 182) because, they conclude, it can actually lead to resource degradation and inequitable outcomes. They show how apolitical approaches obscure how transnational basins are constructed by states and other elite actors with an intention of 'developing' water resources, including building large hydropower dams that enclose and degrade ecosystems. Critical hydropolitics draws on critical geopolitics literature to understand how state and non-state actors as political actors shape geopolitical orders through multi-scaled processes; to critically examine discursive strategies and codified documents as expressions of power relationships that construct transnational basins; and to draw attention to the economic, discursive, and ecohydrological processes and power relations that connect at nodes of water conflict. Through this lens, Sneddon and Fox present an analysis of the 1995 Mekong Agreement and its construction of a transboundary watercourse for development and juxtapose it against the water conflict at the Pak Mun dam in northeast Thailand.

The context of transboundary water governance in the Mekong basin has shifted significantly since the launch of the LMC in 2016. Some analysis of the LMC's hydropolitics and its institutional relationship with the MRC has been published (e.g. Biba, 2018; Williams, 2020), while a body of critical hydropolitics literature is also emerging (Middleton and Allouche, 2016; Wang et al., *Forthcoming*). The concept of 'water diplomacy' through the MRC and LMC also seems to be gaining traction in the region. Here too, institutional analysis is emerging that tends to emphasise cooperation (Kittikhoun and Staubli, 2018; Keskinen et al., 2021; Zhang and Li, 2020), but there is also analysis through a critical hydropolitics lens (Mirumachi, 2020).

DISCOURSES, KNOWLEDGE PRODUCTION, AND POWER RELATIONS

In political ecology literature, it is recognised that material analysis must be conducted together with discourse analysis. As stated by Neumann (2009: 229), "emphasis is placed on a critical perspective toward modernist notions of objectivity and rationality, on interrogating the relationship between power and scientific knowledge, and the recognition of the existence of multiple, culturally constructed ideas of the environment and environmental problems". Knowledge production and power are intertwined with each other and closely connected to processes of governmentality through, for example, expert knowledge that 'render[s] technical' (Li, 2007). Powerful actors and institutional agendas may become dominant through the production of narratives that legitimise their interests while simultaneously discrediting and marginalising the narratives of others who might challenge them (Benjaminsen and

[8] The MRC was established in 1995, formed of the governments of Cambodia, Laos, Thailand, and Vietnam as member states, along with China and Myanmar as dialogue partners.

Svarstad, 2019). Bakker (1999), for example, refers to a 'politics of forgetting' in the Mekong basin, whereby powerful institutions in the 1990s such as the ADB sought to embed a discourse of hydropower development as 'the norm' and thus downplay how projects are contested.

Knowledge production on large dams in the Mekong basin has included state-endorsed studies such as the MRC's 'State of the Basin' reports, civil society and community-produced studies, technical studies for specific projects, and academic research through many disciplinary lenses. Foreign donor-funded epistemic networks have coordinated and published research, provided training, and networked researchers with policy makers; examples include the Mekong Programme on Water, Environment, and Resilience (M-POWER) – which also produced a flagship series of edited volumes, among other knowledge products (e.g. Lebel et al., 2007; Molle et al., 2009c; Daniel et al., 2013); the follow-up Water Land Ecosystems-Mekong project [9]; and the Sustainable Mekong Research Network (SUMERNET) program[10]. Much of this research has both anticipated and documented the ecological and social impacts of large dams and explained how such decisions have occurred and whose interests and knowledge prevailed in the process of making them (Matthews and Geheb, 2015b). Projects have also detailed the extent of large dam construction. Such projects include the 'Greater Mekong Dams Observatory', active between 2013 and 2018 (WLE Greater Mekong, 2017), and the 'Stimson Mekong Infrastructure Tracker' online tool[11], active since 2020. While this knowledge production has, overall, influenced the institutions, legal regimes, and discourses regarding the Mekong basin (Boer et al., 2016), the extent to which it has decisively switched final decisions to (not) proceed with controversial large dam projects, such as the Xayaburi Dam, is less apparent (Fox and Sneddon, 2019).

There is also a significant and diverse body of research on discourses and knowledge production in the Mekong basin (Matthews and Geheb, 2015a; Geheb and Suhardiman, 2019; Molle, 2008; Contreras, 2007; Daniel et al., 2013; Sangkhamanee, 2010; Delang, 2019). In the remainder of this section, I discuss the following themes from this literature: expert knowledge, water data politics, politics of scale, discursive production of 'the region', water paradigms, impact assessment, public participation, and situational knowledge.

The role of expert knowledge, produced by states, project developers and consultants, researchers, and think tanks, among others, has shaped policy, politics, and practices in large dam planning, construction, and operation and the wider water and energy governance context. Expert knowledge is typically claimed to be 'scientific' and therefore authoritative, even if it is technical knowledge produced for instrumental purposes. For example, writing at a time when large dam building was gaining momentum, Käkönen and Hirsch (2009) drew attention to the 'anti-politics of Mekong knowledge production' within the MRC. They argued that while the core of the MRC's knowledge production focused onto scientific knowledge for hydrological models, impact assessments, and scenarios generation, the expectations of the MRC's international donors for greater public participation did not translate into a balancing of this expert knowledge with the situational knowledge of farmers and fishers living in the basin. Rather, public participation at the time reinforced the depoliticisation of the MRC's expert knowledge and served to legitimise river basin development plans that included large hydropower dams. Recently, Fox and Sneddon (2019) enquired into why engineering/technological knowledge has retained its authority in legitimising Mekong mainstream dams despite growing scientific evidence of their ecological and social impacts. They argue that this knowledge has evolved "in conjunction with narratives of development, inequitable power relations, and institutional arrangements, creat[ing] epistemological barriers that devalue or de-legitimise local and ecological knowledge" (2019: 3). Furthering Käkönen's and Hirsch's (2009) argument, this helps explain how the performance of evidence-based policy making

[9] https://wle-mekong.cgiar.org/ (accessed 27 March 2022)

[10] https://www.sumernet.org/ (accessed 27 March 2022)

[11] https://www.stimson.org/2020/mekong-infrastructure-tracker-tool/ (accessed 24 September 2021)

and public participation can still marginalise evidence that is counter to plans for large dam construction (also Suhardiman and Geheb, 2019).

A politics of expert knowledge recently erupted on low flows in the Mekong River since 2019, revealing that the claim to 'expert knowledge' can be contested. There are conflicting explanations on these historic low flows, including: the contribution of regional drought, El Niño and climate change, and the operation of large hydropower dams across the basin. Regarding the latter, the focus has been towards China's 12 dams on the upper Mekong (Lancang) and the Xayaburi Dam on the mainstream in northern Laos. Divergent expert analysis based on various models and incomplete data sets have been at the centre of a heated debate since the publication of a US-funded report by the research consultancy Eyes on the Earth in April 2020 that presented a statistical model of the impact of China's mainstream dams on northern Thailand (Basist and Williams, 2020). Given the limited hydrological and meteorological data from China, the report used historical and current satellite data to generate a 'wetness index'. Overall, the study showed how, in the time since dams in the Lancang cascade began to be commissioned in the early 1990s, there had been a decrease in wet season river levels and an increase in dry season levels, along with more irregular and rapid fluctuations. While similar findings have been previously published (e.g. Räsänen et al., 2017), these particular findings were amplified by several civil society groups and some government representatives in the media to claim that China was responsible for the 2019-2020 low flows, which held political connotations given escalating tensions in Chinese-US relations at the time (Haffner, 2020). As the study's application of a 'wetness index' had not been peer reviewed, other modelling experts publicly questioned some of the study's methodological assumptions (Ketelsen et al., 2020; MRC, 2020; Kallio and Fallon, 2020) or published research with differing interpretations. This research included work by researchers at Tsinghua University (Tian et al., 2020) and a series of reports by the MRC (MRC, 2022). Keovilignavong et al. (2021: 4), paying attention to the multiple explanations provided in academic and public debates, argue that "while droughts in the Mekong region are not caused by a single factor, but rather by combinations of climate factors and cascades of dams, explanations tend to be framed publicly in terms of factors related to the geopolitical, eco-political and developmental stances of respective observers". Grünwald et al. (2021) flagged the risks of the 'politicisation of science', a phenomenon that led to escalation of political tensions between riparian countries and could undermine trust in scientific knowledge production among governments and the public (also Kallio and Fallon, 2020).

The production of scale is an important dimension of political ecology that intersects with discourses and knowledge production (Norman et al., 2012). While the ontological existence of scale has been questioned from a relational viewpoint, scale as an analytical frame is useful in understanding the politics of large dams given that claims for legitimacy or resistance often make reference to various scales (Matthews and Geheb, 2015a; Molle, 2007). Scale is produced discursively, but it is also reified in other ways, including within social networks, institutional structures, and materially in the socio-technical relations of infrastructure. Across these means of producing scale, the exercise of power is fundamental. Narratives on the harms, benefits, and risks of large hydropower are tied to particular scales. For example, as highlighted by Matthews and Geheb (2015: 26), "in Mekong hydropower development, environmental change is often debated at a meso scale between states and unequally balanced against economic growth". In addition, some scales produced beyond hydropower-specific debates also bear relevance to the subject of large dams, including the 'GMS-scale', within which hydroelectricity trade is assumed to occur (Hirsch, 2016; Bakker, 1999); the 'LMC scale', which is geographically comparable to the GMS but with different political drivers (Wang et al., *Forthcoming*); and the 'basin scale', which is an assumed level of water management within the Integrated Water Resources Management (IWRM) paradigm adopted by the MRC (Molle, 2008).

The politics of scale have been unpacked in a relatively expansive literature on the Mekong basin. In an early paper distilling insights from the emerging literature, Lebel et al. (2005) view scale as the joint product of social and biophysical processes that is also connected to the 'politics of place' (emphasising

the particularities of a particular place) and the 'politics of position' (i.e. upstream-downstream relations). Through examples in the Mekong basin, Lebel et al. (2005) demonstrate how this framework for producing scale, position, and place reveals relative authority and power relations in water politics and governance, and they argue in favour of deliberative processes for more inclusive and just outcomes (also Dore and Lebel, 2010). Some studies have shown how scale is produced by contesting networks to privilege narratives of regional and national development over locally experienced risks and impacts. For example, Sneddon's (2003) research on dams in the Khong-Chi-Mun scheme in northeast Thailand drew on actor-network methodologies to show how scale and power are co-created within networks of humans and non-human actors. Comparably, Green and Baird (2020) have drawn on the concept of 'contentious politics' to document how 'anti-dam activists' have challenged large dam proponents in their scaling of impacts in impact assessments (also Yong and Grundy-Warr, 2012). Examining the contradictions within the governance of multi-scaled commons, Hirsch (2020) argues that the dominant institutional bounding of the commons as being transboundary at the country-to-country scale downplays the visibility and viability of local commons that are important to individual communities within the basin. Hirsch's underpinning critique is that states tend to negotiate a national interest in the MRC that does not always coincide with riparian community interests (also Hirsch and Jensen, 2006). Suhardiman et al. (2011), however, question the capacity of states to implement agendas that have been negotiated at the transboundary level in the MRC, identifying a 'scalar disconnect' when regional agreements in the MRC are stymied due to bureaucratic competition and fragmentation at the national level.

'International best practices' in water management and its knowledge production have also influenced the discursive formations and framings of water governance and large dams. Most visible has been IWRM, which emphasises the concurrent goals of economic efficiency, social equity, and environmental sustainability. As demonstrated by Molle (2008), ideas in policy making are never neutral and "are the emanation of complex webs of interests, ideologies, and power" (Molle, 2008: 132). IWRM has been critiqued for privileging expert knowledge and downplaying the politics of water by emphasising neutral management. Molle (2008) proposes that IWRM can be understood as a 'nirvana concept', namely an ideal image of how the world should be that is highly difficult to achieve in practice and yet still functions to legitimise the paradigm. While participatory approaches exist within the IWRM and within the MRC, their potential to negotiate the trade-offs inherent to IWRM – such as the construction of large dams for economic development against the maintenance of fisheries important to local livelihoods – has been questioned (Cooper, 2012). The 'Water Energy Food Nexus' is a more recent 'international best practice', seen by some as the successor to IWRM and another nirvana concept. While the discourse of 'the nexus' has circulated among international experts and foreign donors, there is limited evidence in the Mekong basin that it has fundamentally influenced national policies (Lebel and Lebel, 2017). Through a political ecology lens, the depoliticisation of Mekong resource politics seems to persist in the nexus while concerns for ethics and social justice are peripheral (Middleton et al., 2015a; Foran, 2015).

Although not quite a global paradigm, the discourse of 'sustainable hydropower' has emerged in the Mekong basin and beyond. The 'sustainable hydropower' discourse is rooted in a crisis of legitimacy for the industry in the 1990s that cumulated in the publication of the WCD report in 2000 and the subsequent need for the industry to redefine itself as contributing to 'development' (Middleton, 2018). Hirsch (2010) observes that the final WCD report and its recommendations were not directly incorporated into hydropower governance in the Mekong basin, although many of the issues raised were reflected in the wider politics around hydropower. In this context, the Nam Theun 2 became a global 'model' project for 'sustainable hydropower' as it marked the World Bank's post-WCD return to supporting large dam construction and its need to demonstrate that it could 'do a dam better' (Porter and Shivakumar, 2011), a claim that was heavily disputed (Shoemaker and Robichaud, 2018b). The 'sustainable hydropower' discourse has since been furthered globally by the International Hydropower Association, which prepared

the Hydropower Sustainability Assessment Protocol (HSAP) knowledge tool launched in 2011 for reasons including the promotion of large dams' role in reducing greenhouse gas emissions to address climate change (IHA, 2021). The concept has also been institutionalised into the MRC, which launched an Initiative on Sustainable Hydropower in 2009[12] and approved a Sustainable Hydropower Development Strategy in 2021. Political ecology researchers have critiqued that the sustainable hydropower discourse fails to reflect circumstances on the ground in Southeast Asia, ranging from the impacts on affected communities and ecologies to the effectiveness of livelihood recovery programs and the impacts of disasters such as the Xe Pian Xe Namnoi dam collapse, as well as downplaying the potential of non-hydro renewable electricity (Middleton, 2018; Käkönen, 2020; Soukhaphon et al., 2021). Whitington (2018) argues that the hydropower industry in Laos has engaged in the production of uncertainty by limiting the collection of facts that are required to validate claims that hydropower can be 'sustainable'.

Various studies have also examined the practices and politics of impact assessment on large hydropower dams in the Mekong basin. Matthews and Geheb (2015: 25) point out that narratives framing hydropower often occur in the impact assessment process as it is a "key point of engagement in hydropower development". In a Mekong-focused paper that conceptualises an analysis of 'transboundary water governance complexes', Dore et al. (2012) draw attention to impact assessment tools as shaping the political arenas of water governance. Regarding the politics of knowledge, Lebel (2005) highlights how impact assessments are simultaneously modes of scientific knowledge production, assessment processes, and products of political interests. Lebel further points out that in impact assessments scalar considerations come to the fore in terms of bounding studies, assessing findings, setting policies and knowledge agendas, and shaping institutional design and responses. Reviewing recent regional assessment processes, Keskinen et al. (2012) conclude that major assessments on large dams in the Mekong basin had mostly taken a sectoral approach in compartmentalising the river system (rather than undertaking cumulative impact assessments), had paid insufficient attention to livelihood impacts, and had been predominantly expert led rather than being inclusive of local knowledge. At the project level, legislation now requires environmental impact assessments (EIA) across the region. However, Boer et al. (2016: 134) conclude that "Practices around the initiation and conduct of EA [Environmental Assessment] in the Mekong River Basin seem to be geared more to promoting the interests of developers than to other considerations". An insightful analysis of the political economy of EIA by Wells-Dang et al. (2016) concludes that underpinning challenges on the quality, transparency, accountability, and impact of EIAs in the Mekong basin will not be addressed by revising 'procedural documents', but rather are more fundamentally about power relations in each country that enable 'entrenched interests' to limit the substantiveness of impact assessment practices, including the influence of public participation. They conclude: "Absent such public engagement, environmental assessment will remain a technical exercise subject to political and economic power".

Scrutiny of impact assessment has been most intense for the revived plans for Mekong mainstream dams since 2007 and for the Xayaburi Dam that was the first to initiate construction in 2012. A 'Strategic Environmental Assessment (SEA)' initiated by the MRC in May 2009 and was published in October 2010, one month after Laos initiated the MRC's 'Procedures for Notification, Prior Consultation and Agreement' (PNPCA) for the Xayaburi Dam. The details are beyond the scope of this review, but Suhardiman et al. (2015) argue that within a constrained political space, the 'scientific assessment' process of the SEA did "to a certain extent democratise decision-making processes" (2015: 199), while an inside reflection published by the Project Leader of the SEA highlighted the complexity and highly political character of the study (Carew-Reid, 2017). Several recent studies have also drawn out the politics of the contested PNPCA process for the Xayaburi Dam, which was not officially concluded at the ministerial level of the MRC even as Laos officially initiated construction in 2012 (Middleton and Pritchard, 2016; Rieu-Clarke, 2015; Olson and Gareau, 2018; Hensengerth, 2015).

[12] http://archive.iwlearn.net/mrcmekong.org/ISH/ISH-2.htm (accessed 22 April 2022)

Also relevant to the politics of knowledge in impact assessment has been a critical appraisal of public participation. As introduced above, expert-led processes and the institutions that govern them in the Mekong basin tend towards a depoliticisation of water governance (Käkönen and Hirsch, 2009). Beyond these 'invited' spaces (c.f. Gaventa, 2006), a wider politics of large dams has emerged in 'claimed spaces' since the 1980s, such as when the Assembly of the Poor social movement in Thailand challenged large dam development in the northeast (Missingham, 2003). Given the intense scrutiny towards the Nam Theun 2's approval, its public participation has been subject to critical examination. Singh (2009) shows how the World Bank required public participation that in many cases entailed the performance of participation necessary to legitimise its role in the project and drew in international civil society rather than a domestic civil society because of constrained domestic political and civil freedoms. However, Singh – while not overstating the case – recognises that some debates towards hydropower that previously were not possible in Laos did occur, suggestive of domestic opportunities for influencing outcomes (also Boer et al., 2016: 158-164; Singh, 2018). These findings reflect other literature on the Mekong basin that argues deliberative processes have to a degree improved the transparency and accountability of water governance (Sneddon and Fox, 2007; Dore and Lebel, 2010; Sneddon and Fox, 2008a).

A more recent focus of research on participation has been the Xayaburi Dam PNPCA. Yong (2021), for example, shows in an insightful paper how multiple state and nonstate transboundary environmental publics (TEPs) – as normative, material, and discursive entities – were assembled and evaluates the implications for public participation. Yong contrasts the TEPs formed through the state-led PNPCA (invited spaces) with the approaches of the Save the Mekong Coalition (created spaces), a transnational activism network, to explore in a nuanced way how "TEPs may be mobilised in response to transboundary environmental harms" (Yong, 2021: 11; also Yeophantong, 2020). Along these lines, Boer et al. (2016: 165-186) draw attention to the wider range of socio-legal strategies that civil society has adopted to influence decision making beyond 'invited participation', which have included influencing local and national authorities and using legal strategies such as use of National Human Rights Institutions and the courts. In the case of the Xayaburi Dam, for example, a court case brought by a Thai community network with support from public interest lawyers has been in process since August 2012, and although it was ruled against in the Supreme Court, it is under appeal (Middleton and Pritchard, 2016). For the Pak Beng dam, submitted for the PNPCA in November 2016 and not yet under construction, Suhardiman and Geheb (2021) analyse institutional disjuncture in hydropower decision making between the Government of Laos's national institutions and the MRC's transboundary ones that, they propose, exist in parallel and limit meaningful public participation. The authors identify 'powerful narratives' that reproduce this disjuncture: "In the case of the MRC, such narratives emphasise the environment and sustainable development, in the case of the Lao state, modernity and national development" (Suhardiman and Geheb, 2021: 2)

An emphasis on situational knowledge (known by many other terms, with slightly differing connotations such as 'local knowledge' or 'indigenous knowledge') has been an important focus within political ecology, both as an avenue for action and as post-structural analysis into the politics of knowledge and plural environmental narratives. Community research began to establish itself in the late 1990s in Thailand, where it is known as *Tai Baan* ('villagers' research'), and through civil society and academic research networking projects it has been practiced more widely across the region. Scurrah (2013) identifies two approaches to Tai Baan: 'countering hegemony' and 'institutional integration'. Countering hegemony is intended to strategically challenge expert knowledge when communities conflict with the state over 'development projects' impacting them. This approach to Tai Baan is practiced by 'villager researchers' to detail local resources and livelihoods, often with some support from 'research assistants' who come from civil society or academia. The local knowledge documented is intended to become 'a political force', while Tai Baan as a process is also intended as a means of community empowerment. It has been conducted at high-profile projects such as the Pak Mun and Rasi Salai dams, with the first Tai Baan study documenting the partial recovery of the fisheries and other ecological

resources and livelihoods when the Pak Mun dam gates were opened in 2001 and 2002 (SEARIN et al., 2004; Foran and Manorom, 2009). Sangkhamanee (2013: 12), while acknowledging the empowerment potential of this form of Tai Baan, also cautions that it could unnecessarily bound 'local knowledge' as only that which "seems to be 'politically relevant' to activists and social movements". Regarding 'institutional integration', Tai Baan has been practiced in projects intended to improve natural resource governance, such as in an internationally funded project in Thailand's Lower Songkhram River basin (also Blake et al., 2009). Here, local resource users collaborated with local authorities and NGOs to co-produce Tai Baan with the intention of strengthening relationships and to influence local policy and resource management. Along similar lines, Sangkhamanee (2013) presents ethnographic research from northeast Thailand where villagers prepared a project proposal to build a *Fai Maeo* (multipurpose weir) that purposively drew on state environmental narratives and a 'strategically simplified representation of the community' to ensure support of the state authorities. As Sangkhamanee (2013: 25) concludes, "The aim (…) was not to challenge or resist the state. Rather, it was a strategy to assert their participation in the state's development schemes".

LIVELIHOODS, THE COMMONS, AND WATER JUSTICE

Overall, there is plenty of evidence of the impacts of large dams on livelihoods in the Mekong basin. Soukhaphon et al. (2021) provide a recent review of the major ecological and social changes across the basin due to large dams, highlighting impacts on fish migrations, river hydrology, and sediment movement and connecting these to impacts on riparian communities in areas including food and economic security. Other books have covered a comparable scope, such as Yos Santasombat's 'The River of Life' (Santasombat, 2011) and Brian Eyler's 'Last Days of the Mighty Mekong' (Eyler, 2019). The MRC, in its overarching 'Council Study' (2018) analysis also finds that, for water resources, "The developments proposed are likely to reduce resilience and increase vulnerability of rural communities in the Mekong impact corridor, with the main benefits going to power companies and consumers mainly outside the corridor at the expense of fishing and rural households"[13]. The locations of dams are often in upland areas, and therefore disproportionately affect indigenous groups who live there and who are already subject to various processes of social and political exclusion (also Delang and Toro, 2011; Human Rights Watch, 2019) or internal territorialisation (Baird and Shoemaker, 2007). There are numerous individual case studies researched, for example those published by the M-POWER network (e.g. Lazarus et al., 2011). Civil society groups, including international organisations such as International Rivers and Mekong Watch, along with regional groups such as Living Rivers Siam, Rak Chiang Khong, WARECOD, and NGO Forum on Cambodia, have also documented and campaigned on the livelihood impacts of hydropower dams. Overall, the magnitude of change is such that some researchers refer to a 'rupture' in nature-society relations (Mahanty et al., 2018; Miller et al., 2021; Blake and Barney, 2021). In this section, I first outline an approach towards political ecology and livelihoods. I then relate this to Mekong literature on livelihoods and the commons, the consequences of involuntary displacement and offsite impacts, gendered impacts, and perspectives on water injustice.

A principal focus of political ecology is on changing ecologies and peoples' lives in particular places, including shifting inclusions/ exclusions of individuals and groups from access to, control and use of resources. As summarised by Robbins (2012: 20) "political ecologists follow a mode of explanation that evaluates the influence of variables acting at a number of scales, each nested within another, with local decisions influenced by regional polices, which are in turn directed by global politics and economics". It is the redistribution (or dispossession) and geographical transfer of value extracted from rivers that shapes the macro-political ecology of large dams in the most fundamental sense.[14] An early approach to

[13] http://interactive.mrcmekong.org/council-study-findings/potential-benefits-and-adverse-impacts/ (last accessed 3.4.22)

[14] The author thanks an anonymous reviewer for this insight.

explaining local changes was the 'chains of explanation' method, which is a structuralist approach created by Blaikie and Brookfield (1987) with reference to land degradation that drew attention to political economic factors, institutions and systems of governance, and power relations affecting local change that exist across multiple scales (transnational finance and institutions, the state, local institutions, communities, and the ecosystems). Matthews and Geheb (2015a) adapt the 'chains of explanation' approach to hydropower in the Mekong basin, observing: "While the chain of explanation has been critiqued as being too hierarchical (Rangan and Kull, 2009), it does offer a starting point for discussions about power and the relationships between the scales at which it is exercised" (Matthews and Geheb, 2015a: 21).

The constructivist turn in political ecology emphasised how local ecologies and lives are shaped by the power relations manifest in the politics of discourses, narratives, and knowledge. Overall, there is a tension on the relative emphasis towards structuralist/ materialist approaches and post-structuralist/ constructivist approaches within political ecology, but an acknowledgement that both are needed (Robbins and Bishop, 2008). Feminist political ecology (FPE) has been important to highlight women as a group, gender as a category, and gendered power relations and dynamics in relation to natural resource-based livelihoods (Rocheleau, 2008; Elmhirst, 2015), and it has gained some momentum in Southeast Asia (e.g. Resurrección and Elmhirst, 2008). Sultana (2021) concludes, however, that more remains to be done to bring feminist approaches from the margins to the centre of political ecology.

The concept and practice of the commons is "[o]ne of the first and most essential contributions to a contemporary political ecology" (Robbins, 2012: 52). In the Mekong basin, the river as a common pool resource has long been recognised as central to riparian livelihoods (Ahmed and Hirsch, 2000a). The commons can be understood at multiple scales. At the transnational level, the river is conventionally understood as being held in common between the governments of the six countries through which the Mekong flows and is also institutionalised as a transboundary commons within the MRC for the four lower country member governments. Here, the dominant approach is collective intergovernmental action for regional and national economic growth via large-scale development (Ahmed and Hirsch, 2000b). Yet, the Mekong can also be considered as a nested commons, supporting local-scale common property arrangements, including water, fisheries, land, and forests (Hirsch, 2000). As observed by Ahmed and Hirsch (2000: 3), "Local common property is both directly and indirectly impacted by infrastructure development, the growth of commercial production, new property relations and a myriad of other changes affecting the region". The degradation of the Mekong's common pool resources due to large hydropower dams and the consequences for riparian community livelihoods have been understood as an act of transnational commons enclosure (Santasombat, 2011), partial enclosure (Middleton et al., 2013), and 'water grabbing' (Matthews, 2012). Other commercial activities beyond the scope of this review, including sand mining, aquaculture, channel modifications for navigation, and large private fisheries concessions, also hold implications for common pool resources. Despite these challenges, studies also document how local actors have mobilised to protect local commons, including through building local institutions and drawing on local knowledge. Such local actions have occurred in northern Thailand (Yong, 2020; Santasombat, 2011), Tonle Sap lake, Cambodia (Sok and Yu, 2021; Grundy-Warr and Lin, 2020), and southern Laos (Baird et al., 2005), among many other localities.

In terms of direct and indirect benefits for local communities, the value of these commons is often undervalued in impact assessments (Middleton et al., 2022; Ahmed and Hirsch, 2000b), even as indicators measuring the economic, social, and environmental 'value' of the Mekong River have expanded over time (MRC, 2019). Examining valuation through the lens of commodification and decommodification, Green and Baird (2016) show how, in the case of ethnic Heuny people resettled for the Xepian-Xenamnoy dam in southern Laos, compensation practices decommodified some non-timber forest products and wild fisheries while also keeping sites like swidden fields and forest land as noncommodified, thereby reducing the compensation provided and ascribing property rights that restructure nature-society relations for the Heuny. Grundy-Warr and Lin (2020: 249), meanwhile, emphasise the "unseen transboundary commons

that matter for Cambodia's inland fisheries", including sediments, nutrients, and the annual flood pulse itself (also Fox and Sneddon, 2005). Their paper highlights that as these commons become increasingly compromised, 'biophysical matter' will become 'trans-border geopolitical matter' (also Grundy-Warr, 2017). In an insightful paper, Hirsch (2020: 2) situates the challenge as follows:

> [Transboundary] institutional arrangements treat countries as if they are actors securing the interests of their own populations and resources. But the commons exist at multiple scales. The local commons are those most immediately affected by [events such as large dam collapses] (…), yet existing transboundary governance arrangements tend to be blind to such impacts.

Hirsch (2020) argues the need "to go beyond the country-oriented scalar reference of conventional approaches to transboundary environmental governance". This move serves two purposes. One is to acknowledge the role of non-state actors in collective action responses, many of whom are marginalised in transboundary discussions due to prevailing power relations (e.g. Käkönen and Hirsch, 2009; Fox and Sneddon, 2019; Miller et al., 2020). The other is to widen the understanding of 'transboundary' to include the environmental footprints of large-scale projects and the transboundary flows of finance, investment, and ideas. Thus, as also highlighted by Yong (2020), the maintenance of the local commons depends upon communities' and civil societies' agency to influence and transform dominant state-centric processes of transboundary governance.

The most visible impact of large dams on livelihoods is forced displacement due to resettlement. Surprisingly, the total number of people resettled due to large dams basin wide is not documented; Le Texier (2013) draws on the MRC Hydropower Database to identify 69,413 people displaced by Laos' tributary dams, but states this is an underestimate as the dataset is incomplete. There are modest trends towards the strengthening of regulations for resettlement across the region, but they don't sufficiently translate into practice (Dao, 2010; Zha, 2015; Suhardiman et al., 2014). While some projects are less harmful than others, the overarching picture that emerges from existing literature shows how, following resettlement, hydropower developers typically provide physical homesteads and community infrastructure of varying quality to resettled communities. However, livelihood restoration is less likely to be achieved, monetary compensation if provided is inadequate, and participation in the project approval process and resettlement arrangements is superficial (Soukhaphon et al., 2021; Suhardiman and Rigg, 2021; International Rivers, 2008; Blake and Barney, 2021; Delang and Toro, 2011).

Several large dams have attracted heightened attention for their impacts on livelihoods and on the environment overall, and forced displacement has therefore also been more documented in these cases. Perhaps the highest profile case has been the Nam Theun 2, which, as introduced earlier, shaped global debates on large dams. In an edited volume produced by the World Bank, Porter and Shivakumar (2011), argue that Nam Theun 2 demonstrated that the negative impacts of large dams can be mitigated and the revenues generated can be utilised for poverty reduction and environmental protection. The project entailed the resettlement of over 6200 mainly indigenous people on the Nakai Plateau. While the World Bank argued that their safeguard mechanisms and other measures, such as a semi-independent 'Panel of Experts' monitoring mechanism, ensured a best-practice resettlement process, others, including a paper by an ex-member of the Panel of Experts (Scudder, 2020), have documented many shortcomings, much of which have to do with livelihood restoration (Hunt et al., 2018; Blake and Barney, 2021). Blake and Barney (2021: 15) suggest that Nam Theun 2 "may well represent some of the 'best' (i.e. least damaging) examples of resettlement in Laos" because of the safeguards and scrutiny by international civil society groups and semi-independent monitoring, and they observe that many other projects proceed with far less scrutiny. Other heavily documented projects involving significant resettlement include the Theun Hinboun dam and its extension project in Laos (e.g. FIVAS, 2007; Whitington, 2018; Blake and Barney, 2018), the Lower Sesan 2 dam in Cambodia (e.g. Baird, 2016; Harris, 2016; Chu, 2017), and to a lesser extent, the Manwan Dam and other Lancang Dams in China (Yu, 2002; Galipeau et al., 2013; Lyu, 2015).

The multi-scaled power relations discussed in early sections on political economy, governance, discourses, and knowledge production also shape the processes and outcomes of resettlement. After

three detailed case studies on resettlement in Laos – the Nam Ngum 1, Theun-Hinboun, and Nam Theun 2, Blake and Barney (2018) conclude that resettlement reproduced and intensified conditions of social injustice, inequity, and underdevelopment for socially marginalised and vulnerable individuals and groups. They situate these outcomes within a set of political conditions in Laos (also Creak and Barney, 2018), including a lack of accountability mechanisms for human rights instruments to which the Government of Laos is a signatory, as well as a lack of transparency and a limited space for public participation and civil society. Beyond these factors, micropolitics are also significant. Katus et al. (2016), for example, highlight that resettled communities themselves are not homogenous, and some within them are able to better negotiate the process than others due to their political or economic resources. They conclude that local politics and power relations between villagers, local government authorities, and dam developers also shape outcomes positively or negatively (also Chanthavong, 2019).

Forced displacement has also occurred due to dam breaks. The catastrophic collapse of a saddle dam at the Xepian-Xenamnoy dam in Champasak Province, southern Laos, on 23 July 2018, shortly before construction was completed, released a torrent of water and mud that surged through dozens of villages downstream in Attapeu Province with little advance warning (IDI and IR, 2019). The disaster caused at least 71 deaths and forcibly displaced over 7000 people downstream of the dam in Attapeu province, Laos, and 15,000 people across the border in Cambodia were also impacted. There was extensive damage to farmland and homesteads, along with loss of livestock and property. At first, the Government of Laos claimed the saddle dam's structural failure was due to heavy rainfall (Blake and Barney, 2021). Later evidence emerged that the South Korean and Thai companies' poor-quality construction work, possibly involving cost-reducing design changes, was to blame (Baird, 2021). While the project commenced commercial operation in December 2019, those impacted by the dam break struggled to access adequate support and compensation, and as of July 2021, the majority of the replacement permanent homes were yet to be constructed, leaving displaced persons in temporary accommodation (Sohsai, 2021; Blake and Barney, 2021). Baird (2021) contextualises the 'catastrophic violence' of the dam break disaster in longer-term patterns of forced displacement of ethnic Heuny (Nya Heun) people over the previous decades in the process of building the project, understood as 'slow violence'. Baird (2021: 1169) highlights that "catastrophic events frequently morph into slow violence" but argues that rather than taking a binary view, "we need to understand how the different temporalities of slow violence and catastrophic violence are interwoven".

As summarised earlier, many large hydropower dams cause significant environmental impacts far away from their project locations. The impacts affect, for example, river hydrology, water quality, and/or wild fisheries (Soukhaphon et al., 2021). A limit of existing individual project impact assessments is that impacts are occurring cumulatively, yet the cumulative and spatial extent of impacts are underestimated in practice (Green and Baird, 2020). Several basin-level studies have estimated the social impacts of large dams in abstract terms. For example, the Mekong Mainstream Dam SEA estimated that 43.6 million people living within 15 km of the mainstream and the Mekong delta in Vietnam could be indirectly impacted by mainstream dams, and of these, 2.1 million people live within 5 km of the mainstream and are considered 'riparian communities' more at risk (ICEM, 2010). As ecosystems become degraded and the river hydrology less predictable, documented impacts on livelihoods include on wild-capture fishing, riverbank agriculture, the collection of other aquatic products from the river and wetlands, and the erosion of riverbanks and people's land. This reflects, as discussed earlier, a partial degradation (or enclosure) of the commons. The extent of these impacts is often contested, as revealed, for example, in the long-running state-community conflict at the Pak Mun dam (Foran and Manorom, 2009; Baird et al., 2020a). Extensive off-site impacts have also been documented on the Xe Bang Fai River in Laos, downstream of the Nam Theun 2, with inadequate compensation and mitigation programs in place to address them (Baird et al., 2015; Manorom et al., 2017). Similar findings have been found downstream of the Theun Hinboun dam, where communities alongside the Hinboun River are squeezed between the impacts of the dam and the expansion of tree plantations (Baird and Barney, 2017; FIVAS, 2007).

Transboundary downstream impacts also occurred impacting indigenous communities on the Sesan River in northeast Cambodia following the unilateral construction of a cascade of large dams upstream in Vietnam. Impacts were acknowledged by the Vietnamese government retrospectively and negotiated with the Cambodian government via the MRC, although with limited improvements in the long term (Wyatt and Baird, 2007; Hirsch and Wyatt, 2004). The connection between the changing flood regime of Tonle Sap lake and its consequences for wild-capture fisheries and (fishing and farming) livelihoods have also been heavily debated, especially in the context of very weak flooding in Tonle Sap lake since 2018 (Kallio and Kummu, 2021; Althor et al., 2018).

Migration is one potential response to offsite impacts, which can be understood as an act of agency, as a 'slow-forced displacement', or as a combination of both. Evidence of out-migration exists, for example, in the Khone Falls area of southern Laos, where construction of the Don Sahong dam commenced in 2016 (RFA, 2019); on the Hinboun River downstream of the Theun Hinboun dam (Blake and Barney, 2018); and on the Mun River upstream of the Pak Mun Dam (Soukhaphon et al., 2021). Southeast Asia's population is historically mobile, and in the context of policies for economic modernisation, migration has been promoted (and critiqued) as a development strategy (Rigg, 2016), but migration linked to large dam operation is less studied, and conceptual approaches of a 'mobile political ecology' are only beginning to emerge (Elmhirst et al., 2018).

Regarding gendered impacts, there is a relatively limited feminist political ecology literature specifically on large hydropower dams in the Mekong basin to date. Given the gendered division of labour and responsibilities in households, large dams have gender-specific impacts that often generate greater social costs for women. These gendered costs relate to a range of factors, including changes in access to land- and water-based resources, which hold implications for income, food security, and work; gendered allocations of work and responsibility in the process and outcomes of resettlement; and strains due to familial and community impacts (WCD, 2000). Furthermore, these impacts are rendered less visible due to the disproportionately few opportunities for participation of women in project participatory processes and the wider societal gender inequalities that result in gender-skewed decision making and redress mechanisms (Delfau and Yeophantong, 2020). In an empirical study that examined the impacts of the Nam Theun 2 on the ethnic Brou indigenous group and especially Brou women living downstream, Manorom et al. (2017) found that the World Bank had failed to recognise the people impacted as Indigenous Peoples and that the programs implemented for mitigation and compensation were inadequate, concluding that "Much more needs to be done (…) ". A paper by Lebel et al. (2018) focuses onto the activities of civil society organisations "in the absence of gender mainstreaming in politics and policy processes" (2018: 305). Activities include: sharing information; expanding participation and challenging some forms of development, including large dams; and supporting local practices of development. The paper concludes that "achieving women's empowerment will take many other sustained actions to reconfigure the power structures that marginalise women, including the political and economic processes which led to large scale hydropower development in the first place" (Lebel et al., 2018: 319). A second paper examines discourses towards gender and hydropower dams in the Mekong basin by various types of civil society organisations as a means of 'discursive power' (Lebel et al., 2019). Overall, Lebel et al. (2019) argue that the discursive strategies adopted can have positive but sometimes unexpected and negative outcomes for women's and men's empowerment. Both papers provide details on the role of CSOs and highlight that, while there is much being done, there is also more to do to strategically connect the environment to gender equity in discourse and action.

Feminist political ecology in the Mekong basin has also addressed the wider water governance context. For example, Resurrección and Manorom (2007) assess various water governance programs active in the Mekong basin, finding that, where women's participation was promoted, it was often instrumentalised towards the efficiency goals of projects and donor requirements, while local power and gender relations were often overlooked. They conclude (2007: 194):

> (…)efforts to redress inequality between women and men should be centrally a part of the program agenda and goals. Otherwise women will continue being harnessed as a reserve army of labour under the aegis of poverty alleviation, conservation and participatory development.

Relatedly, focusing on the role of water bureaucracies in Thailand, Ongsakul et al. (2012) find that despite adopting IWRM as a paradigm – which in principle emphasises gender equality and women's participation in water resources management, organisational culture remained predominantly masculine, disadvantaging and excluding women within the organisations.

Reflecting donor expectations of gender mainstreaming into aid-funded programs, there is also more applied literature on gender and water governance; for example, Nguyen et al. (2019) evaluate current national water policies and policies on EIAs to find only limited gender mainstreaming, finding also that gender policies are not designed to link specifically to water issues. Hill et al. (2017) detail Oxfam's experience in piloting 'gender impact assessment' (GIA) while working with hydropower companies in Laos and Vietnam, arguing the benefits of these tools to improve participation and minimise negative impacts while also noting the lack of a legal framework that could systematise GIA beyond their pilot project. Regarding transboundary water governance, Nguyen et al. (2019: 2) argue that "Gender concerns are not highlighted in transboundary water governance arenas (…) Women's engagement and gender equality advocacy are conventionally confined to the micro, community or household scales, while economic and technical issues dominate the analytical centre stage at transboundary scales". While the MRC does have a gender policy, strategy, and plan[15], it is apparent from the preceding literature review that there is very limited recognition and analysis of gender in the literature above the local scale, especially through a feminist political ecology lens, and this is an important gap (also Delfau and Yeophantong, 2020).

These impacts on people and ecologies are fundamentally issues of social, environmental, and ecological justice – concerns that underpin much writing in political ecology (Robbins, 2012). In recent years, more attention has been paid to 'water justice' internationally (Boelens et al., 2018; Sultana, 2018) and in the Mekong basin. Some researchers have drawn on an environmental justice approach (Walker, 2012), examining the distributive justice, procedural justice, and to a lesser extent, justice as recognition dimensions of water justice. Sneddon and Fox (2008b), for example, applied this approach to consider social movement struggles for justice at the Pak Mun dam in the context of the just-launched WCD report and the global debate surrounding it. Mirumachi and Torriti (2012) also considered the Nam Theun 2's public participation and economic valuations processes in relation to the WCD report, identifying significant shortcomings in terms of distributional and procedural justice. At a transnational scale, Matthews (2012) and Marks and Zhang (2019), among others, have emphasised the distributional inequalities between sites of hydropower production in rural areas in Laos and sites of electricity consumption as hydroelectricity is traded across the border to urban areas in Thailand. In this context, accountability mechanisms via hard law become more complex as project impacts span across multiple sovereign territories and court jurisdictions. While the Thai national court has been used recently in the case of the Xayaburi dam in Laos, regional agreements mandating regional institutions (such as the MRC) and international soft law (such as the OECD Guidelines on Multinational Corporations) also become important arenas for seeking justice (Middleton and Pritchard, 2016). In two important papers intended to move water justice discussions beyond normative approaches focused on formal law and institutions, Blake and Barney (2018; 2021) connect concepts of 'slow violence of hydropower development' and 'grounded water justice' (also Boer et al., 2016). While realistic about the socio-political barriers, they argue the need for greater transparency, community participation and accountability, and improved recognition of human rights norms and principles.

[15] https://www.mrcmekong.org/our-work/topics/gender/ (last accessed 5.4.22)

CONCLUSION: 'THE HATCHET' AND 'THE SEED'

'The hatchet' and 'the seed' is a well-known refrain in political ecology, suggested by Robbins (2012) to emphasise that political ecology should critique existing unjust practices, but also further just alternatives. The political ecology of large hydropower has largely emphasised 'the hatchet'. One reason for this is that many 'seeds' lie in identifying alternatives beyond large dams, including rethinking how electricity is planned (Kaisti and Käkönen, 2012) and perhaps even more profoundly, the social production of electricity demand itself (Shove and Walker, 2014). In the past couple of years, non-hydro renewable electricity has decreased in cost and increased in regional installed capacity such that the arguments in favour of alternatives to large hydropower dams are more compelling than ever, even as 'sustainable hydropower' remains on the agenda (WWF, 2016). Another 'seed' lies in (re)affirming the value of healthy rivers, people, and ecology, which is an important message regularly conveyed by the region's civil society and local practices of river commons governance.

The primary conclusion of this review is that political ecology literature has contributed much to critically understanding the expansion of large hydropower dams in the Mekong basin. These contributions have been made through academic research and in alliance with various practitioners and community movements working strategically towards more just outcomes. Crucially, political ecology literature has narrated decisions towards the planning, construction, operation, ownership, and financing of large hydropower dams as fundamentally political rather than technical and drawn attention to the strategies of powerful elite actors including in relation to those who challenge them. It has also widened the analytical lens on large dam infrastructure to draw together a range of connected themes, as covered in this review, including: relational hydrosocial approaches; networked political ecologies; multiple ontologies of water(s) and ontological politics; political economy, (transboundary) governance, and critical hydropolitics; discourses, politics of knowledge, and power relations, including on water data, scale, 'international best practice', impact assessment, public participation, and local/situational knowledge; and on livelihoods, the commons, forced displacement, off-site impacts, feminist political ecology, and water justice. Despite the substantial research conducted to date and given the continually shifting domestic and regional politics, geopolitics, and socio-economic contexts, even these themes must be continually revisited as a core political ecology research agenda. Moreover, a substantial portion of this research has been conducted as the extensive plans for large dams were materialising. The ecological, social, and political consequences now that the river is impounded and fragmented by large hydropower dams to a significant extent is a new situation still to be fully understood.

To conclude this review, I suggest some research directions that would further the understanding of the political ecology of large hydropower dams in the Mekong basin:

1) As the socio-ecological and political-economic impacts of a heavily impounded basin become apparent, it is likely to generate political ecology questions that are distinct from those asked about the contestation over proposed dams when the river was more lightly impounded. For example, it seems probable that a 'dam cascade management' regime coordinated between the MRC and LMC will be consolidated in the coming years, raising important political ecology questions towards the ecological, social, and political consequences of the river being governed as a 'basin-scale' socio-ecological-technical system.

2) In order to better draw out the 'ecology' in political ecology, political ecologists could utilise interdisciplinary methodologies that stimulate a critical engagement with the production (and producers) of 'scientific evidence' in the physical and natural sciences. These methodologies could include those that study impacts of climate change, which affects all aspects of the political ecology of large dams in the Mekong basin and yet is relatively less studied.

3) Literature on hydrosocial research has grown rapidly in other regions, yet on the Mekong River this relational approach to water is less taken up. Taken together with STS research on how infrastructure reworks nature-society relations, hydrosocial research could deepen insights on the ontological politics

underpinning water conflicts, reveal deep processes of hydrosocial ordering, and suggest new strategies (or 'seeds') for alternatives. Relatedly, more-than-human epistemologies, such as multispecies ethnography, could also transform the frame of reference around research on river-society relations.

4) The relatively limited engagement with feminist political ecology, especially at scales above the local, is a gap in political ecology research on large dams in the Mekong basin at present. Asides from working to bring feminist political ecology to the centre of political ecology work at the local and everyday scale, especially drawing on intersectional approaches, it must be extended to analyse structures and discourses that produce and reflect gendered power relations at higher scales.

5) Another empirical and conceptual gap regards the consequences of forced and slow-forced displacements for the lives of peoples who migrate away from the river or resettlement sites. Understanding these mobile political ecologies will require new methods and conceptual approaches that accommodated the multi-sited lives of displaced and then mobile people and their families.

6) With political ecology's primary concern on justice and its implicit – if not explicit – presence in political ecology research, there should be a continued effort to understand 'grounded water justice' and draw on insights as a 'seed' for establishing or strengthening accountability mechanisms and proposing alternatives.

7) In recent years, political ecologists have considered the politics of knowledge regarding the dominance of Northern scholars and institutions working within and defining the field. While not downplaying the contribution that much of this research makes and also being careful to avoid the assumption that nationality necessarily reflects 'local voice', there is a growing movement to decolonise political ecology and broaden the diversity of researchers and conceptual approaches within it, for example via regional and international conferences, support for the next generation of political ecologists via higher education programs in the region and beyond, and engagement in locally defined and led collaborative research. It also means making research outside of English-language publications that are influencing the regional political ecology debate more visible.

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