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## Fractured hegemony and Vietnamese pragmatism in the Red River basin

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a fractured upstream superpower.

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#### ARTICLE INFO ABSTRACT Keywords: In the transboundary Red River basin, Viet Nam is the downstream country with China PRC and the Lao PDR Pragmatism situated upstream. The Red River has been rapidly developed with hydraulic infrastructure both in China and Hydropolitics Viet Nam, accelerated by UNFCCC funding for dams through the Clean Development Mechanism. This rapid and Infrastructure simultaneous construction of dams has brought about many changes to the river in a shared basin that does not China have the transboundary institutional capacity nor cooperation to jointly monitor and manage these changes. This Vietnam is typically a scenario that has been found to lead to increased hydropolitical tensions and conflict. However, Transboundary rivers given the fractured hegemonic power of China as an upstream neighbor and the importance of the China relationship for Viet Nam, neither conflict nor cooperation around shared water are realistic options. Instead, Vietnamese actors are operating pragmatically in the spaces between. Experimentation in 'what is possible' given the asymmetric relationship is diverse, decentralized, and widespread. Distributed sensemaking by Vietnamese actors, while not able to overcome the power imbalance, does decrease gaps of uncertainty and allow for Viet Nam to enhance its ideational power of how and why change is happening in the Red River. This enhanced understanding through pragmatic sensemaking improves the knowledge and bargaining power of Viet Nam with

### 1. Introduction

This paper focuses on the responses of downstream Vietnamese actors in an asymmetric Red River basin (RRB) shared between Yunnan, China PRC (48.8 %), the Lao PDR (0.9%), and Viet Nam (50.3 %) (Dang et al., 2010). Considerable changes have occurred in the RRB in the past two decades, particularly through a rapid rollout of hydropower construction in both China and Viet Nam sections of the river. There are over 50 commissioned hydropower dams of 15 MW or larger upstream in Yunnan and the hydropower companies are active in dam construction in neighboring Lao PDR and Viet Nam (MERFI 2024; Motta and Matthews, 2017). In Viet Nam, Chinese companies are heavily involved in the hydropower industry, particularly with regards to project design, construction, and equipment supply (Lamb and Dao, 2017). This rapid development on both sides of the border was enhanced by the UNFCCC Clean Development Mechanism, which subsidized large-scale hydropower projects constructed in the shared river basin, including dams on the Red River's mainstream less than 100 km of the border (Rousseau 2017). The excess capital for hydropower through the CDM coincided

with China's stimulus package in response to the Global Financial Crisis, which sped up the construction of water infrastructure (Jiang et al., 2020; Motta et al., 2025).

The proximity of large-scale dams to the border means that China's dam operations have a very direct impact on transboundary water quantity and quality in Northern Viet Nam (Fig. 1). Changes in water quantity can be experienced suddenly as flash floods cross over the border from dam releases in Yunnan (Linh 2021). Likewise, issues of water quality have arisen, which is accentuated in the dry season when the Chinese dams hold back water to fill reservoirs (Gia 2021).

Rapid unilateral construction of hydropower in a basin increases the risk of hydropolitical tensions (De Stefano et al., 2017). This is particularly the case in rivers where "the rate of change within a basin exceeds the institutional capacity to absorb that change" (Wolf et al., 2003p. 43). The RRB is further considered a 'basin at very high risk' for hydropolitical tensions because it does not have a multilateral organization, treaty, or technical working group to jointly monitor and manage the high rates of change in the shared river (De Stefano et al., 2017).

This concern is compounded by the RRB being the location of recent

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armed conflict in 1979 followed by a decade where China continued to engage in small-scale battles and threaten a 'second lesson' of full-scale invasion (Zhang 2015). A period the Vietnamese describe as 'neither war nor peace' (Thayer 1994). The shared 1,400 km land border was not demarcated until 1999 (MOFA PRC, 2000; Xiaosong and Womack, 2000). The normalization of relations in the 1990 s entailed both sides agreeing to not mention the Sino-Vietnamese War, with the states enforcing bans on discussing the conflict and the costs (Ngo 2021). The recent conflict has created a securitized information environment and discourse around the governance of the shared Red River (Bréthaut et al., 2022). Within this securitized discourse environment, unilateral and undisclosed dam development has been rampant.

The withholding of hydrological information alongside a dearth of data on dam specifications from over 50 commissioned hydropower projects in Yunnan, creates high levels of uncertainty for downstream Viet Nam (MERFI 2024). Despite rapid changes occurring in the RRB after armed conflict, unilateral infrastructure construction, and a more recent breakdown in diplomatic relations after China parked an oil rig in contested ocean waters in 2014, the basin at 'very high risk' has remained relatively stable. This research aims to understand how this is the case. A common explanation is China's hegemony as an upstream super power. We first explore the consistent labeling of China as a 'hydro-hegemon' using the politics of scale before employing a theoretical lens of pragmatism to understand power dynamics and the hydropolitical situation in the RRB.

There is a non-public agreement around data sharing during the

monsoon season signed between China and Viet Nam in 2009 (Ministry of Water Resources PR China, 2015). Uniquely, the foundation of this data sharing is found outside of the RRB in a smaller river, the Kỳ Cùng River in Northern Viet Nam. The Kỳ Cùng instead of flowing south into the Gulf of Tonkin, actually flows north into China's Guangxi Province where it is known as the Ping'er or Zuo Jiang (左江) as part of an upper catchment of the Pearl River basin, which renders a small part of China's watershed downstream from Viet Nam (Fig. 2).



Fig. 2. Zuo River Tributary in transboundary Pearl River Basin (Demattè 2015).



Fig. 1. Map of major dams in the Red River Basin from (Nguyen et al., 2021). (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

This interesting hydrological feature creates an environment where China is downstream in the Kỳ Cùng (Zuo Jiang) and has interest in receiving transboundary hydrological data from upstream Viet Nam in exchange for RRB data in the monsoon season. The agreement is renewed every five years and did survive low points in diplomacy, namely issues around South China Sea contestations. When asked about 'data sharing' Vietnamese actors were quick to point out that it is much more of a '*data trading*' scenario where limited information is sent from the Kỳ Cùng basin in exchange for RRB data during the monsoon.

Drought risks and dry season data were viewed as a key time period for exchanges, however this crucial information is not shared. China does not share data from major tributaries of the river system, including the 'Lo River' tributary which is considered one of the main three stems of the river system in Viet Nam, essentially removing upstream data for about a third of the basin (Interview 11). China also leaves out many crucial pieces of information such as water quality, sedimentation, dam operations, and future construction plans all of which are essential to any notions of integrated river basin management or infrastructure planning (ibid).

Despite increased engagement by China with downstream Mekong countries through international platforms that pertain to river basin management the current state of cooperation and data exchange in the RRB is arguably worse now than it was prior to the conflict in the late 1970 s. At that point Viet Nam enjoyed year-round data sharing from dozens of hydrological stations in all three major tributaries and held frequent exchanges with Chinese counterparts (Interview 9). Active participation through the Greater Mekong Subregion (GMS) or the China created and led regional Lancang-Mekong Cooperation Mechanism (LMC) have not achieved 1970 s levels of data sharing and cooperation in the RRB.

China's upstream power is considerable, and it is often conceived of in the Mekong Region as a 'hydro-hegemon' (Biba 2018, 2021; Han 2017; Ho 2016; Mirumachi, 2015a; Rein 2016; Vörös 2023; Zeitoun and Warner, 2006; Zhang and Zhang, 2021). Pragmatic behavior can illuminate existing power relations and is one of the 'choices' left for the non-hegemon (Zeitoun et al., 2011). However the 'hydro-hegemon' framing is problematic when taking into account issues of scale (Cash et al., 2006). It tends to reduce the complexities of scale, and gives too much credence to an aligned strategy and the organizational capacity from Beijing.

Instead, we conceive of power as relational in nature and echo Jones and Hameiri's (2021) assessment of China's power imbalances to be 'fractured' in its foreign relations and the messy space of transboundary hydropolitics. This fractured power is enhanced by China's fragmented water governance arena (Mertha 2009) that blurs the lines between state and non-state actors and extends beyond China's borders to form international coalitions that do not have strong authority structures (Han and Webber 2020; Webber and Han, 2017). These coalitions are not aligned, and instead compete with one another across functions (Ho 2014; 2016) and administrative levels that achieve governance outcomes that are not necessarily deliberate (Clarke-Sather 2012).

While Vietnamese actors are not able to overcome the fractured power imbalances and multifaceted reliance on neighboring China, pragmatic actions are reducing the level of uncertainty for downstream Viet Nam. We find that the pragmatic behavior is enhancing Viet Nam's 'power through ideas' (Carstensen and Schmidt, 2016) as a downstream country as they construct their own narratives and understandings of the changes in the Red River without robust formal information provision or cooperation from China. The pragmatic practices are able to increase Viet Nam's understandings of the state of the basin in Yunnan, which we highlight in the results section. The less than ideal situation does remain however, and the limitations to downstream pragmatism, particularly around dam operations, will be highlighted in the discussions section followed by a conclusion on the implications of these findings for transboundary water governance.

# 2. Theoretical framework: Pragmatism in transboundary water governance

Pragmatism is a distinct form of governance and theory that was pioneered by American philosophers such as John Dewey and others in the early 20th century (Dewey 1910; Ansell and Boin, 2019). Pragmatism is notable in that it shifts the focus of governance from finding an ideal formal structure, to instead view governance as a process of practices that are dynamic and informal (Farjoun et al., 2015). It deals with decision making in arenas with high levels of uncertainty, which has found utility in the climate change era and as this study will show, also with regards to transboundary water governance (Ansell and Boin, 2019).

Many conceptual features of pragmatism are already reflected in the water governance literature, making it a good fit for analysis. Firstly, both consider governance challenges to be highly contextual (Dewey 1931; Pahl-Wostl et al., 2012). There is a rejection by pragmatists of duality (Dewey 1896), namely between society and nature that finds parallels in hydro-social systems (Turton and Ohlsson, 1999; Linton and Budds, 2014). There is an appreciation of the politics of scale and an embrace of complex systems (Ansell and Boin, 2019; Islam and Repella, 2015; Lebel et al., 2005). It is understood that complexity and uncertainty of the governance regime increases when the issues are transboundary (Ansell et al., 2010; Dore and Lebel, 2010). This focus on process in complex situations, means that there are counterintuitive and opposing strategies, such as cooperation and conflict taking place simultaneously (Farjoun et al., 2015; Mirumachi and Allan, 2007).

For pragmatists there is an assumption that actors have agency and are diverse and multiple (Farjoun et al., 2015). These diverse and counter intuitive actors, leads pragmatists to assume that knowledge is fallible and there are not such things as perfect models or information (Shields 2008; Forester 2013). With regards to knowledge claims, pragmatism and water governance literature both assume that there are multiple ways of knowing and doing (Dewey 1938; Zwarteveen et al., 2017). These ways of knowing and doing influence the formal and informal rules of the game that determine how water is governed. As Ansell (2022, p.421) describes "the recent shift in focus from the formal institution of government to more informal and interactive governing processes accentuates the relevance of pragmatism to governance theory, because this orienting logic is extremely useful for addressing the wicked and unruly problems that lie at the heart of many governance processes".

Transboundary water governance is a wicked problem as it crosses multiple scales and boundaries, has an undetermined scope, is made up of complex interdependent factors that are constantly changing, is not readily solvable, and is influenced by diverging values and interests of actors (Ansell et al., 2010; Baird et al., 2016; Mirumachi, 2015b; Rittel and Webber, 1973; Souter et al., 2020). Water professionals dealing with wicked problems operate outside of their training in these messy spaces (Islam and Smith, 2019). In situations of uncertainty, they metaphorically 'climb a tree' to gain a better understanding of the situation (Dewey 1910). The actors involved are complex and their goals shape the governance process (Farjoun et al., 2015).

Pragmatism presumes that agents' knowledge claims reflect their power relations and governance outcomes are played out through practices in a particular context. This understanding of power through practice in pragmatism dovetails well with cultural understandings of power relevant to this context. Chinese scholars had made contributions to international relations theory by viewing power through the lens of 'guanxi' or 'relations' (Qin 2009). Qin Yaqing would argue that Beijing or China's hegemonic power can only obtain meaning through the practice of interacting with your relations:

"Power has to reside in relations. Therefore, power is relational by definition, that is, power is not the material possession of any entity, but the reflection of inter-subjective relational practice." (Qin 2009, p.19).

Power is not solidified by large-scale dams and their symbolism, but is an incomplete process mediated by daily practices (Lamb et al., 2024). This is the case in the RRB, where the dams are constructed and contestations reside around operations and management. The hydropower industry, and various scales of government are not aligned on how to operate the infrastructure, and this creates multiple centers of government (Rogers et al., 2016). This relational practice creates an environment where power in the RRB is challenged and renegotiated by an increasingly diverse group of actors across multiple scales. This aligns with Foucault's point that while power is usually exercised with a series of aims and objectives, there is no 'headquarters' that presides over the rationality of the choices and decisions made (Foucault, 1981).

# 2.1. Pragmatism and power in transboundary hydropolitics: fractured hydro-hegemony

Pragmatism is less concerned with how things should be and instead focuses on what is possible in the current context given what we bring from the past, to move us into the future (Ansell and Geyer, 2017). One of the main features of action around 'what is possible?' is experimentation in less than ideal circumstances (Dewey 1910; Cleaver 2012). Pragmatism has been used to analyze water governance outcomes previously, particularly by Francis Cleaver who has applied the theory to natural resource governance more broadly (ibid), to river basin management in Tanzania (Cleaver and Franks, 2005), as well as water utilities and service delivery with a strong focus on East Africa (Cleaver 2000; 2015; 2017). It has also been used to analyze Malawi and Kenyan water utilities (Rusca et al., 2015; Schwartz and Boakye-Ansah, 2023). There are pragmatic policy approaches to water governance challenges across geographies in U.S. river restorations (Gerlak 2008). This research is the first application of pragmatism in the transboundary Red River basin.

Pragmatic behavior in water diplomacy can be seen as revealing power imbalances that are in place (Zeitoun et al., 2017). Pragmatic water management that focuses on compliance, can downplay the cause of the tensions and maintain the status quo (Zeitoun et al., 2014). However, pragmatism, which is deeply tied to the governance context, can maintain unequal power relations and is able to challenge them (Clever 2012; 2015; Rusca and Cleaver, 2022).

A frequent explanation for transboundary hydropolitical relations in the Mekong Region is conceiving of China as a 'hydro-hegemon' (Biba 2018, 2021; Han 2017; Ho 2016; Mirumachi 2015; Rein 2016; Vörös 2023; Zhang and Zhang, 2021) (Fig. 3). Hydro-hegemony as a lens tends

HYDRO-HEGEMONY FOUR PILLARS OF POWER			
GEOGRAPHY	MATERIAL	BARGAINING	IDEATIONAL
	POWER	POWER	POWER

Fig. 3. Revised pillars of hydro-hegemony from Cascao and Zeitoun (2010).

to view state behavior as top-down and unified. This misrepresents the oversight and organizational power of Beijing 'over' Vietnam, but also over a complex array of Chinese actors. We do not view China as a monolithic state, and instead we see a state transformation process that is counterintuitive, unwieldly, diverse, and '*fractured*' (Jones and Hameiri, 2021).

This fractured hegemony is particularly pronounced when taking into consideration the politics of scale. Within China's water governance space, rather than top-down rule over water decisions, it is the power of provincial authorities that can make the national government in Beijing beholden to their own water management interests (Moore 2014; 2018). International rivers are a low priority for Beijing and China's institutional arrangements are not well designed to manage international rivers (Ho 2016). In the Mekong Region, transboundary river governance is often left to Yunnan province, which plays a lead role diplomatically and represents China in transboundary water relations (Ho 2014).

Yunnan Province directly engages with its neighbors around a wide range of transboundary policy issues, and directly signs legislation such as trade agreements with Vietnamese counterparts (VNA, 2023a). Yunnan's Hekou city and Viet Nam's Lao Cai city have direct ties and cooperation at the border. There is also direct cooperation and agreements between institutes in Kunming and Hanoi outside of official government diplomacy. Even if Hanoi and Beijing are having diplomatic spats or recovering from past grievances, this does not apply across spatial scales in the RRB. This complicates the many geographical and administrative scales involved in Sino-Viet relations, rather than viewing Viet Nam as simply a downstream non-hegemon.

The material and geographical power of the hegemon is further complicated as growth in China is uneven, with Yunnan having large economic disparities compared to provinces on the east coast (Su 2012). In practice, counting Shanghai GDP towards Yunnan's material power in the RRB is misleading. The upper basin is rural and mostly composed of the Honghe Hani and Yu Autonomous Prefectures. 'Honghe' also meaning 'Red River' is a prefecture with over 60 % of its population being made up of ethnic minorities and the annual disposable income of the rural population is 16,030RMB (\$2,225) (People's Government of Honghe Hani and Yi Autonomous Prefecture, 2022). This uneven economic development is then addressed by policies from Beijing that support further investment in infrastructure and economic integration with Mekong countries (Goodman 2004). Yunnan's material wealth generally, and in the RRB particularly is not high, and the solution is increasing cooperation and economic integration with neighboring Viet Nam, both currently and in the past.

The temporal scale considerations would also drastically change the labeling of China as a hydro-hegemon, as power by definition is provisional in nature and changes over time (Allen 2008). This can be seen in the more cooperative relations prior to armed conflict in the 1970 s. Yunnan province had not extensively dammed the Red River at that time and China's material power was quite low. China's population was impoverished with 97.5 % of the country or 770 million people living below the poverty line (World Bank and the Development Research, 2022World Bank and the Development Research Center of the State Council, the People's Republic of China, 2022). China's material power has shifted drastically over time during the largest and fastest industrialization processes in world history (Saich 2017).

Material resources, however, are not the same as power, and just possessing material power is not the same as mobilizing it in practice to influence outcomes (Allen 2008).

Yunnan actors manage the day-to-day practices and implementation of policies with its neighbors through platforms such as the GMS program and is more integrated when compared to Beijing (Su 2012). Yunnan also mobilizes material power for infrastructure development unilaterally, even on international rivers. Yunnan actors were surveying and constructing large-scale hydropower dams on the transboundary Red and Mekong rivers prior to Beijing (re)establishing diplomatic relations with the governments in Lao PDR or Viet Nam.

We take Ptak's (2017) idea of 'multiple Chinas' or Heilig's (2006) 'many Chinas' to describe a diverse range of actors across a complex system that has multiple and often contradictory or competing relations. Even within Yunnan, actors are at odds between the transportation interests that want to use the rivers for shipping and the hydropower lobby (Ho 2014; 2016). We do recognize that currently China and the multiple Chinas' have considerable sources of power. However, this is 'fractured' and includes a wide range of actors at various scales and sectors that have overlapping and conflicting agendas with each other and at times also with a distant capital.

Through our discussion of scales above we illustrate how power is provisional and complex. We take a pragmatist definition of power that sees power as something that is experience based (Dewey 1938; 1981). Practices are carried out in a particular geographical context through relations, and these relations always influence the exercise of power (Qin 2009). Power in this sense cannot be assessed by measuring resources or GDP, but instead looks at how these are used in practice (Allen 2008).

#### 3. Methods

### 3.1. Data collection

45 semi-structured interviews were carried out with Vietnamese actors in 2022–2024 starting with online interviews in the fall of 2022 prior to fieldwork. In person interviews took place primarily in Hanoi, the capital of Vietnam, and Lao Cai Province, where the Red River mainstream forms the border with Yunnan, China PRC in the spring of 2023. Ethical approval for this study was given by the authors' institution and ethical guidelines were followed. General questions and the consent form were typically sent in advance so that the interviewe was familiar with the research questions prior to the interview. Questions were focused on the perceived changes in the transboundary RRB system across time, actors' perceptions of related risks and challenges, and their subsequent governance responses to the evolving RRB politics and management.

Respondents were given consent options of anonymity and to choose if the interviews were recorded. Informed consent was used and participants could stop the interview at any time. Despite the political context, recording took place for the majority of the interviews and the responses were then transcribed verbatim. A Vietnamese research assistant was present and the interviews were carried out in Vietnamese and English depending on the language of preference. The interviews were semi structured in nature, typically lasting 1–2 h. For Vietnamese responses the transcription was then sent to a third party for translation. Notes were also taken during the interviews.

Interviewees were sampled through a snowballing strategy and often contacted first by phone. Interviewees consisted of government officials from the Ministry of Agriculture and Rural Development (MARD), the Ministry of Natural Resources and the Environment (MONRE), the Ministry of Industry and Trade (MOIT), Vietnam Electricity (EVN), and the associated institutions and universities of these ministries. In addition, interviews were carried out with the Viet Nam Committee on Large Dams (VNCOLD), the World Bank (WB), the Asian Development Bank (ADB), embassies, hydropower and energy corporations, consultants, academics, and non-governmental organizations (NGOs). The interview results are enhanced by a review of relevant policy documents related to the RRB (see Appendix 1).

### 3.2. Data analysis

The interviews were transcribed and coded using a mix of deductive and inductive coding with the software Atlas.ti in order to organize the view of changes in the RRB. Transcripts were coded around the perceptions of changes in the RRB and the responses by Vietnamese actors to better understand or manage these challenges, which eventually formed the basis for downstream pragmatic actions. These actions were coded and then grouped into five typologies of pragmatic behavior in transboundary water governance of; hardware technology, software technology, strategic planning and policy creation, direct diplomacy, and cooperation with third parties. A hydropolitical timeline was constructed and sentiments for the future of the RRB and hydrodiplomacy with China was coded at various scales of administration (China, Beijing, Yunnan, Honghe, Hekou) and the sentiments around the relationship.

#### 3.3. Limitations

During this study, China was inaccessible for conducting research under the Zero COVID policy. This is a major limitation of the research design and the reason this analysis focuses on downstream responses. Additionally, there were no village-level interviews or discussions with farmers and other local water users living in the RRB. With the amount of rapid changes in the RRB that were highlighted during the interviews this perspective is undoubtedly rich but was beyond the scope of this study. It is hoped that future research can bring in perspectives from Yunnan and from local Vietnamese water users on the governance of the RRB.

#### 4. Results

#### 4.1. Wicked infrastructure

The changes to the RRB caused by hydraulic infrastructure construction and infrastructure operations was the most common challenge identified in the RRB. The infrastructure in the transboundary river has high levels of complexity, uncertainty, and is multiscalar in nature, exhibiting the aforementioned symptoms of a wicked problem (Ansell et al., 2010). Hydropower construction undermines other infrastructure and causes impacts in the river system that renders existing irrigation projects downstream to be less or non-functional. This creates a vicious cycle that in turn can lead to calls for further hydraulic infrastructure construction to compensate for failures caused by existing infrastructure (Interview 31).

This wicked infrastructure problem can ironically be seen most clearly with regards to sediments, or in this case, the lack thereof. The Red River, even though it is a much smaller catchment than the Mekong, has a similar sediment load (Interview 43). The RRB gets its 'Red' name from the high quantities of sediment transport, however respondents noted that the Red River is no longer Red as the sediment load is only 20 % compared to previous levels (Interview 11; Interview 14). These changes are picked up in the monitoring work, but also can be seen with the naked eye (Interview 15).

The high sediment loads in the RRB mean that there is significant sediment retention behind the hundreds of dams in upstream Yunnan and Northern Viet Nam. The sediment starved or 'hungry water' that is released below dams creates erosion and severe scouring of the riverbed. Scouring of the riverbed, erosion, and landslides, which have been enhanced by sand mining in the river, have led to significant lowering of the riverbed and subsequent infrastructure failures. Some government officials consider the lowering of the Red's riverbed to be the largest challenge in the past 20 years:

"For example, with the same water volume in the dry season, the water level now is 2 m lower than that of the 1990 s. This impedes irrigation works to get water, or even worse, prevents them of getting water at all. I think the most urgent problem with the RRB is the lowered riverbed. The main reason for the lowered riverbed of the RRB is because of the hydropower dams, i.e., hydropower dams retained sediment upstream, and water without sediment flows downstream and takes soil from the riverbed. The second reason is

sand overexploitation. Vietnam should set a target for sand exploitation, otherwise the riverbed will continue to be lowered. This has been an alarming issue for a while now. It is the most urgent issue of the RRB from my point of view." (Interview 8).

The hydrologic changes caused by the rapid roll out of hydropower dams pose negative impacts on existing infrastructure, particularly irrigation systems which can no longer reach the river they were designed to pump water from. There are 8,932 pumping stations in the RRB delta area alone (MARD, 2022). The solution to this part of the wicked problem is at least in part to build more dams. In the RRB, Viet Nam has considered multiple infrastructure interventions to raise the water level or riverbed because of the impact to irrigation schemes. New pump systems need to be installed to access lower and lower riverbed levels, or new dams are planned to raise the water level lowered by the existing dams (MARD, 2022p. 167).

In addition to the longer-term challenges of dams, the uncertainty caused by hydropower operations was seen as one of the most immediate challenges in the RRB. Viet Nam lacks information and even the formal agreement does not entail dam operations as part of the data trading. Information is sent at specified hours, regardless of dam releases, which means large quantities of water are coming over the border suddenly and often without notice (Interview 4). These hydropower developments not only cause flash floods, but are believed by government officials to be one of the main reasons the data-trading is so limited.

"In fact, China still wants to hide the data because it has some problems with hydroelectric dams. The first is flood discharge. When there is a forecast about the flood coming to the reservoir, they are forced to discharge to prevent the flood. They refer to that kind of release as natural floods, but it is 'floods on floods', so that is something China wants to hide. We would object if we knew, that is why they provide the information on 5 stations only" (Interview 9).

It is notable that while the formal data-trading agreement does not entail dam specifications or operations, Lao Cai has received advanced notice of releases from their counterparts in Hekou, although this is not done on a regular basis (Interview 14). While the Da River has a cascade of dams in Viet Nam allowing the flash floods to be managed well before reaching Hanoi, in the Thao River, there are not dams on the mainstream and villagers have to be evacuated quickly with communities suffering economic losses due to riverbank inundation (Interview 9; Interview 15). Lao Cai is the first point of alarm for the Thao and they then need to send warnings downstream (Interview 16). This is a particularly dangerous situation if the Chinese dams operate at night, while people are sleeping downstream (Interview 11).

"Currently, because there is no timely information when China suddenly releases water, then the production areas beside the river are flooded and incur heavy losses. The Thao River has significantly large river banks with dykes inside. When China discharges, the residential areas on the river banks will obviously be affected: people, livestock, and crops. Water can flow at high speed, it can reach downstream in about 6–7 h. If that is the case, we cannot prepare" (Interview 9).

#### 4.2. Undisclosed dams and dry season woes

Record breaking lows have been recorded in the RRB during the dry season with minimums dropping to levels that have not been seen in the past hundred years (Interview 11). These low points of water availability are extending later and later into the dry season and are causing issues of quantity, quality and timing for downstream Viet Nam. Despite this time period being an obvious moment when information on water levels is vital, particularly on reservoir operations, there is no data sharing or joint coordination during this crucial time. Undisclosed information around transboundary dam management enhance the domestic issues in the RRB during the dry season. Viet Nam struggles with tradeoffs of its own reservoir management, mainly between state-owned energy utility Vietnam Electricity (EVN)'s goals of retaining water for power generation and irrigation needs and flood prevention. These tradeoffs mean that Vietnamese hydropower generation is being hampered in both the dry and monsoon season.

EVN is required to both save space in the reservoirs for flood control by the Committee for Flood and Natural Disaster Control, and is forced to release water for downstream agriculture in the dry season. EVN has to send compensatory water to the delta for irrigation in the dry season, in part to alleviate the wicked infrastructure issues and lack of water coming from China, causing large financial losses. The water sent to the underperforming irrigation systems causes large losses in energy production, as 4 to 6 billion m3 are released every year (Interview 43).

This dam management is very inefficient and most of the water is not able to be taken up in the irrigation systems and flows out to the sea (Interview 31). EVN's financial losses are such that the corporation was considered to have gone bankrupt, if it were allowed to be bankrupt as the county's primary state-owned grid operator (Interview 41). At the time of fieldwork, EVN was rumored to be running out of cash and to have posted over \$4 billion in losses in 2022–2023 (Guild, 2023).

#### 4.3. Pessimistic partners

Interviewees were asked to envision and describe the future of the RRB in 2040. This helped in establishing a hydropolitical timeline, but is also revealing as the pragmatic question of 'what is possible?' stitches together the past, present, and future (Ansell 2022). The sentiments were overwhelmingly pessimistic about an improvement in cooperation with China, and the main justifications for this pessimistic outlook on the future were historical.

Histories shape contemporary institutions and the scope of what is possible (Cleaver and De Koning 2015). Vietnamese actors think that if there was an intention for China to become more open and cooperative in the RRB, that it would have already happened after the many years of attempts to gain a better governance arrangement. The Mekong River Commission (MRC) was cited as an example of an opportunity for China to become a more cooperative full member in the MRC, where it has maintained a mere observer status over decades. The recent history of conflict and securitized discourse around the RRB, the high rates of change and infrastructure volatility in the system, and the pessimistic outlook for improvements in Chinese diplomacy leads Vietnamese actors to engage in a variety of pragmatic behaviors to improve their understanding of the changes in RRB with limited cooperation or information from the upstream.

#### 4.4. Pragmatic responses: Tree climbing in the securitized Red River basin

"In the suspense of uncertainty, we metaphorically climb a tree; we try to find some standpoint from which we may survey additional facts and, getting a more commanding view of the situation, may decide how the facts stand related to one another" (John Dewey, 1910, p.11)

The interviews revealed that changes in the RRB and degradation of the river is mainly attributed to human activities. Furthermore, the most common changes of concern for the RRB stemmed from uncoordinated hydraulic infrastructure construction and operations in the shared river. The rapid construction of hydropower dams in the 2000 s, supercharged by the CDM, put pressure on the region's transboundary rivers and hydropolitical relations (Motta et al., 2025). The rapid changes caused by the infrastructure spurred the resumption of data sharing and the pursuit of the 2009 agreement between China and Viet Nam (Interview 9).

These changes in the river system from infrastructure development

are reflected in the respondents' perceived challenges in managing the RRB; dam operations, flash floods from dam releases, losses from hydropower management – namely around tradeoffs between energy and agriculture production, inefficiencies in existing irrigation schemes, risk of dam failures and collapses, sediment deficits through dam retention and sand mining, and planning uncertainties caused by unknown infrastructure futures, were all more common responses as challenges in managing the RRB compared to any aspects of climate change. Understanding the hydraulic infrastructure dynamics is viewed as essential for Viet Nam to manage risks.

Vietnamese actors have engaged in a decentralized and diverse 'tree climbing' in the face of uncertainty in the Red River Basin. Attempts at closing the information gap created by the lack of cooperation between China and Viet Nam and to increase the understanding of the state of the basin beyond the formal monsoon data trading agreement was pervasive across ministries, sectors, and organizations. Outside of those with official roles in diplomacy, nearly all institutions were engaged in at least one type of 'tree climbing' that we outline below.

We grouped these 'tree climbing' activities into five different typologies of downstream pragmatism (Fig. 4). While the various activities cannot be said to overcome China's fractured power, as a whole we argue that these pragmatic efforts do strengthen Viet Nam's ideational power and add stability in uncertainty. Their ability to construct their own narratives and understandings of the changes in the RRB, could lead to improved bargaining power. It was noted that to approach China with grievances around the management of the RRB that the science and understanding of the issue needed to be very sound even without data provision or cooperation from China (Interview 36).

#### 4.4.1. Software & scenarios

Vietnamese actors are piecing together what is happening in Yunnan without data being formally shared from China. In the absence of information through diplomatic channels, remote sensing is used to monitor changes in the water levels and water surface coverage in the reservoirs and in the RRB's riverbed (Interview 1). The Department of Hydrology and Meteorology (MONRE) formally established a system linking ground observations and satellite imagery with the objective of monitoring transboundary water (Interview 9).

Since China has restricted information sharing for decades, there are efforts to recreate rainfall records in China over the past 30 years (Interview 4). This historic data is the input for reconstructing flow data in the RRB and allows for an overview of the Chinese side of the basin (Tran et al., 2025). They use the technology to monitor the reservoir systems in Yunnan to gain estimates on the quantity of water retained, changes in levels, flow times, and to predict discharge (Interview 19). This information can then be turned into scenarios and forecasts so that

Viet Nam can operate its own reservoirs as efficiently as possible given the situation, and reduce their overall water related risks (ibid).

This type of 'tree climbing' to gain a better insight of Yunnan's hydropower storage is pervasive across ministries, but power through ideas is not just top-down but also bottom-up (Carstensen and Schmidt, 2016). Some of these pragmatic approaches to monitor Chinese infrastructure are already being taught within universities in Hanoi. We found that masters students were actively experimenting with monitoring Chinese dams from space and building models of the river without available data being shared (Interview 12). Vietnamese academics have published on how to monitor 'poorly gauged' river systems in Yunnan or more accurately - monitoring gauged but 'poorly shared' river data from space (Interview 42; Du et al., 2022; Vu et al., 2023). This has led Vietnamese researchers to describe the phenomenon as 'geopolitically ungauged' basins - as the data exists but is constrained due to a lack of cooperation (Du et al., 2020). These studies are carried out on the more studied Mekong River basin (MRB), but will be applied to the RRB in 2024 (Vu et al., 2022; 2023; Interview 45).

These advances in remote sensing are processed utilizing advances in AI and machine learning. The machine learning is used for reservoir predictions in the upstream and also in disaster response. Then AI component speeds up the processing time of large datasets, and that of flood models so that they have more time to respond to inundation risk. Instead of taking 30 min to numerically calculate, Hanoi can gain estimates of flood waters in a couple of seconds (Interview 38). This is an example of how software in downstream Viet Nam is not just used to monitor changes in the upstream, but can also reduce sudden risk by shortening response times to disasters.

#### 4.4.2. Hardware & early warning systems

Given the uncertainty of water quantity, quality, and timing coming over the border, Viet Nam has had to improve its hardware and early warning systems. The hardware has been improved through the installation of automatic sensors and hydrologic stations. The installation of these near the border has been very contentious, and China does not allow Viet Nam to install stations on their own side of the river where it forms the international boundary (Interview 16). The first point of measuring the changes through hardware is north of Lao Cai city, where actors are responsible for monitoring the changes and to communicate these downstream to the other provinces and Hanoi. During the flood season this monitoring and communication responsibility is staffed full time with an around the clock hotline to ensure no valuable time is lost if floods and/or dam releases are coming through the system (ibid).

#### 4.4.3. Policies & planning

Water has been elevated in its importance by the Vietnamese



Fig. 4. Typology of downstream pragmatism.

government, and perhaps more importantly by the Vietnamese Communist Party (VCP). The Politburo released Conclusion 36 in 2022, that outlines a vision for water security and hydraulic infrastructure safety by 2030 with a vision to 2045. The Politburo is the highest layer of government in the country and the issues raised around transboundary hydropolitics in the RRB are reflected in the policy:

"Strengthen the building of bilateral cooperation mechanisms on management and use of cross-border water resources, hydropower development activities, and exploitation of water resources in international river basins and promptly find adaptive and proactive solutions in all situations" (Politburo Conclusion 36-KL/TW, 2022, p. 7).

In addition to improvements in direct diplomacy, the Politburo also calls for accelerations in hardware and software systems within shorter timescales:

"Modernize the monitoring, warning, and data information base related to water source security and dam safety, reservoirs, and connect with meteorological and hydrological monitoring systems to serve the management, operation, and operation of dams and reservoirs in real time" (Politburo Conclusion 36-KL/TW, 2022, p.5).

Illustrative of the overlaps in ministerial work, both MONRE and MARD have separate master plans for water resources. MARD's master plan covers both water resources and disaster risk. There is a clear emphasis on addressing the wicked infrastructure issues MARD is facing in the RRB with low water levels, a lowering riverbed, and failing irrigation works in the dry season, a period of time when there is no agreement or data exchange between China and Viet Nam:

"Water shortages in river systems during the dry season reduce the capacity of irrigation systems" (MARD, p.31). "With the current trend of lowering river bottoms along with the trend of exploiting water sources, resources and other economic development activities, it is forecasted that in the near future the level of lowering of the Red River bed continues to increase by 50–100 cm" (MARD 2022, p.34).

MONRE has responsibilities over transboundary waters and instream flows. The master plan shows that the government is attempting to reduce its risk exposure to relying on their shared waters. With regards to international river basins, there is a clear policy objective to lower Viet Nam's reliance on these transboundary waters with specific emphasis on the Red and Mekong rivers in the national master plans.

"Minimize dependence on water resources from transnational water sources and optimize the benefits brought by these water sources and proactively regulate water resources for people's livelihood activities and socio-economic development for the country currently and during the planning period." (Master Plan National Water Resources 2021–2030 with vision to 2050, MONRE, 2022, p. 145)

#### 4.4.4. Third-party partnerships

Third-party partnerships in the RRB have a long history with many different partnerships across UN agencies, donors, and development banks (Molle and Hoanh 2009). The WB and ADB have extensive experience in the RRB, particularly around disaster risk management, and the UNDP acted as the coordinating body in the past (Interview 28). The Japanese led ADB's activities are in addition to Japan's overseas development assistance (ODA). Japan is the largest ODA funder to Viet Nam accounting for over 60 % of the total ODA, which provides loans, grants, and technical cooperation related to water management (Interview 30; Nguyen 2023). These cooperation activities include software and hardware investments in hydrological observation, monitoring, forecasting, and disaster risk reduction (ibid).

In addition, many Western donors have provided extensive funding for decades around water governance through bodies like the MRC (Interview 6; 11; 13; 23; 30). This diversity of third-party partnerships is reflected within the Vietnamese ministries that are well versed in the expertise that certain third-party partnerships can offer. The ministries have organized grids of foreign partners and their corresponding relevant water management expertise (Interview 36). They can then choose what third-party partner to engage with in order to improve a certain aspect of their water management approach. However, much of the foreign funding was reduced after Viet Nam was elevated to a middle-income country status, bringing in a paradigm shift from 'aid to trade' (ibid). The reduced support that remains mainly goes towards the Mekong, which receives much more focus from 3rd party partners compared to the RRB (Interview 27).

#### 4.4.5. Direct diplomacy

The Chinese relationship is the most important international relation for Viet Nam. Some even assess it as being more important than all of the other relationships combined (Interview 37). This means the relationship is carefully managed at high levels and most of the negotiations and direct diplomacy happen behind closed doors. These carefully managed interactions are supported by available information, and if the Vietnamese are going to raise grievances with Chinese counterparts the science behind the claims needs to be strong. In this way, pragmatic actions are not merely creating new information within Viet Nam, but assist in framing transboundary water governance issues in their negotiations. Vietnamese government officials have on numerous occasions and in many arenas requested improvements in water diplomacy, cooperation, the provision of year-round relevant water related data, and the disclosing of information from China, but have been unsuccessful.

"When I offered the information exchange, he refused at once, reasoning they were not allowed to share. We suggested that we would provide them with the master water planning of the RRB in exchange for their information, yet they did not agree. That is the principle China always follows" (Interview 9).

The 'not allowed to share' issue does have some legal validity as water data is regarded by both countries as an issue of national security. There are laws in place on both sides preventing the sharing of river management data and it hampers joint projects and cooperation (Interview 9). In addition to avoiding breaking national security laws, going through official channels requires navigating multiple bureaucratic layers and obtaining formal approvals, often from the minister level or higher (Interview 42).The carefulness that the relationship is managed in combination with rigid party state institutional structures, make formal cooperation difficult, such that "official meetings on the Red River issue between the Vietnamese and Chinese governments are extremely rare" (Interview 11)..

Water issues then become bundled into the highest levels of diplomacy, managed by the Ministry of Foreign Affairs (MOFA). Although there are opportunities for information to be fed into the process, the water experts and actors with a deep understanding of the RRB's governance issues are typically not in the room together or their relationships are sporadic (Interview 36). MOFA is managing many arenas where fractured power relations exist with China. Water becomes deprioritized and the knowledge on the topic is reduced in these bundled diplomatic arrangements.

This same issue is replicated in other formal cooperation mechanisms and can be seen in the China led LMC. When asked if the LMC has the potential to improve the water governance situation, respondents perceived the mechanism to not prioritize water, which is only one of five areas of cooperation (Interview 31). China has the power to lead the mechanism, but water priorities get outweighed as they are bundled together with trade and security. The LMC is located in Beijing, and once again managed at a distant diplomatic level.

"If the LMC was in Yunnan, there would be more negotiation on water management. The LMC is very diplomatic in nature, and non-

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technical. Viet Nam engages the LMC through MOFA and it is more diplomatic in nature, less about water management" (Interview 33).

Despite the formal setbacks, direct diplomacy as a pragmatic typology includes lower level and informal Sino-Viet engagement. These direct diplomatic attempts take place at the highest level of national leadership, but also happen at the ministry, provincial, and city scale and through personal relationships. Prior to the use of satellite data, most of the information on Yunnan's water exploitation was garnered through personal relationships, often within the hydropower sector (Interview 5). Academic networks, and professor relationships also produced information out of Yunnan on the upper basin (Interview 6). Informal and unofficial channels for water actors to exchange and dialogue on the RRB become more important in this governance context.

It is noteworthy that in these party state contexts, unofficial spaces can be created by official bodies. Embassies and ambassadors can fund and host space for informal dialogues in both Yunnan and Hanoi (Interview 9). Additionally, actors can swap hats and are able to attend events without wearing their official role in the ministry, which requires formalities. Instead, water actors can directly engage with their counterparts informally and join the discussion as a member of an institute, academy, university or consultancy (Interview 42). Actors are dynamic and multiple, and a single individual typically has more than one role option available.

#### 4.5. Pragmatic limitations to wicked infrastructure problems

These pragmatic behaviors taking place in downstream Viet Nam reduce the information gap in the RRB and the overall risk of a disaster. These pragmatic steps are reducing uncertainty, but there are widespread inefficiencies and unknowns around the management of the RRB, particularly with regards infrastructure operations. It is important to note that these actions are reducing risk, but in no way overcome the deficiencies caused by the lack of cooperation, data provision, and wicked infrastructure issues in the RRB as a senior official explains:

"We utilized hydrological data from the time when there was no impact of the Chinese reservoirs when designing and building the reservoirs. Therefore, after (Vietnam's reservoir) construction, the Chinese reservoirs have altered the amount of water flowing into Vietnam, so these reservoirs in Vietnam must be adaptable to cope with that alteration. There is no other way. It is extremely challenging to forecast how China would operate (the reservoirs). We can master the general rules. Yet it is impossible to know the specifics and accurate operations at any given period. We have to accept this. Simply accept it." (Interview 19).

Remote sensing can close a lot of gaps currently around storage and volume in the upper RRB, however dam rules and operations are more challenging. Achieving general rules is better than nothing, but it still renders Viet Nam's dams to be inefficient and causes large losses. These economic losses occur both in the design phase and management, with data that does not reflect the current reality of a river highly regulated by hydropower. The operations suffer with risks that the dams will be overwhelmed by rapid changes and poor cooperation.

"Let's say there is a significant flood coming downstream from upstream. We do not have a forecast of China's farther upstream and only the data of stations at the border of Vietnam is available to us. Therefore, it is difficult for us to take control of the flows, i.e., the flow into the reservoirs and reservoir operations" (Interview 18).

This section illustrates the fallibility in this downstream approach of 'tree-climbing' for Viet Nam. The risk is reduced but considerable uncertainty remains. The lack of accuracy in reservoir operations causes increased risk and direct economic losses for Viet Nam.

#### 5. Discussion

#### 5.1. Politics of scale and relational power

Through engaging with the politics of scale we have shown how the hydro-hegemony framing of Beijing as a monolithic entity having power 'over' Viet Nam is too simplistic to understand a diverse range of actors and practices that take place in the transboundary RRB (Ptak 2017). Decentering China as a hydro-hegemon allows for a more relational understanding of power that is provisional (Allen 2008). Viewing power as relational across spatial-temporal scales opens up opportunities for hydrodiplomacy in arenas that are counterintuitive. Opportunities for incremental improvements in 'what is possible' are present in arenas that are often perceived of as sensitive geographies and communities. This is illustrated in the RRB by the role of informal data and diplomacy, the border region, and the hydraulic engineering community.

The nation state centric approach to power in transboundary water governance fails to capture the multiscalar and complex relationships intertwined in a larger political economy. Trade is the primary economic tie between the two countries. At the global level it is true that China has a larger GDP and Viet Nam is a fraction of the size in many respects. However, Viet Nam is also China's largest trading partner in ASEAN and the most familiar politically for Beijing, with a communist-party state relationship that goes back to both countries' founders (Goscha 2016). For upstream Yunnan and Honghe or the Red River prefecture, Viet Nam is powerful materially and geographically even downstream. Viet Nam provides access to global trade via roads and train lines to ports and the sea. Trade at the border gate between Lao Cai province and Yunnan Province grew at a breakneck 20 % growth between 2010–2019 and averages over \$3.5 billion annually (VNA, 2023b).

Water management is a high priority for the Vietnamese government and Vietnamese Communist Party, but the relationship with China is of the highest diplomatic priority across many sectors and scales. This means that formal direct diplomacy to address concerns in the RRB might not be the highest priority for Viet Nam. The RRB is shared by three communist party-states, and the Soviet influenced institutional arrangements and the planning time scales they operate under make formal cooperation challenging both domestically and internationally (Sehring 2009). Not cooperating around transboundary water governance does not inherently mean there is not cooperation due to upstream hegemony.

On the recent diplomatic mission by Xi Jinping to Hanoi, China and Viet Nam signed 36 cooperation agreements (VGP 2023). Of these that related to the RRB, there was mention of the MOU on improving the sharing of hydro-meteorological data during flood season, and two signed around the joint construction of an additional bridge over the Red River further upstream at Bat Xat where it forms the border (ibid). Changes in the status quo to formal water diplomacy between nation-states is slow and becomes overwhelmed by a multitude of inter-linkages and 33 other cooperation priorities that include security and trade. Instead of a top-down and hierarchal explanation for a lack of water cooperation, we see multiple competing interest groups and high levels of complexity (Ansell and Geyer, 2017).

#### 5.2. Yunnan's role and cooperation opportunities

Traditional upstream–downstream dynamics in transboundary water governance analysis is less relevant as the hydropower industry is increasingly globalized and China's role in it is expansive (Han and Webber, 2020). This globalization of Chinese hydropower is often thought of as a more recent phenomenon, dating to 21st century central government policies such as the Going-Out or Belt and Road strategies. However, Yunnan institutions have been engaged in cross border collaboration through hydropower construction and dam design in Viet Nam dating back to the 1960 s (Yunnan Provincial Power Industry Association, 2019). Yunnan has well established relations with Viet Nam in the very industry that is a driver of uncertainty in transboundary water governance – the hydraulic engineering community. Prior to the option of utilizing satellite imagery, information on infrastructure in the upstream of the RRB came through these relationships. The relationships are so strong that when an EVN employee has a family member pass away, Yunnan hydropower actors travel to Hanoi to pay respects (Interview 45). The relational power is evident in the long history of, and current collaboration between China and Viet Nam around hydraulic infrastructure construction (Lamb and Dao, 2017).

These transboundary relationships in the hydropower industry in Yunnan both spatially and temporally are close, and predate the formal provision of policy directives from Beijing. Yunnan actors direct water governance processes that are not necessarily aligned with the distant capital or even within river management industries (Ho 2014; 2016). These are not mere social relationships, they also come with shared world views and forms of authority (Cleaver and De Koning, 2015).

In the RRB, Yunnan hydropower operators and local government actors notify their Vietnamese neighbors of potentially dangerous dam releases, even though there is no formal agreement between the nationstates for this provision of data (Linh 2021). In hydraulic infrastructure construction from design to operations and data trading, lines of the state are blurred and actors are multiple (Farjoun et al., 2015). Viewing hydropolitical tensions and power in a unified hegemonic way can obscure these cooperation opportunities at different scales and through different relations.

Lao Cai was flattened in the 1979 Chinese invasion (Zhang 2015). Although a recently demarcated border has its sensitivities, from a relational power perspective this is arguably a likely site for building transboundary cooperation. Lao Cai and Hekou city do cooperate regularly and despite the conflict waged by Beijing in the 70 s and 80 s, their relations are highly integrated with friends, family, and employment found on both sides of the river (Interview 40).

Less asymmetric power dynamics can be seen at this administrative scale through regular meetings and positive relationships with government counterparts (Lebel et al., 2005; Moore 2018). At the border they are already holding meetings on transboundary environmental management, albeit currently without discussions of transboundary water. From a relational power perspective these are promising arenas for cooperation as they hold the relevant information on infrastructure operations, and are where strong cross-border relationships reside.

#### 5.3. Downstream pragmatism and data exchange

The multiple roles, titles, associations, identities and 'hats' that actors wear in these governance contexts allows flexibility in rigid institutional arrangements, where the bending and blending of practices are not entirely shaped by the formal rules of state agencies (Cleaver 2015). This is not to say that improvements in formal processes should not be pursued, but these have proven historically to change slowly. Additionally, even if there are formal provisions for the sharing of information or cooperation between countries, the reality is that this is often not robust in practice – particularly with regards to dams (Schmeier 2024).

The formal cooperation in data exchange exemplifies this inertia, as it is still locked in the historical risks of the RRB, which have typically been around flood control. The increase in storage and water exploitation have not been reflected in the RRB's management and Viet Nam still uses historical data and outdated estimations of a river before rapid large-scale hydropower construction. Currently much of the flood risks are not 'natural' and instead interact with dam releases and reservoir management. Water data exchanges are hindered by social barriers as much as they are technical considerations and are heavily influenced by preexisting relationships and institutional arrangements (Sugg 2022).

These 'water numbers' are not neutral, but highly political processes built on old habits that are difficult to adjust (Molle et al., 2024). In Viet Nam, water numbers for reservoir operations are continuously renegotiated between competing stakeholder groups and have water numbers dating back to the era of Soviet support with the most recently negotiated inter-reservoir operation Procedure 740 passed in 2019 (Nguyen and Bui, 2023). The formal data sharing in the monsoon is important, however there has been little cooperation with regards to the long-term management of drought and lowering of the riverbed in the dry season. For many actors, this is one of the most pressing management challenges in the RRB, a time when no formal information is exchanged.

In order to fill these information gaps, Vietnamese actors engage in 'tree-climbing' to improve their understanding of changes in the RRB while member to rigid institutional structures. This combination of experimentation as a member to one or more institutions both reproduces existing arrangements in the RRB and also challenges them (Rusca and Cleaver, 2015). This allows for forms of informal diplomacy and information production, that while not able to overcome power imbalances, does challenge the status quo and incrementally reduces the overall risk in the RRB.

Enhancing transboundary cooperation with Yunnan actors is possible, but also comes with uncomfortable caveats within Viet Nam domestically. Discussions about Yunnan's hydropower dams and data would need to accompany discussions of Viet Nam's dams in the RRB, which contribute to the 'wicked infrastructure' problems. The Da and Lo tributaries in the RRB hold the largest dams and the most installed capacity in the country (Dao 2010). Conversations about hydropower within Viet Nam have only recently been permitted and shown to be a highly sensitive topic (Dao 2017; Bruun and Rubin, 2023). With regards to dam operations and management, there is currently no provision for public participation (Le et al., 2016).

Similarly, if criticizing China's international data exchange, interministerial data trading in Viet Nam would have to improve drastically from its current siloed situation. Siloed governance and competition between MARD and MONRE is intense and evolving, with both claiming state management functions for water (Molle and Hoanh, 2009). Domestically, basin wide management and RBOs have been unsuccessful as they are not able to be grafted onto the Vietnamese institutional arrangements, context and distributions of power (ibid).

Vietnamese actors have improved understandings of the RRB through their downstream pragmatic behavior, but it is costly. This approach requires a relatively high level of labor and training costs, and the overhead associated with changing the governance system to allow for implementation (Sugg 2022). The experimental and diffuse process of 'tree climbing' relies on experimental and technically trained Vietnamese actors. This training cost increases across generations as the use of these approaches have to be integrated with experts in positions of decision making currently, and to train the future generations. There is a heavy upfront financial burden that comes with accessing the satellite information as many of the databases are not free. In addition, it can take years to develop and utilize these databases with mixed results.

#### 6. Conclusion

A history of conflict and fractured power relations in the RRB creates a securitized environment where territorial integrity or other forms of cooperation render transboundary water to be deprioritized. Downstream actors engage in pragmatic behaviors of direct diplomacy with Chinese counterparts, third-party partnerships, hardware and early warning systems, software and scenario development, and policy and planning activities to reduce uncertainty in the shared river system when formal cooperation is limited. These pragmatic actions can challenge uneven power arrangements by bending around siloes and allow for Vietnamese actors to construct a better understanding of the state of the RRB. The multiplicity of actors and their roles can at times blend the more rigid institutional arrangements to improve cooperation in the RRB through informal means.

Informal or less-than-official spaces can be created by official bodies.

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There is too much confidence placed in formal mandates, and further efforts should support informal practices and relationships. Informal practices could be assisted by supporting open access to crucial databases. This improved access is not just valuable to downstream Viet Nam, but also to Chinese actors that are conducting assessments on hydraulic infrastructure operations. As this type of experimentation increases, it could create communities of practitioners that can discuss dam operation observations on both sides of the border.

Opportunities for enhanced cooperation will reside in arenas where interpersonal relationships are already established or when the possibility for regular relations is more feasible. This means reconsidering entry points for cooperation based on relationships. From this perspective, seemingly sensitive or securitized arenas such as the hydraulic engineering community or the recently demarcated border region hold positive relationships that hydrodiplomacy can be built upon. Improvements are likely to be incremental but offer more readily available possibilities to change the status quo.

Formal improvements in the governance of the transboundary river are slow to evolve. The international cooperation and domestic management of the RRB are locked into flood prevention thinking, despite the increasing dry season challenges. There are still flood risks, but these are often described as 'not natural' and are often enhanced by dam releases. A situation that is not reflected in the formal data shared or utilized in the cooperation arrangements both domestically and internationally. Dry season diplomacy is desperately needed to reduce uncertainty created by the wicked infrastructure problem.

Downstream pragmatic actions have limitations, primarily around wicked hydraulic infrastructure construction and operations. Downstream pragmatism lowers, but does not remove the uncertainty caused by uncoordinated dam development. Gaining a better understanding of hydraulic infrastructure and the changes in the upstream of the basin, is possible, but not complete. This incomplete picture of transboundary water governance comes at high costs both for the access to the technology and in the capacity building required to understand and integrate these new ways of doing and achieving 'what is possible' for Viet Nam.

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#### CRediT authorship contribution statement

**Stew Motta:** Writing – original draft, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Johanna Koehler:** Writing – review & editing, Supervision.

#### Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

#### Appendix

#### Appendix 1. . Reviewed policy documents

The National Master Plan for 2021–2030 with vision to 2050 (National Assembly 2023); the Master Plan for National Disaster Prevention and Water Resources 2021–2030 with a vision to 2050 (MARD); the Master Plan for National Water Resources 2021–2030 with a vision to 2050 (MONRE); the Master Plan for the Red-Thai Binh river basin 2021–2030 with a vision to 2050; Vietnam: Toward a safe, clean, and resilient water system (World Bank 2019); Vietnam – Sea-Red river delta master plan (Trinh 2009); the Red River Inland Waterway Transport System (JICA 2003); Water Sector Development in Vietnam (MOFA, Netherlands, 1998); Agriculture, Natural Resources and Rural Development Sector Assessment, Strategy and Road Map – Viet Nam 2021–2025 (ADB 2022); the National Adaptation Plan 2021–2030 with a vision to 2050 (MONRE, 2021); the Adaptation Monitoring and Evaluation Framework (UNDP 2023); The National Power Development Plan 2021–2030 with vision to 2045 (PDP8); Politburo Conclusions; and China-Viet Nam joint statements were reviewed as part of this research.

## Data availability

Data will be made available on request.

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