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Damming the Mekong tributaries: water security and the MRC 1995 Agreement

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Abstract

Water security is a key governance challenge especially in relation to transboundary rivers. While the literature elaborates on the water security concept, there is very little on how to operationalize it in the transboundary context. Hence, this paper addresses the question: How can the governance of transboundary rivers be operationalized to deal with national water security concerns? It uses a literature review and a case study focusing on dams in the Mekong tributaries, namely the Sesan, part of the 3S Basin, in Vietnam and Cambodia. The paper describes the damming process in the 3S Basin and how it threatens water security for downstream states in terms of securing the flow, volume, quality, space, and the temporal variations of the rivers and the livelihoods of river dependent communities. It examines how the Mekong River Commission (MRC) members address these issues, balance their interests and secure the free flow of the Mekong River and its tributaries. It concludes that the MRC Agreement of 1995 is an inadequate mechanism to regulate the developments of hydrological infrastructure on the shared international tributaries, and that further operationalization of the concept of water security is necessary to enable the improvement of existing cooperative regulations and mechanisms.

Keywords: Hydropower development; Mekong; River tributary management; Transboundary water management; Water governance; Water security; 3S River Basin

1. Introduction

Although there is considerable research on water security (Pahl-Wostl *et al.*, 2016), there is little elaboration of this concept in terms of the governance of dams on transboundary river systems. Hence, this paper addresses the question: How can the governance of transboundary rivers be operationalized to deal

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with national water security concerns? It addresses this issue through a case study of the 3S Basin (formed by the rivers Sekong, Sesan, and Srepok) within the Mekong.

Many international river governance scholars argue that states use different ways and means to control the river flowing within their territory (Savenije & Van der Zaag, 2000) for national security reasons (Zawahri, 2008, p. 281). Territory not only includes the land area under national jurisdiction, but also surface water resources, air space and underground resources. State security thus aims to 'secure the volume' (Elden, 2013).

Upstream countries tend to claim absolute territorial sovereignty – i.e. that they should be allowed to do what they wish with the waters flowing through their territory as part of their national water security. Some countries claim water ownership under the principle of historical uses as Egypt does. Downstream countries define water security in terms of the volume *and* flow of the river (Grundy-Warr *et al*., 2014) under absolute integrity of state territory which implies that they should receive the same quality and quantity of water as before. For example, in 1967 just before the Six-Day War, Israeli Prime Minister Levi Eshkol defined water as a security issue (Biliouri, 1997, p. 5). However, both absolute sovereignty principles are now heavily contested and sovereignty is now seen as subject to (a) not causing harm to other countries, and (b) equitable sharing under Articles 7 and 5 of the UN Convention on the Law on the Non-Navigational Uses of International Watercourses (United Nations, 1997) which entered into force in 2014.

This implies that riparian countries need to share the volume and flow of the river and ensure protection from floods and droughts, promote livelihood and food security, and enable functioning ecosystem services. Furthermore, water security is about the quality of the flow implying reduced pollution of water bodies (Shmueli, 1999). The rapid growth of dams in transboundary rivers has affected the flow, volume and quality of the water, affecting people and ecosystems (McCully, 1996; Petts & Gurnell, 2005; Graf, 2006). In 2000 and 2001, floods in India and Pakistan respectively led affected people to demand state assistance (Zawahri, 2008). Finally, the current resurgence in state investment in 'clean' hydropower to spur development by powerful regional players is creating new security challenges (Bakker, 1999; Hirsch, 2010; Merme *et al*., 2013).

In the Mekong, there is growing political tension between the riparians. China's six dams in the upper Mekong mainstream, the Lancang, causes flow, volume and quality problems for Thailand, Laos, Cambodia, and Vietnam (Arias *et al*., 2014). The downstream countries had established the Mekong River Commission (MRC) in 1995 to address all transboundary issues. However, while blaming China for building dams on the Lancang, the Lower Mekong countries also build dams in the mainstream and tributaries (Merme *et al*., 2013). The MRC Agreement (MRC, 1995: Article 5) has encouraged dam building: about 41 hydropower projects have either been built, or are under construction, and an additional 30 tributary dams and 11 mainstream hydropower dams are expected by 2030 (Piman *et al*., 2013a; 2013b). Dams are also controversial (e.g. the Xayaburi Dam in Laos) because of their non-transparent decision-making process (Merme *et al*., 2013; Arias *et al*., 2014).

The 3S Basin is the second largest tributary of the Mekong. It covers about 78,650 km^2, or 10% of the Mekong Basin, distributed among Cambodia (33%), Laos (29%) and Vietnam (38%) (MRC, 2003; Piman *et al*., 2013a; Arias *et al*., 2014). It contributes 23% of the total annual flow of the mainstream, estimated at 100 km^3 or 2,886 m^3/s (MRC, 2010; Piman *et al*., 2013b). It originates in Vietnam and Laos and merges with the Mekong in Cambodia (Piman *et al*., 2013b). It is home to about 2.5 million people, mostly ethnic groups. At least 42 dams are being developed without much regional coordination or consultation. Vietnam has built 13 dams and plans more dams on the Sesan and Srepok. Laos has built one dam; five others are under construction and 15 have been proposed. Cambodia is building

the Lower Sesan 2 dam and plans another six dams (Merme *et al*., 2013; Piman *et al*., 2013a). These would further intensify water problems in the Mekong, affecting water security.

This article analyzes the damming process in the 3S Basin and water security in relation to the Watercourses Convention and the MRC Agreement. It first examines the concept of water security in relation to the Mekong; then looks at the impacts of the dams; followed by an examination of how climate variability and change will affect the 3S Basin. The article then discusses the issue of dam building in tributaries as opposed to the mainstream. Finally, it identifies the strategies for enhancing transboundary cooperation.

This paper is based on an explorative analysis of (i) the Lower Sesan 2 (LS2) Dam on the Sesan and Srepok in Cambodia, and (ii) the Yali Dam on the Sesan in Vietnam. It combines literature review with 93 in-depth interviews, focus-group discussions and a household survey[1] on the Sesan and secondary information and 15 interviews with key informants on the Yali Dam, conducted between July 2013 and July 2014.

2. Yali and LS2 hydropower dams

The Yali Dam in Vietnam and LS2 Dam in Cambodia were built partly to produce 720 MW and 420 MW of energy, respectively. The 65 metre-high Yali Dam is 70 to 80 km from the Cambodia–Vietnam border, and its reservoir covers 64.5 km^2. The 75 metre-high LS2 dam is 25 km away from where the 3S rivers meet the mainstream, and has a reservoir area of 340 km^2 (Key Consultants Cambodia (KCC), 2009). However, these dams threaten water security via affecting access to environmental services (cf. Myers, 1993).

The Kbal Romeas, Srea Kor and Phluk communities in Stung Treng Province have 787 households over 0.15 million ha. This area is mostly forest, with 8,589 ha of residential land, 1,682 ha of rice farming, 531 ha of *chamcar* (crop fields) areas, and 0.14 million ha of water bodies, rivers and ponds. The study communities are located along the banks of the Sesan and Srepok, representing five ethnic groups: Laotians account for 95% of the population in Phluk and Srea Kor, while the Phnong ethnic group constitutes about 97% of the population in Kbal Romeas. These people farm rice, crops in *chamcar* fields, fish and collect non-timber forest products (NTFP).

3. Human security

> '*The river Sesan is the life of Srea Kor's people*', the Commune Chief of Srae Kor said, '*building Lower Sesan 2 Dam would make our life lost*' (per. comm., 16 May 2014). The Village Chief of Kbal Romeas village confirms that '*my villagers' lives depend on the river Srepok*' (per. comm., 18 May 2014).

These quotations show how important the 3S rivers are for the local people who cultivate rice and fish and supplement their foods by raising animals like pigs, chicken and cattle (done by one third of the people) and collecting NTFP, see Table 1.

[1] Three villages were studied: (i) Srekor village on the Sesan located upstream of the proposed dam; (ii) Phluk village located downstream of the proposed dam; and (iii) Kbal Romeas village, located upstream of the dam on the Srepok. See also Figure 1.

Table 1. The main sources of livelihood security.

Village name	No. of interviewees	Farming		Fishing		*Chamcar*/ NTFP		Raising animals	
		No.	%	No.	%	No.	%	No.	%
Srea Kor	20	19	95	18	90	14	74	8	40
Phluk	21	21	100	18	86	14	67	6	29
Kbal Romeas	22	22	100	19	86	16	73	8	36
Total	63	62	98.41	55	87	44	70	22	35

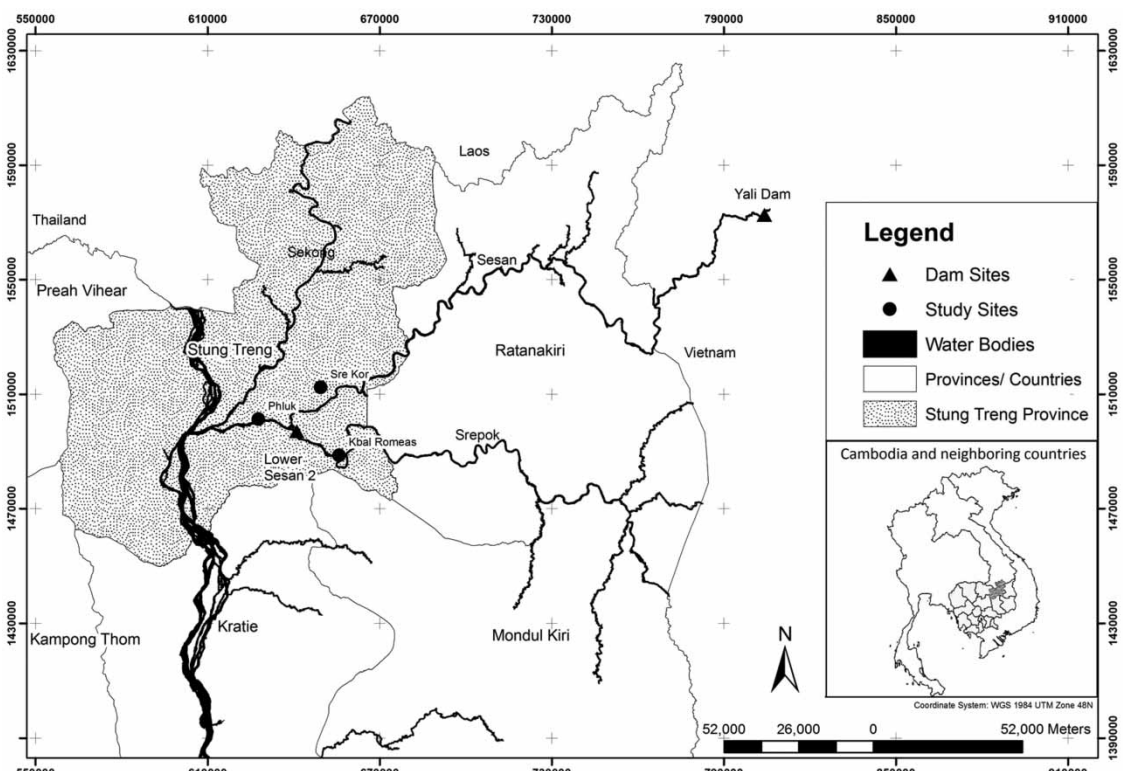

Fig. 1. Map of the 3S River Basin and the location of the study areas.

Dams in the 3S Basin, including Yali and LS2, have affected the human security of the studied communities. Dam construction of LS2 will displace about 787 households of 3,284 people who will be relocated to six areas covering 4,000 ha, mostly located within forest concession and reserved land areas. A total of 554 households from Srae Kor and Kbal Romeas villages, and 40 households from Phluk, will be displaced while 193 households in Phluk will not be displaced, as the village is 7 km downstream of the dam.

The company building the LS2 Dam has promised the dam-affected households land and housing and financial compensation for their relocation. Each affected household in Srae Kor and Kbal

Romeas has been offered 5 ha of land and company-funded housing and cash. However, the replacement land is of poorer quality for lowland rice paddy cultivation, being inappropriate and inadequate. The financial compensation is US$500 per hectare for lowland paddy land, US$740 for garden land, and US$230 per hectare for lost fallow swidden land (KCC, 2009). Of the 40 displaced households from Phluk village, only 12 have received the cash package, which is meant to cover the loss of housing, land and fruit trees. The other 28 families in Phluk were not eligible for the compensation package, even though their houses, land and fruit trees will be lost to the dam, as they had moved to the area not long before the compensation deadline. A further 193 households in Phluk village, 7 km downstream of the dam site, also received no compensation. Furthermore, the villagers do not wish to move even if the resettlement area would have new housing, roads, schools, health centers and markets, as they are going to lose their land, houses, forest spirits and the domains of their ancestors (pers. comm., on 15–20 May 2014).

The dams are not always operated to control floods; in the wet season when the reservoirs are full, water is released causing floods downstream. Such floods have occurred almost annually since 1996 affecting local livelihoods, health, food and environment (Baird *et al*., 2002; Rutkow *et al*., 2005; SWECO Grøner, Norwegian Institute for Water Research, ENVIRO-DEV & ENS Consult (SWECO), 2006; Ryder, 2008; Grimsditch, 2012), and causing property destruction and loss of life (Grimsditch, 2012). Since 2000, dam-induced flood surges in the 3S have led to at least 35 deaths in Cambodia creating the fear of dams as a life threat. As the village chief of Kbal Romeas says (per. comm., 15 May 2014):

> '*I have lived here since my birth and we lived peacefully with the river, we never worried about the possible harms caused by river. Recently, we heard of the loss of lives in other areas of the 3S rivers, and we fear that one day it will come to us*.'

About 33,564 ha of forests and farmland will be permanently flooded (KCC, 2009). Related resettlement, relocation and displacement will exacerbate the socio-economic conditions of the villagers, particularly incomes, livelihoods, and forest areas. It also means a loss of culture, local knowledge and practice, farmlands, fishing grounds, and their ancestral home. Villagers in Srae Kor village expressed it as follows (per. comm. with villagers in Srae Kor village, 16 May 2014):

> '*How can we abandon our village? This village is a place of our ancestors and thus, we cannot leave our ancestors behind and leave them in the flood. We have been living in this village for many generations and we have our culture, tradition and knowledge that support our livelihoods and thus we cannot leave our village*.'

4. Environmental security

Human security depends on environmental security which concerns the maintenance of the ecosystem (river, water and forest resources) and its services (Brauch, 2011). Environmental Impact Assessments (EIAs) are the most prominent national policy instruments to develop compensation and mitigation measures for the negative impacts of dam developments. The Yali Dam's EIA, which was never made public, had a geographical scope of six kilometres downstream of the dam within Vietnamese

territory, and did not assess the impacts of the dam further downstream in Cambodia (Öjendal *et al.*, 2002). The people and their environment downstream were outside the scope of the EIA.

4.1. Floods and flood damage

Dams in the 3S Basin, including Yali Dam, have caused annual flooding events affecting the fisheries, biodiversity levels and the people. In 1996, there was one severe flood in the Sesan, in 1997 and 1998, there were two annual floods (Ly, 2010), in 1998–1999 less water flowed as the Yali Dam's reservoir was being filled (Vietnam National Mekong Committee (VNMC), 2000) leading to the deaths of fish within deep-water pools. On 30th September 1999, water was accidentally released at 5,700 m^3/s from the Yali Dam without warning (VNMC, 2000) inundating villages downstream on the Sesan three times by more than two metres of water, and each event lasted for several days (Ly, 2010). On 28 and 29 February 2000, some 'technical problems' during the testing of Yali Dam's new spillway led to a flood in Cambodia (VNMC, 2000). A second flood hit the villages downstream in Cambodia during the dry season in April 2000, when Yali Dam's discharges reached about 500 to 600 m^3/s (VNMC, 2000). Villagers described massive surges of water occurring at this time – up to two metres high (Sithirith, 2007).

Water level fluctuations of between a half and one metre within a single day also occurred during the years 2001, 2002 and 2003 in Ratanakiri Province (Sithirith, 2007; Wyatt & Baird, 2007). The water level in January 2003 was higher than at the same time in 2001 and 2002, but in February 2003 the water level abruptly fell to lower than the level reached in 2001. Villagers along the Sesan refer to these abrupt and unpredictable fluctuations in the level of the Sesan as *tonlechgoat* or 'crazy river', and these events have continued in Srae Kor, Kbal Romeas and Phluk, causing damage to rice crops and property (pers. comm. with villagers, 15–18 May 2014). In 2011, the 3S Basin in Cambodia suffered severe floods, but in 2012 it was extremely dry, causing food shortages. Furthermore, in 2013, heavy floods occurred twice both in August and September (pers. comm. with villagers, 15–20 May 2014). Since the dams have been built along the Sesan and Srepok in Vietnam, dry season flows at the 3S outlet in Cambodia have increased by 28%, while wet season flows have decreased by 4% (Piman *et al.*, 2013a). As a result, dry season flows are sometimes comparable to wet season flows, a phenomenon described as a 'homogenized flow'. This has resulted in areas that used to be dry in the dry season being permanently inundated, and areas that used to be flooded in the wet season remaining dry, leading to reduced land productivity.

4.2. Disruption to fisheries

Both the Yali and LS2 dams disrupt water flows and block fish migration routes upstream, reducing the number of fish able to breed due to degraded habitats and fluctuating water levels (Baird & Dearden, 2003; Baird, 2009). This will affect the 89 migratory fish species belonging to 15 families which migrate to the 3S Basin each year, with 64 species migrating to the Sekong, 54 species to the Sesan and 81 species to the Srepok thus impacting on upstream fish stocks and fisheries (Baran *et al.*, 2013; pers. comm., with staff of 3SPN, 18 May 2014). The building of LS2 will lead to a 9.3% basin-wide drop in fish biomass levels, which is approximately 200,000 tons of fish per year, thereby affecting fisheries' productivity (Ziv *et al.*, 2012).

The upstream dams affect the Sesan and Srepok rivers and the entire basin, extending to the seven Sesan tributaries and 11 Srepok tributaries located in Cambodia, which are home to 133 and 240 fish species respectively (Mak *et al.*, 2011). If all 78 proposed dams in the 3S Basin are built, it would have a catastrophic impact on fish productivity and biodiversity levels, and lead to lower energy production levels (Ziv *et al.*, 2012). These tributary dams could pose a greater risk than the six mainstream dams proposed on the Lower Mekong (Ziv *et al.*, 2012), severely affecting the ecosystem.

4.3. Forest degradation

Dams affect forest resources on river banks. Since the Yali Dam was built, forests along the Sesan are now sometimes submerged permanently or not at all. The 'homogenized' flows affect local forest productivity levels, fish habitats and river ecosystems. The LS2 Dam will have a greater impact on forest resources than the Yali Dam, as 30,000 ha of forests, 1,290 ha of agricultural land, 218 ha of grassland, 47 ha of bush forest land and land made up of water bodies will be used to construct the dam (KCC, 2009). The LS2 will submerge 350 ha of evergreen forest, 5,073 ha of semi-evergreen forest and 27,711 ha of deciduous forest (KCC, 2009).

LS2 will also submerge thousands of hectares of forested land along the Sesan and Srepok riverbanks, including 2,003 ha of community forest land in Srae Kor Commune and 1,307 ha in Kbal Romeas. About 787 households will lose access to their community forest areas. The LS2 will also affect 10,399 ha of economic and forest concession land that the Royal Government of Cambodia previously granted to six private companies. Of these forested areas, about 150 ha of spirit forest – protected by communities, 35 ha of graveyards and about 65 ha of ancestor domain land will be lost (pers. comm. with villagers, 15–18 May 2014).

4.4. Food security

As mentioned above, the change in water flow, volume, quality and seasonality affects local farming, fishing, *chamcar* and forest areas along the 3S rivers contributing to food insecurity. Dams block fish migration, change the water temperature, flows and turbidity negatively which also affects the fish populations and migration leading to declining fish catch and yields have dropped by up to 70% (SWECO, 2006). In studied villages, the daily catch per fisherman has gone down from 5–10 kg to 1–2 kg affecting the protein content of local diets.

The water level fluctuations from the Yali Dam have destroyed the vegetable gardens providing 19 types of edible riverine plant (Baird & Mean, 2005), and damaged rice fields, crops, and properties of Phluk, Srae Kor and Kbal Romeas villages. In 2011, 2012 and 2013, the studied villages experienced heavy floods twice a year, in July–August and September–October, resulting in poor crop yields making it difficult to adjust food production systems. A villager in Phluk said (per. comm., 19 May 2014):

> '*My family owns 1.8 ha of farmland. If there is no flood, it could yield 5,500 kg, and I could use this to feed my family for the whole year. However, when it is flooded, then yield losses are 50%, which causes food shortage … Many villagers in Phluk abandoned their low lying farming lands, and looked for upland fields to be farmed.*'

About 20% of the population has stopped growing rice and crops along the river bank and fishing and agricultural incomes have reduced by 87% and 54%, respectively (Rutkow *et al*., 2005) leading to food shortage and reduced incomes between August and November.

5. Water security

These dams in the 3S Basin have thus created water insecurity for local people.

5.1. Securing the flow

Since, altering the flow affects the bio-physical and human environment, securing the flow is key to protect people and the environment (Power *et al*., 1995; Hirji & Davis, 2009, p. xiii). The seasonal fluctuation has supported the evolution of societies and ecosystems, and animals, plants and humans have adapted to the seasonal cycle of flood and recession (MRC, 2011a; Piman *et al*., 2013a).

The MRC Agreement (MRC, 1995: Article 6) encourages cooperation to maintain the mainstream flow:

> '*(a) of not less than the acceptable minimum monthly natural flow during each month of the dry season; (b) to enable the acceptable natural reverse flow of the Tonle Sap to take place during the wet season; and, (c) to prevent average daily peak flows greater than what naturally occur on average during the flood season*.'

This secures the Mekong mainstream river flow, but not that of tributary dams which require only notification, despite their potentially significant transboundary impacts.

This raises the question: Can the flow of the Mekong be secured by such a discriminatory policy?

First, the MRC Agreement only addresses developments on the mainstream and not tributaries, and vaguely defines (Article 6) the acceptable minimum monthly natural flow and natural reverse flow but does not explicitly deal with flows in tributaries and their relationship with the mainstream flow. Thus, the MRC Agreement is unable to secure the flow in the mainstream (Piman *et al*., 2013b). At the same time, Vietnam's Prime Minister has decided (No 707/QĐ-TTg, 2013) on a minimum flow of 195 m^3/s in the Sesan to flow into Cambodia from the Sesan 4A reservoir (Ngo & Masih, 2014). This minimum flow is higher than the natural low flow and aims to optimize energy production rather than environmental flows.

Second, the mainstream dams modify the flow of the river and the dams in China make guaranteeing the flow in the Mekong impossible. Furthermore, nine operating and 11 dams under construction in the Lower Mekong Basin, with a total installed capacity of 3,643 MW and an active storage of 6,196 million m^3, change the flow, volume and quality of water downstream. The 12 proposed hydropower dams will affect water flows, reduce fisheries, inundate banks, reduce nutrient flows (causing a loss of US$500 million/year (Grumbine *et al*., 2012)), affect livelihoods and food security, require resettlement of 100,000 people and affect a further 2.1 million indirectly (Barlow *et al*., 2008). Dams would turn 55% of the lower mainstream into reservoirs with slow-moving water (Grumbine & Xu, 2011), increasing the risk of waterborne diseases like schistosomiasis and opisthorchiasis (Grumbine *et al*., 2012). Some 22 other 3S dam projects are envisaged which will also affect flows (daily and seasonal

flows) and quality (KCC, 2009; Piman *et al.*, 2013b). When states individually 'secure the flow' through dams, they ignore the other aspects necessary for ecological and livelihood security (Grundy-Warr *et al.*, 2014) and the need for transboundary management (Dalby, 2009, p. 162).

Furthermore, to optimize electricity generation, hydropower operations fill reservoirs during the wet season and release water at higher volumes than natural flows in the dry season. Existing dams increased the dry season flow by 28% and decreased the wet season flow by 4% at the 3S outlet. The proposed hydropower dams in the 3S will increase dry season flows by 63% and decrease wet season flows by 22% at the 3S outlet (Piman *et al.*, 2013a). This 'homogenized flow' permanently inundates previously dry areas and dries previously flooded areas in the wet season affecting productivity (e.g. flood recession farming, but also temporal flooded areas serve as a breeding ground for fish and wildlife). Further 'homogenizing flow' will exacerbate the existing effects. Furthermore, if all 78 dams on the tributaries are built, it would have catastrophic impacts on fish productivity, biodiversity and energy production (Ziv *et al.*, 2012). Of these dams, the building of Lower Sesan 2 has the largest impact on fish biomass; the tributary dams could pose greater risks than the six mainstream dams (Ziv *et al.*, 2012).

5.2. Securing the volume

Water security is linked with securing the volume (Elden, 2013). While dams are non-consumptive (not taking evaporation into account), they allow for storage and diversion. Securing the volume in the 3S tributary means contributing enough water to secure an acceptable (environmental) flow in the Mekong and in the 3S rivers, enabling harmonious co-existence of living and non-living entities; and increasing ecosystem services and providing food security to people. But national security means enough water for irrigation and energy for the national population. Dam development can potentially secure the 'volume' of water, by creating a homogenized flow (Cochrane *et al.*, 2014).

The MRC Agreement does not explicitly focus on volume but on water quantity in the mainstream calling on states to avoid, minimize and mitigate harmful effects (Art. 7) and to notify and consult other parties and the Joint Committee on potential problems and take remedial action. We now assess whether the dams in the 3S River Basin and the MRC 1995 Agreement can secure the volume? In January 2011, Vietnam faced water shortage, causing 3×10^{12} kWh energy shortfalls (Grimsditch, 2012). Reservoirs in the upper Sesan can only produce at maximum capacity for 3 months annually (Ngo & Masih, 2014). The Yali Falls Hydropower Plant's reservoir was 20 m lower than in previous years and in March 2011, the water level dropped to only 6 m, which was a 50-year low (Grimsditch, 2012). Vietnam's hydropower developments may themselves contribute to the drought: the Upper Kon Tum hydropower project diverted water from the Sesan to the Dac Snghe (an inter-basin transfer) reducing water volume of the Sesan. According to an interviewee, this threatens ecological diversity, livelihoods, and power production downstream (Grimsditch, 2012). When reservoirs are filled for energy production during and after long dry periods, dams cannot always increase the dry season flow. At the same time, dams are not always operated to control floods and most dams release excess water causing floods, as was the case in 2000, 2007, 2011 and 2013 along the 3S tributary. Cambodia struggles with excess water in the wet season and shortage in the dry season which are affected by upstream power generation and peak floods. The dams cannot secure the volume for its various water uses causing damage downstream.

5.3. Securing the quality

Poor water quality also threatens security (Shmueli, 1999). Dams lead to the accumulation of river sediments, nutrients, and wastes, and the decomposition of submerged vegetation which depletes oxygen levels, reduces the waste dilution capacity of rivers and affects downstream ecosystems. Water degradation in the Sesan and Srepok since 1996 causes skin diseases to bathers; blue green algae from vegetation decomposition affects fisheries (Fisheries Office Ratanakiri Province & NTFP Project, 2000). In July 2002, water tests could not verify the complaints from villagers in 1996, 1997 and 2000 (MRC, 2002). Well water in Kachon Leu village in Veun Sai District, Ratanakiri, has led to sickness since 1996 and two thirds of the villagers now boil this water. In Tiam Leu village, neighboring Kachon Leu, people have also started drinking boiled water, but villagers continue to bathe in this water (per. comm., 20 May 2014). The villagers of Phluk, Srae Kor and Kbal Romeas also complain about skin irritations after bathing, confirmed by EIAs of the LS2 which show high concentrations of coliform and phosphate (KCC, 2009).

5.4. Securing the space

Water security is also related to water space as politics operates in and through space and on different scales (Lebel *et al*., 2005). Places 'are never neutral entities with undisputed objective meanings. Rather, they are socially constructed by individuals and groups who draw on their experiences, beliefs and prejudices to imbue places with particular characteristics, meanings and symbolisms' (Jones *et al*., 2004, p. 115). The politics of position (Lebel *et al*., 2005) relates to upstream-downstream power relations but also to deforestation on river banks. In the 3S, Laos and Vietnam are upstream powers affecting downstream Cambodia (Lebel *et al*., 2005). The MRC Agreement (MRC, 1995: Article 5) enhances this power through the limited notification procedure which does not require the prior informed consent of Cambodia. Vietnam, downstream to Laos, is building dams itself while questioning the Xayaburi and Don Sahong Dams in upstream Laos. Laos's assertiveness to build Xayaburi and Don Sahong Dams might encourage Cambodia to build the proposed Sambor Dam, which will together affect the Mekong ecosystem dramatically. The politics of location makes cooperation in good faith very difficult.

For Cambodia, the Tonle Sap Lake is the pulsing heart of the Mekong, and if the heart stops, the system dies. In the wet season, the excess water volume from the Mekong is absorbed by the Tonle Sap, expanding the lake area from 2,500 km^2 in the dry season to 16,000 km^2 in the wet season and reducing flooding along the Mekong (Kummu & Sarkkula, 2008). Fish migrate into the lake to spawn, while others migrate from Tonle Sap upstream to areas like the 3S Basin. In the dry season, the Tonle Sap Lake releases water into the Mekong, reducing salt intrusion in the Mekong Delta. About 2.1 million ha of the Mekong Delta are affected by the salinity during the dry season (Tuan *et al*., 2007), and the volume of water from the Tonle Sap acts as a natural flush, reducing salt water intrusion into the mainland.

The Mekong dams affect the Tonle Sap Lake through the increased water levels in the dry season, increased turbidity and reduction in nutrients for fish (Kummu & Sarkkula, 2008) and reduced wet seasonal flow (Piman *et al*., 2013a). The permanent lake area could increase by between 400 and 1,000 km^2 (17–40%) in the dry season, and the total area of the forest (197.2 km^2) would be inundated (Kummu & Sarkkula, 2008). That would mean that 41% of the present flooded forest area would be under water

longer than by natural inundation and would be lost in the future. The 149 km^2 of the protected Ramsar site in Boeung Chhmar in the Tonle Sap Lake would be inundated permanently (Kummu & Sarkkula, 2008). High flows are expected to be reduced by 0.36 m, affecting the wider flood recession farming practices. Because of the geographical characteristics, relatively small changes in water levels will affect disproportionately large areas (Kummu & Sarkkula, 2008). Furthermore, dam developments upstream will allow permanent salt intrusion, killing mangroves and damaging rice cultivation (Centra Technology & Scitor Corporation National Intelligence Council, 2010). The trade-offs for individual countries between the benefits and losses of dams need to be analyzed in the context of the larger Mekong issues. The MRC Agreement has been unable to deal with these trade-offs.

5.5. Securing seasonality and temporal variation

Climate change affects rainfall in the Mekong affecting water quantity. The annual rainfall varies from 1,100 to 3,800 mm (Piman *et al*., 2013b). Dams may mitigate greenhouse gas emissions and help adapt to climate change through their water control capacity. The MRC Agreement stresses the need for cooperation to cope with climate variability and change and dams. However, while the homogenized flow possibly mitigates the effects of climate change in the 3S (Chinvanno, 2004; Eastham *et al*., 2008), reduced seasonality will affect ecosystems, fishing, forests and agriculture (Ngo & Masih, 2014). At the same time, dam operations change flows unpredictably and local communities in Srae Kor and Phluk villages call it a '*tonle chkot*' or '*crazy river*' (per. comm., 18 May 2014). The unpredictability of water levels makes the local communities reluctant to risk growing vegetables and rice paddy on the riverbanks. They have also sold their buffaloes to hire labor to clear the upland fields for rice cultivation.

6. Transboundary management for water security

Transboundary river basin management can mitigate conflicts between states over the allocation, use, and sharing of water resources (International Network of Basin Organizations (INBO) & Global Water Partnership (GWP), 2012). In the 3S, Vietnam builds dams to control the flow and secure water for irrigation and electricity generation. But Cambodia also needs to secure water for food, energy and livelihoods. Dam construction may affect the rivers more than climate variability and change. Politically, countries keep redefining the boundaries of the river (Mekong as watercourse or river basin or international region, etc.); this allows them to leave out 'tributaries' from the jurisdiction of the MRC Agreement so that tributary-based projects can go ahead despite their transboundary implications (Lebel *et al*., 2005). These dams which are expected to lead to economic boom, may instead lead to water insecurity that escalates into national insecurity (Baker, 2012, p. 1).

The Mekong Agreement (1995: Article 5) mentions that diversions in tributaries are subject to notification and assumes that tributaries are of national rather than of international concern. Only conversions in the mainstream Mekong are subject to prior consultation with the Joint Committee. The Agreement fails to secure the interests of all riparian states by ensuring that proper trade-offs are made to the benefit of all riparians (Wyatt & Baird, 2007). Nor was Cambodia involved in the EIA process, and the downstream impacts in Cambodia were ignored (SWECO, 2006; Wyatt & Baird, 2007).

Nevertheless, the MRC Agreement provides water security on a number of problems for each MRC riparian state. Vietnam has a guarantee that the delta will not be deprived of fresh water in the dry

season. Thailand does not have to face downstream vetoes on its river and tributary development plans[2]. Laos has some room to maneuver for long-term hydropower development, and Cambodia has received assurance for protection of the water supply to the Tonle Sap Lake. All countries enjoy the benefits from improved information flow (although information on some aspects is still limited) and a higher concern of overall environmental protection in the river basin. All members have therefore secured their key water related issues (Öjendal *et al*., 2002). However, these benefits are paid for with other trade-offs. For example, Cambodia is unable to influence other MRC members when it comes to trans-basin diversion and other large-scale upstream water uses. The agreement allows economic growth since individual states can change water flows and enter into major infrastructure construction without the prior *consent* of the other riparian states. The private sector, both bilateral and multilateral, can engage in various projects more easily now (Öjendal, 2000).

Through the MRC Agreement (1995) notification and prior consultation became legal terms and non-negotiable aspects. As prior consultation does not provide the right of veto for other MRC members it enables an upstream mentality for all members, as highlighted by Vietnam which is located downstream in the basin, but has an upstream mentality when building dams in the 3S Basin. In accordance with the Agreement, Vietnam notified Cambodia of its plans for building the dams in the upper Sesan. The current dams have caused severe impacts on the livelihoods and ecosystems downstream in Cambodia. The question remains, who is accountable for the impacts? At the same time, Vietnam is moving ahead with developing more dams. Articles 5 and 26 outline procedures that should be followed in case of diversion of water from the mainstream. From a downstream country point of view, it could be argued that as long as no binding restrictions exist, the struggle for water security is victim to power politics between the states.

The MRC Agreement does not set any strict upper limits to water use, except for trans-basin diversions in the dry season. The Agreement (p. 2) requires a Basin Development Plan (BDP) which is 'a blueprint to identify, categorize and prioritize the projects and programs' and is described as the instrument for cooperation in the development of the Mekong beyond the nation state (MRC, 2013). It took 6 years after establishment of the Agreement before the formulation of the BDP began. Fifteen years of sub-optimal coordination and cooperation, delays, process development and consensus seeking (Nette, 1997; Öjendal *et al*., 2002; MRC, 2013), resulted in 2011 in the Basin Development Strategy (MRC, 2011b).

The MRC Agreement itself does not have any articles on the protection, management and cooperation in transboundary tributaries, like the 3S Basin. Transboundary management is therefore dependent on other instruments developed within the MRC framework, like the BDP. The Basin Development Strategy (MRC, 2011b) recognizes the uneven distribution of risks in hydropower development (especially from main stream hydropower development upstream) and that any potential transboundary impact should be collaboratively identified and mitigated using the MRC Transboundary Environmental Impact Assessment Framework (TbEIA, which is in progress, and not yet adopted). All in all, like the 1995 Agreement, the Strategy supports dam developments in tributaries, if they are implemented sustainably (which is unclear). It, however, does not provide instruments to downstream countries to control (or even block) upstream developments and focuses on benefit sharing options, but stays very vague on socio-economic and environmental cost sharing options.

[2] Unlike in the Mekong River Agreement of 1957.

The MRC does not have experiences and capacities to resolve transboundary issues between two member countries. The Yali Dam case highlights the inability of the MRC to assist the Cambodian government with technical support to challenge the hydropower development plans of Vietnam. The Cambodian Sesan Communities have been unable to raise community concerns, because of lack of scientific evidence, to the Cambodian and Vietnamese governments. The Cambodian government did not show the willingness to negotiate or act on behalf of the communities, which might be also related to geopolitics within the state (the 3S communities do not represent the majority Khmer population). Lack of technical and financial capacity to analyze the impacts of the Yali Dam on Cambodia shows the lack of political will to confront Vietnam. This has put Cambodia in a weak position (Wyatt & Baird, 2007). The MRC has been hampered by its own lack of mandate and commitment to respond to community complaints around development issues in the international tributaries. The MRC mandate in transboundary cooperation is hampered by its 1995 Agreement which has no explicit requirement for transboundary EIAs for development projects like the Sesan dams. The history of delays in developing the BDP suggests that the development and adoption of TbEIAs might also take a while. And although the MRC is not accountable for the impacts of Yali Dam, since this was dealt with by the Interim Mekong Committee, the MRC did allow the development of other dams in the 3S and therefore has a poor track record in contributing to mitigating the transboundary negative social and environmental impacts of hydropower developments.

7. Conclusions

Transboundary rivers, like the 3S Basin, always face conflicting claims over water resources. The MRC 1995 Agreement does not demand limited state sovereignty and the mitigation of transboundary harm. Riparian states prioritize national interests and sovereignty of decision-making for water and national security over sharing benefits, rights, responsibilities and risks.

Furthermore, tributaries like the 3S rivers get less political attention and are treated differently than the mainstream. Sometimes, states ignore or avoid discussing tributaries because of their remote geographical location as in the case of the 3S rivers, or because legal agreements, like the MRC Agreement, did not explicitly require consultation, only prior notification. This loophole allows unlimited dam development in the 3S Basin and affected riparians have no instrument to counter this. Vietnam thus kept building hydropower dams in the 3S Basin and plans to construct more, while trying to stop upstream countries from building more dams. Cambodia continues to plan the Sambor dam, and dams in the 3S Basin (and securing Vietnam's energy demands), but dislikes the upstream dam developments in Vietnam (in the 3S Basin) and Laos in the mainstream.

Climate change exacerbates water security in the 3S Basin, through heavier rains in the wet season (requiring release of excess dam water in Vietnam in 2011 and 2013 causing floods downstream, particularly in Cambodia), and drier hot seasons (when more water is stored in the reservoirs, threatening downstream livelihoods).

Water sharing between up and downstream riparians in the 3S Basin has been affected more by geopolitics, economic relations, and bilateral relationships, than by the MRC Agreement, leading to uncontrolled dam development in the 3S Basin. This has affected the ability of the riparians to jointly ensure water security in terms of flows, volumes, qualities, space, temporal variations and livelihoods, posing an increased security threat in the region.

The MRC is unable to sustainably develop dams in the tributaries. The Basin Development Strategy and several other proposed instruments, like the TbEIA, are trying to deal with this challenge, but the political interests of its members raise questions about its capacity to develop such mechanisms within the time frame of the development of the current planned dam projects.

Nevertheless, the MRC should continuously review and revise the MRC 1995 Agreement to keep up with the increased socio-economic and demographic developments in the basin. The national security threats of MRC members are increasing as damming the mainstream in Laos and Cambodia (to secure energy demands in Thailand and Vietnam) is causing threats to social and ecological security. The various elements of water security presented in this paper (flows, volumes, space, temporal variations, and livelihoods) can contribute in developing and operationalizing transboundary river management instruments. Vietnam became the 35th country to ratify the UN Water Courses Convention in May 2014; although the others have not ratified the agreement, they did sign it and are obliged not to take measures that go against the spirit of the Convention and especially Article 7 which requires countries not to cause significant harm to other riparians (UNWC, 2014).

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